H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

October 21, 2026

Board of Directors
3225 Main Street
P.O. Box 226
Barnstable, MA 02630

RE: Cape Cod Commission Developments of Regional Impact Exemption Request
The Town of Barnstable, Department of Public Works
Barnstable Fire District Wells 3&4 Water Treatment Plant
Barnstable, Massachusetts

To whom it may concern:

On behalf of the Barnstable Fire District Water Department (District; Applicant), please find enclosed a completed Developments of Regional Impact (DRI) Exemption Request for the above referenced project.

The District is proposing to construct a new water treatment plant for the removal of PFAS, iron, and manganese within the parcel of land associated with the existing pump houses and chemical addition facilities for Well 3 and Well 4 at 1650 Iyannough Road/Route 132 (Site). The proposed facility will be equipped with three (3) 10.5-foot diameter GreensandPlus™ media filters; six (6) 10-foot diameter GAC pressure vessels; associated process mechanical valves and piping; potassium hydroxide (KOH) storage, feed, and handling facilities; and sodium hypochlorite (NaOCl) storage, feed, and handling facilities.

This project also involves the construction of two (2) sand filters and two (2) infiltration basins for the processing of water treatment residuals; a septic system for the facility bathroom; best management practices (BMPs) for the treatment and infiltration of stormwater; new yard piping and hydrants for water transmission and distribution; new underground electrical lines to deliver power to the building; new underground fiberoptic lines to transmit Supervisory Control and Data Acquisition (SCADA) information; two (2) new generators to supply emergency power, three (3) new propane tanks to supply the fuel supply for heating and the generators; yard fencing for site security; and a paved driveway and parking area for facility access.

The proposed project triggers review under the Cape Cod Commission due to the Site's location within Barnstable County and the filing of an Environmental Impact Report (EIR) under the Massachusetts Environmental Policy Act (MEPA), as stated in Section 12(i) of The Cape Cod Commission Act (Act) and Section 2(d)(i) of the Cape Cod Commission Chapter A Enabling Regulations Governing Review of Developments of Regional Impact Barnstable County Ordinance 90-12, Revised November 17, 2021 (Enabling Regulations).

The proposed project triggered review under MEPA as the project requires one or more State Agency Activities and exceeds the following review threshold for an Environmental Notification Form (ENF):

- 301 CMR 11.03(4)(b)4.: Construction of a new drinking water treatment plant with a Capacity of 1,000,000 or more gpd.

While the proposed project does not exceed any mandatory EIR thresholds, it is located within an Environmental Justice (EJ) Designated Geographic Area (DGA), as the Site is located within one mile of mapped EJ Communities. Given that the proposed project is located within the EJ DGA, an EIR was required in accordance with MEPA's Environmental Justice Protocols (effective January 1, 2022). The Applicant submitted the required Expanded Environmental Notification Form (EENF) and the Proposed Environmental Impact Report (PEIR) to the MEPA office and Cape Cod Commission on June 9, 2026, and both documents were published in the Environmental Monitor on June 24, 2026. The EENF Certificate was issued on July 31, 2026, with a statement of approval for a Rollover EIR. As such, the PEIR was published as a Final EIR (FEIR) in the Environmental Monitor on August 7, 2026. The FEIR Certificate was issued on September 14, 2026, with a statement that the FEIR adequately and properly complies with MEPA and its implementing regulations.

In the FEIR, it was found that the proposed project will not create a disproportionate adverse effect or materially exacerbate any existing unfair or inequitable environmental or public health burden impacting the EJ population. Additionally, the proposed project will supply improved water quality and provide increased reliability of clean and safe public drinking water to all customers serviced by the District, and all members of the general public that make use of the businesses and facilities which use or serve public drinking water serviced by the District. Please refer to the EENF or PEIR for a complete evaluation of project parameters, mitigation measures, and impacts.

The applicant respectfully requests an exemption from the Cape Cod Commission's DRI review in accordance with the provisions set forth in Section 12(k) of the Act and Section 7 of the Enabling Regulations. The above mentioned section allows any applicant to apply for an exemption from the Cape Cod Commission's review if *"the location, character and environmental effects of the development will prevent its having any significant impacts on resources, values and purposes protected by the Act outside of the municipality in which the development is to be located"*.

The proposed project will not have any significant impacts on the values and purposes specified in Section 1 of the Act outside of the municipality in which it is proposed. Additionally, in accordance with Section 1(c) of the Act, this project is consistent with the Commission's purpose to have a provision for adequate capital facilities, including water supply, and is expected to greatly benefit public health by improving the quality, reliability, and usable production capacity of the District's water supply sources.

In addition, please find enclosed the following additional materials to be submitted as part of the DRI Exemption Request:

- Appendix A: Application Cover Sheet
  - Attachment A: Project Narrative
  - Attachment B: Copy of Deed and Easement
  - Attachment C: List of Required Permits
- Appendix B: Copy of Filing Fee
- Appendix C: Certified Abutters List and Labels
- Appendix D: EENF
- Appendix E: PEIR
- Appendix F: EENF Secretary's Certificate
- Appendix G: PEIR Secretary's Certificate

Please feel free to contact me if you have any questions or require additional information. I can be reached at sco@h2olsonengineering.com or (508) 375–7007.

Very Truly Yours,
H_2Olson Engineering, Inc.

Stephen C. Olson, P.E.
President

CC: Sean Anderson, Barnstable Fire District Water Department, Barnstable, MA
Genevieve Cordeiro, E.I.T., H2Olson Engineering, Inc.

Appendix A: Application Cover Sheet

Application Cover Sheet

Cape Cod Commission
3225 Main Street, PO Box 226
Barnstable, MA 02630
Tel: (508) 362-3828 • Fax: (508) 362-3136

For Commission Use Only
Date Received:
Fee ($):
Check No:
File No:

A Type of Application (check all that apply)

- ☐ Development of Regional Impact (DRI)
- ☐ DRI Scoping
- ☑ DRI Exemption
- ☐ Hardship Exemption
- ☐ Jurisdictional Determination
- ☐ Request for Joint MEPA/DRI Review
- ☐ Decision Extension
- ☐ Decision Modification

B Project Information

Project Name: Barnstable Fire District Wells 3&4 WTP

Total Site Acreage: 2.10

Project/Property Location: 1650 Iyannough Road/RTE #132

Zoning: RG/RF-1

Brief Project Description:

Include total square footage of proposed and existing development, gross floor area, number of lots existing or to be created, specific uses, description of existing conditions, as applicable (attach additional sheets if necessary).

See Attachment A.

C Owner(s) of Record

List the following information for all involved parcels. Provide copies of each Deed and Purchase and Sale Agreement and/or evidence of leasehold interest, if applicable, for all involved parcels. Proof of ownership/legal rights for Applicant(s) to proceed with the proposed development must be documented prior to the Commission deeming any application complete. List the local, state, or federal agencies from which permits or other actions have been/will be filed (attach additional sheets if necessary).

Map/Parcel	Owner's Name	Lot & Plan	Land Court Certificate of Title #	Registry of Deeds Book/Page #
254-018	Barnstable Fire District Water Department			Book 2070 / Page 0091

There **ARE/ARE NOT** (circle one) court claims, pending or completed, involving this property (if yes, please attach relevant information).

Is there an existing CCC Decision for the Property? ☐ yes ☑ no (if so, recording information for decision, please attach relevant information).

D Certification

I hereby certify that all information provided on this application form and in the required attachments is true and accurate to the best of my knowledge. I agree to notify the Cape Cod Commission of any changes on the information provided in this application, in writing, as soon as is practicable. I understand failure to provide the required information and any fees may result in a procedural denial of my project.
NOTE: For wireless communication facilities, a licensed carrier should be either an applicant or a co-applicant.

APPLICANT

Applicant(s) Name: Sean Anderson Tel: 508-362-6498 Fax:

Address: 255 Breeds Hill Road, PO Box 546, Barnstable MA 02630

Signature: Sean Anderson Digitally signed by Sean Anderson Date: 2026.10.21 13:03:08 -04'00' Date: 10/21/26

CO-APPLICANT

Co-Applicant(s) Name: Tel: Fax:

Address:

Signature: Date:

CONTACT

Contact: Stephen C. Olson, P.E. Tel: 508-375-7007 Fax: 508-748-5960

Address: 10 Riverside Drive Suite #103, Lakeville MA 02347

Signature: Date: 10/21/26

PROPERTY OWNER

Property Owner: Barnstable Fire District Water Department Tel: 508-362-6498 Fax:

Address: 255 Breeds Hill Road, PO Box 546, Barnstable MA 02630

Signature: Sean Anderson Digitally signed by Sean Anderson Date: 2026.10.21 13:36:36 -04'00' Date: 10/21/26

BILLABLE ENTITY

Name: Stephen C. Olson, P.E. Tel: 508-375-7007 Fax: 508-748-5960

Address: 10 Riverside Drive Suite #103, Lakeville MA 02347

Attachment A

Project Narrative

Project Description (Narrative)

The project site is located on a portion of municipal-owned land currently in use for public water supply located at 1650 Iyannough Road/Route 132 Barnstable, Massachusetts, parcel number 254-018, as seen in Attachment B of the EENF and Appendix B of the PEIR. This land consists of a paved access road, a pump house for the Barnstable Fire District's groundwater supply Well 3, and a pump and treatment building located at Well 4. The property is located in the Residential RG and RF-1 zoning districts, as well as the Wellhead Protection Overlay District, as seen in the Zoning Map shown in Attachment B of the EENF and Appendix B of the PEIR. Existing utilities include transmission and distribution water mains for Well 3 and Well 4, overhead electrical lines to transmit power to the pumping and treatment facilities, and underground fiberoptic lines to transmit SCADA information between the well stations and treatment facility as seen in the Design Plans provided in Attachment B of the EENF and Appendix B of the PEIR.

Currently, water from Well 3 is pumped to the Well 4 Pump and Treatment Facility, where it is treated with potassium hydroxide for pH adjustment and sodium hypochlorite for disinfection before being pumped into the distribution system. The current system has a combined capacity of 1,500 gallons per minute.

The project site includes a portion of the existing paved access road, a vegetated area to the south of the existing paved access road, and a small vegetated area to the south of the Well 4 Pump and Treatment Building. Refer to the Site Locus Map and the Design Plans provided in Attachment B of the EENF and Appendix B of the PEIR for the location and extent of the project.

The proposed project involves the construction of a new water treatment plant for the treatment of water from Well 3 and Well 4. The 4,040 square foot building will be equipped with three (3) 10.5-foot diameter GreensandPlus^{TM} media filters; six (6) 10-foot diameter GAC pressure vessels; associated process mechanical valves and piping; KOH storage, feed, and handling facilities; and NaOCl storage, feed, and handling facilities. Along with the building, the project involves the construction of two (2) sand filters and two (2) infiltration basins for the processing of water treatment residuals; a septic system for the facility bathroom; best management practices (BMPs) for the treatment and infiltration of stormwater; new yard piping and hydrants for water transmission and distribution; new underground electrical lines to deliver power to the building; new underground fiberoptic lines to transmit Supervisory Control and Data Acquisition (SCADA) information; two (2) new generators to supply emergency power, three (3) new propane tanks to supply the fuel supply for heating and the generators; yard fencing for site security; and a paved driveway and parking area for facility access.

There will be no changes to the existing easements, zoning, or land use at the site, nor will there be changes to the capacity of the system. The project site is not within the FEMA 100-year floodplain, as seen in the FEMA FIRMette Map provided in Attachment B of the EENF and Appendix B of the PEIR. The site is not within an area of critical environmental concern, as seen in the MassGIS Environmental Concerns Map provided in Attachment B of the EENF and

Appendix B of the PEIR, and the site is not within the limits of mapped priority habitats of rare species or estimated habitats of rare wildlife, or an area that is likely to affect significant historic or archaeological resources. Please refer to Attachment I of the EENF and Appendix C of the PEIR for Correspondence with the National Heritage and Endangered Species Program (NHESP) and the Massachusetts Historical Commission (MHC).

Attachment B

Copy of Deed and Easement

BOOK 2070 PAGE 091

16274

COMMONWEALTH OF MASSACHUSETTS

Barnstable, ss.

Office of the Board of Water Commissioners of the Barnstable Fire District

ORDER OF TAKING OF LAND IN BARNSTABLE, BARNSTABLE COUNTY, MASSACHUSETTS, BY THE COMMISSIONERS FOR WATER SUPPLY PURPOSES

We, Lauchlan M. Crocker, William Daniel Knott and William P. Lovejoy, Jr., the duly elected and qualified members of the Board of Water Commissioners of the Barnstable Fire District, a municipal corporation located in Barnstable, in the County of Barnstable and Commonwealth of Massachusetts, under the provisions of Chapter 302 of the Acts of 1934 and all other statutes in amendment thereof and in addition thereto, and under the power conferred upon us as such Board of Water Commissioners by vote of said Barnstable Fire District, while acting under Article 11 of the Warrant for the Annual Meeting of the Barnstable Fire District, duly called and held on the eleventh day of March, A.D, 1974, as will more particularly appear by reference to the records of the Clerk of said District, and by virtue of every other power us hereto enabling, having complied with all the preliminary requirements prescribed by law, do adopt and decree this Order of Taking, and do hereby take in fee for and in behalf of said Barnstable Fire District, for the purpose of additional well fields and additional pumping plants and improvements and extension of the water system for the Barnstable Fire District, under the provisions of Chapter 79 of the General Laws (Ter. Ed.) and all Acts in amendment thereof ar in addition thereto, all the land, with the trees and all standing wood thereon and any rights of way or other easements, excepting public ways, crossing said land, situated in said Barnstable, within said District, at or near the Village of Barnstable, so-called, more

particularly bounded and described as follows:

Southerly	by land of Allan F. Jones, on two courses, a total distance of one thousand one hundred twenty and 40/100 (1,120.40) feet;
Westerly	by land of said Jones, on four courses, a total distance of one thousand six hundred twenty-eight and 90/100 (1,628.90) feet;
Northerly	by land of said Jones, on two courses, a total distance of seven hundred ninety-seven and 53/100 (797.53) feet;
Westerly	by land of said Jones, two hundred eighty and 00/100 (280.00), feet; more or less;
Northerly	by land of the Commonwealth of Massachusetts, one hundred forty-five and 00/100 (145.00) feet;
Easterly	by land of William P. Swift, on three courses, a total distance of three hundred ninety-four and 21/100 (394.21) feet, more or less;
Northerly	by land of said Swift and land of Martin E. Sher, Trustee of Martin Real Estate Trust, a total distance of five hundred eighty-five and 00/100 (585.00) feet;
Easterly	by land of said Martin E. Sher, Trustee and land of Owners Unknown, on two courses, a total distance of one thousand twenty-two and 93/100 (1,022.93) feet;
Southerly	by land of William Durrell, one hundred fifty-one and 86/100 (151.86) feet;
South-easterly	by land of said Durrell, two hundred sixteen and 41/100 (216.41) feet;
Southerly	by land of Eero V. Koski, ninety-seven and 59/100 (97.59) feet; and
Easterly	by land of said Koski, one hundred twenty and 00/100 (120.00) feet.

All as shown on: "PLAN OF LAND IN BARNSTABLE, MASS. FOR THE BARNSTABLE FIRE DISTRICT January 17, 1974 - Revised June 4, 1974 - Scale 1" =100' Edward E. Kelley, Reg. Land Surveyor, Cummaquid, Mass.", which said plan is duly recorded with the Barnstable County Registry of Deeds.

The names of the Owners and area of taking are as follows:

Parcel & Rights of Way	Owner & Address	Area
Rights of Way and any other easements crossing said land.	Owner or Owners Unknown	
1	Allan F. Jones and Stephen C. Jones Trustees of Iyanough Hills Realty Trust, under a Declaration of Trust recorded with Barnstable County Registry of Deeds in Book 2027, Page 254, c/o Allan F. Jones, Hyannis Road, Barnstable, Mass.	3.66

2	Allan F. Jones and Stephen C. Jones Trustees of Iyanough Hills Realty Trust, under a Declaration of Trust recorded with said Barnstable Deeds in Book 2027, Page 254, c/o Allan F. Jones, Hyannis Road, Barnstable, MA.	7.21
3.	Allan F. Jones and Stephen C. Jones, Trustees of Iyanough Hills Realty Trust, under a Declaration of Trust recorded with said Barnstable Deeds in Book 2027, Page 254, c/o Allan F. Jones, Hyannis Road, Barnstable, MA.	8.38
4	William P. Swift, an undivided 3/5th interest, Bow Lane, Barnstable, MA. Bridgeport City Trust Company, Trustees under the Will of Daniel W. Nye, an undivided 1/10th interest, Bridgeport, Connecticut Mabel T. Nye, an undivided 1/10th interest, of Westport, Fairfield Cty., Connecituct Thomas H. Nye, or his heirs, an undivided 1/5th interest, address unknown	4.99
5	Owner or Owners Unknown	4.99
6	Owner or Owners Unknown	.99
7	Owner or Owners Unknown	.96
8	Owner or Owners Unknown	1.09
9	William P. Swift, Bow Lane, Barnstable, MA.	1.93
10	William W. Durrell and Priscilla L. Durrell, Old Route 132, Barnstable, MA.	.29
11	Eero V. Koski and Jennie O. Koski, 21 Garfield Road, Quincy, MA.	.47
12	Allan F. Jones and Stephen C. Jones, Trustees of Iyanough Hills Realty Trust under a Declaration of Trust recorded with said Barnstable Deeds in Book 2027, Page 254, c/o Allan F. Jones, Hyannis, Road, Barnstable, MA.	4.79
13	Allan F. Jones and Stephen C. Jones, Trustees of Iyanough Hills Realty Trust under a Declaration of Trust recorded with said Barnstable Deeds in Book 2027, Page 254, c/o Allan F. Jones, Hyannis Road, Barnstable, MA.	11.13

14 Gustave R. Maertins and Priscilla M. Willard Trustees of Maertins Realty Trust, under a Declaration of Trust recorded with Barnstable County Registry of Deeds in Book 1343, Page 784 and Amended by instrument recorded in Book 1581, Page 180, c/o Gustave R. Maertins, 11 Russo Road, Hyannis Park, West Yarmouth, Barnstable County, Massachusetts 1.17

Adopted and dated at Barnstable this 9th day of July, A.D., 1974.

Lauchlan M. Crocker

William Daniel Knott

William P. Lovejoy, Jr.

BOARD OF WATER COMMISSIONERS
BARNSTABLE FIRE DISTRICT

RECORDED JUL 15 74

BARNSTABLE COUNTY
REGISTRY OF DEEDS
A TRUE COPY, ATTEST
JOHN F. MEADE, REGISTER

62-98P

	OWNER	AREA	DEED REF.	ADDRESS
PARCEL 1	ALLAN F. JONES	3.66 ACRES		HYANNIS RD., BARNSTABLE, MASS. 02630
PARCEL 2	ALLAN F. JONES	7.21 ACRES	BK.1831 PG.148	
PARCEL 3	ALLAN F. JONES	8.38 ACRES	BK.1831 PG.148	
PARCEL 4	WILLIAM P. SWIFT	4.99 ACRES	BK.1863 PG. 83	BOW LANE, BARNSTABLE, MASS. 02630
PARCEL 5	MARTIN E. SHER, TR.	4.99 ACRES	BK.1806 PG. 22	C/O HARRY SHER, SUITE 341 PARK SQ. BUILDING BOSTON, MASS.
PARCEL 6	UNKNOWN	0.99 ACRES		
PARCEL 7	UNKNOWN	0.96 ACRES		
PARCEL 8	UNKNOWN	1.09 ACRES		
PARCEL 9	WILLIAM P. SWIFT	1.93 ACRES	BK.1863 PG.83	
PARCEL 10	WILLIAM DURRELL	0.29 ACRES	BK.1458 PG. 884	95 CHRISTOPHER ST. NEW YORK, N.Y. 10000
PARCEL 11	EERO V. KOSKI	0.47 ACRES	BK.1596 PG. 99	21 GARFIELD ST. QUINCY, MASS. 02169
PARCEL 12	ALLAN F. JONES	4.70 ACRES	BK.1831 PG. 148	
PARCEL 13	ALLAN F. JONES	11.13 ACRES	BK.1831 PG. 148	
PARCEL 14	GUSTAVE R. MAERTINS ETAL	1.17 ACRES	BK.1263 PG. 405	11 RUSSO RD. HYANNIS PARK, HYANNIS, MASS. 02601
	TOTAL	51.96 ACRES		

RECEIVED AND RECORDED
Jul 16 2 18 PM '74
BARNSTABLE COUNTY REGISTRY OF DEEDS
STEPHEN A. CRANE REGISTER

Re: Order of Taking Bk. 2070 Pg. 91

BOOK 286 PAGE 24

MID-CAPE HIGHWAY ROUTE 6

R=10,875.00 MHB (FND) CB (FND)
A=172.62 A=160.16

LOCUS SKETCH SCALE 1"=

COMMONWEALTH OF MASSACHUSETTS BK. 354 PG. 130

ALLAN F. JONES
ALLAN F. JONES BK. 1831 PG. 148
ALLAN F. JONES BK. 1831 PG. 148
WILLIAM P. SWIFT BK. 1863 PG. 83
FRANCES G. WESSELHOEFT LCP. 36999
POND LIJAH ANCIENT WAY ROAD 40' WIDE
STONES (FND)
STK & STONES (FND)
STK & STONES (FND) CB (SET)
SB (FND)
CB (SET)
WELL 4
WELL 5
WELL 6
WELL 6-3
WELL 7
PARCEL 1
PARCEL 2
PARCEL 3
PARCEL 4
PARCEL 5
PARCEL 6
PARCEL 7
PARCEL 8
PARCEL 9
PARCEL 10
PARCEL 11
PARCEL 12
PARCEL 13
PARCEL 14
LEASE AREA 13,062 SQ.FT.
MARTIN E. SHER, TR. MARTIN REAL ESTATE TRUST BK. 1806 PG. 22
OWNER UNKNOWN
WILLIAM DURRELL BK. 1458 PG. 884 PL.BK. 131 PG. 85
EERO V. KOSKI BK. 1596 PG. 99 PL.BK. 131 PG. 85
ROAD
WOOD
OVERGROWN
TRAVELED WAY
CAPE & VINEYARD ELECTRIC COMPANY - EASEMENT
EASEMENT 30' WIDE
270' WIDE
COUNTY WAY
OLD ROUTE 132
80' WIDE

NOTE - THE LAND ACQUISITION SHOWN ON THIS PLAN HAS BEEN APPROVED BY THE MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH ON APRIL 23, 1974.

PLAN OF LAND IN BARNSTABLE, MASS.
FOR
THE BARNSTABLE FIRE DISTRICT

JANUARY 17, 1974
REVISED JUNE 4, 1974
SCALE 1"= 100'

EDWARD E. KELLEY
REG. LAND SURVEYOR
CUMMAQUID, MASS.

APPROVAL UNDER THE SUBDIVISION CONTROL LAW NOT REQUIRED
DATE JUL 1 1974

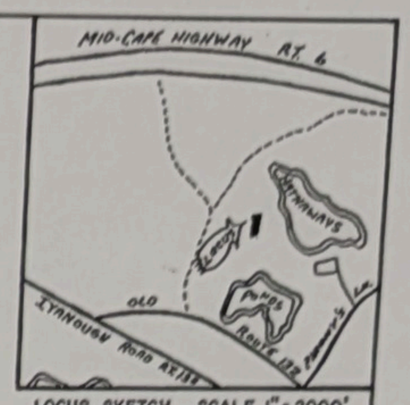
Sally A. Norris

BARNSTABLE PLANNING BOARD

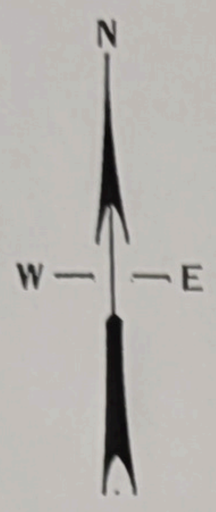
COMMONWEALTH OF MASSACHUSETTS EDWARD E. KELLEY No. 6130 REGISTERED LAND SURVEYOR

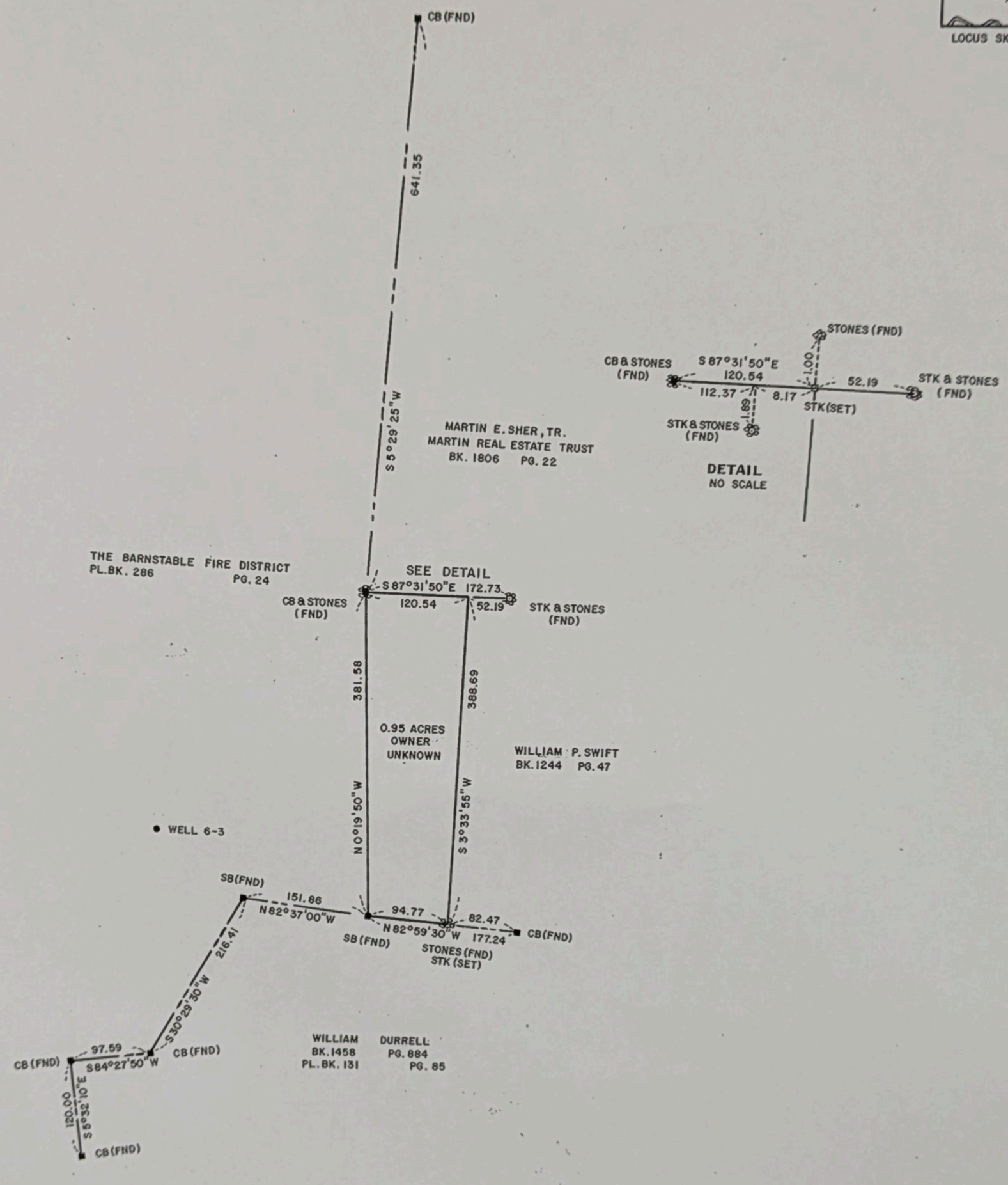
292-73

RECEIVED & RECORDED
MAR 18 11 26 AM '75
BARNSTABLE COUNTY
REGISTRY OF DEEDS
STEPHEN WEEKES
REGISTER



LOCUS SKETCH SCALE 1" = 2000'





BOOK 292 PAGE 73

PLAN OF LAND IN BARNSTABLE, MASS.
FOR
THE BARNSTABLE FIRE DISTRICT

AUGUST 12, 1974 SCALE 1" = 100'

EDWARD E. KELLEY
REG. LAND SURVEYOR
CUMMAQUID, MASS.

APPROVAL UNDER THE SUBDIVISION CONTROL LAW NOT REQUIRED.

DATE SEP 9 1974

Sally A. Monts

BARNSTABLE PLANNING BOARD

NOTE - ON JANUARY 14, 1975 THE MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH APPROVED THE ACQUISITION DELINEATED HEREON.

COMMONWEALTH OF MASSACHUSETTS
EDWARD E. KELLEY
No. 21120
REGISTERED LAND SURVEYOR

PLAN OF LAND IN BARNSTABLE, MASS.
FOR
THE BARNSTABLE FIRE DISTRICT

MARCH 3, 1978

50 0 50 100
SCALE IN FEET

EDWARD E. KELLEY
REG. LAND SURVEYOR
CUMMAQUID, MASS.

APPROVAL UNDER THE SUBDIVISION CONTROL LAW NOT REQUIRED.
DATE 1. May 1978
Mary Anne Crafton-Rodgers
_____
_____
_____
_____
BARNSTABLE PLANNING BOARD

THE LAND ACQUISITIONS SHOWN ON THIS PLAN HAS BEEN APPROVED BY THE DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING ON
...November 28, 1977.....

LOCUS SKETCH SCALE 1"=2000'



MID-CAPE HIGHWAY STATE HIGHWAY VARIABLE WIDTH ROUTE 6

SCALE 1"=100'

BOOK 321 PAGE 99

LIST OF OWNERS

	OWNER	AREA	DEED REF.	ADDRESS
PARCEL 1	MARY H. CRANE	0.07 ACRES	PROB. 28958	MAIN STREET BARNSTABLE, MASS.
PARCEL 2	EERO V. KOSKI	0.38 ACRES	BK.1596 PG.99	21 GARFIELD ST. QUINCY, MASS.
PARCEL 3	EERO V. KOSKI	0.86 ACRES	BK.1596 PG.99	21 GARFIELD ST. QUINCY, MASS.
PARCEL 4	WILLIAM P. SWIFT	1.13 ACRES		BOW LANE BARNSTABLE, MASS.
PARCEL 5	OWNERS UNKNOWN	0.80 ACRES		
PARCEL 6	WILLIAM DURRELL	2.21 ACRES	BK.1458 PG.884	OLD ROUTE 132 BARNSTABLE, MASS.
PARCEL 7	OWNERS UNKNOWN	2.80 ACRES		
PARCEL 8	WILLIAM P. SWIFT	7.84 ACRES	BK.1863 PG. 83	BOW LANE BARNSTABLE, MASS.
PARCEL 9	COMM. OF MASS.	4.00 ACRES		DEPT. OF ENVIRONMENTAL MANAGEMENT 100 CAMBRIDGE ST. BOSTON, MASS.
PARCEL 10	COMM. OF MASS.	3.54 ACRES		
PARCEL 11	ALLAN F. JONES	0.93 ACRES		49 CHOLE COURT WAY BARNSTABLE, MASS.

EDWARD E. KELLEY No 23100 REGISTERED LAND SURVEYOR
COMMONWEALTH OF MASSACHUSETTS

I CERTIFY THAT THIS PLAN CONFORMS WITH THE RULES AND REGULATIONS OF THE REGISTER OF DEEDS.
MARCH 3, 1978 Edward E. Kelley
REG. LAND SURVEYOR

REC'D & ENT'D
MAY 3 2 46 PM '78
BARNSTABLE COUNTY
REGISTRY OF DEEDS
STEPHEN WEEKES
REGISTER

MUTUAL LICENSES BETWEEN THE BARNSTABLE FIRE DISTRICT

AND

TOWN OF BARNSTABLE

FOR

GOLF COURSE TEES, PATHS, WAYS AND MAINTENANCE

The undersigned JOHN C. KLIMM, Town Manager of the Town of Barnstable, New Town Hall, 367 Main Street, Hyannis, Barnstable County, Massachusetts, 02601-3907, 508-862-4610 on behalf of the Town of Barnstable (hereinafter "Town"), and the undersigned JON ERICKSON, Superintendent of the Barnstable Fire District Water Department, 1841 Phinneys Lane Lane, Barnstable, Massachusetts, 02630 (hereinafter "District"), in consideration of the mutual covenants contained herein, hereby grant mutual permission under the following terms and conditions.

1. The District and Town mutually acknowledge the existence of certain easements across the Hyannis Golf Course property owned by the Town (hereinafter "golf course") identified in Exhibit "A" hereto attached (hereinafter "easements") in favor of the District which pre-date the Town's acquisition of ownership of the golf course and the permits and rights held by the District pursuant to the easements.

2. The District and Town mutually acknowledge that the following are located on land owned by the District shown on plan recorded in Plan Book 321, Page 99: portions of the seventh tee cart path and tee box west of "Parcel 3 Article 7 dated March 1975 Eero V. Koski Parcel"; portions of the cart path on southwest side of land shown on said plan; portions of the cart path through "Parcel 11 Article 8 May 1977 Allan F. Jones"; and further acknowledge that these improvements existed and were used in their present location well prior to the Town's ownership of the golf course.

3. The District gives permission for the continued use by the Town of the encroachments described in the preceding paragraph and depicted in Exhibit "B 1 - 3" hereto attached so long as:

(a) the Town makes no further changes to the use or improvements of the tee and cart paths without the express written consent of the District;
(b) the Town provides the District with its pesticide, insecticide, fertilizer, turf management and hazardous materials storage practices;
(c) the Town has control of and continues the operation of the golf course; and
(d) the Town insures the tee and cart paths and holds the District harmless from any liability arising out of use of the tee and cart paths by the Town's invitees subject to and without waiver of the liability limitations applicable to the Town.

4. This constitutes a grant of conditional permission only given by the District to the Town for maintenance and use of the encroachments described in paragraph number 2 as

depicted in Exhibit "B 1 - 3." The Town acquires no rights in District land by reason of the conditional permission given. In the event that any of the conditions are breached, or if the District no longer controls the land or is required by outside authority to discontinue the land containing the encroachments, the permission given hereunder may be revoked by the District: provided, however, that in the event that an authority outside the control of the District requires discontinuance of the land containing the encroachments, the Town and District cooperate in seeking a permit for continued use by the Town pursuant to G. L. c. 40 § 15B before any revocation by the District.

Dated: October 10, 2007

JOHN C. KLIMM, Town Manager,
Town of Barnstable

JON ERICKSON, Superintendent
Barnstable Fire District Water Department

Board of Water Commissioners

Evelyn G. Bassett, Chair

Richard P. Carroll

David A. Jones

EXHIBIT A

BOOK 2134 PAGE 290

28975

EASEMENT

We, ALLAN F. JONES and STEPHEN C. JONES, TRUSTEES of IYANOUGH HILLS REALTY TRUST, under a Declaration of Trust dated April 10, 1974 and recorded with Barnstable County Registry of Deeds in Book 2027, Page 254, the HYANNIS CO-OPERATIVE BANK, a Massachusetts banking corporation of Barnstable (Hyannis), Barnstable County and COOLIDGE CORNER CO-OPERATIVE BANK, a Massachusetts banking corporation of Brookline, Norfolk County, holders of a mortgage from the said TRUSTEES dated April 10, 1974 and recorded with said Registry of Deeds in Book 2027, Page 265.

For consideration paid,

Grant to the BARNSTABLE FIRE DISTRICT, a municipal corporation of Barnstable, Barnstable County, Massachusetts,

With quitclaim covenants,

A perpetual easement to travel along the "Easement 30' Wide" shown on a plan entitled, "Plan of Land in Barnstable, Mass. For The Barnstable Fire District June 10, 1974 Scale 1"=100' Edward E. Kelley, Reg. Land Surveyor Cummaquid, Mass.", which plan is duly recorded with Barnstable County Registry of Deeds in Plan Book 286, Page 23, from State Highway Iyanough Road, Route 132, to land of the Grantee, including the right to bring construction equipment into its well fields for the purpose of installing, maintaining, repairing and replacing wells and for other related purposes, and a perpetual easement to install, maintain, repair and replace water mains and underground utility lines in the said "Easement 30' Wide";

Also a perpetual easement to install, maintain, repair and replace a water main or mains and underground electric utility lines in the "Traveled Way" running in a northeasterly direction from Old Route 132 to land of the Grantee as shown on a "Plan of Land In Barnstable, Mass. For The Barnstable Fire District January 17, 1974 Revised June 4, 1974 Scale 1"=100' Edward E. Kelley, Reg. Land Surveyor Cummaquid, Mass.", which said plan is duly recorded with Barnstable County Registry of Deeds, in Book 286, Page 24.

The Grantors reserve the right to relocate the said easement for travel to another location along Route 132 or Old Route 132. In the event of said relocation, the Grantors hereby agree to place the new location in a condition satisfactory for travel by the Grantee.

MYCOCK, KILROY
& GREEN
ATTORNEYS AT LAW
171 MAIN STREET
HYANNIS, MASS. 02601

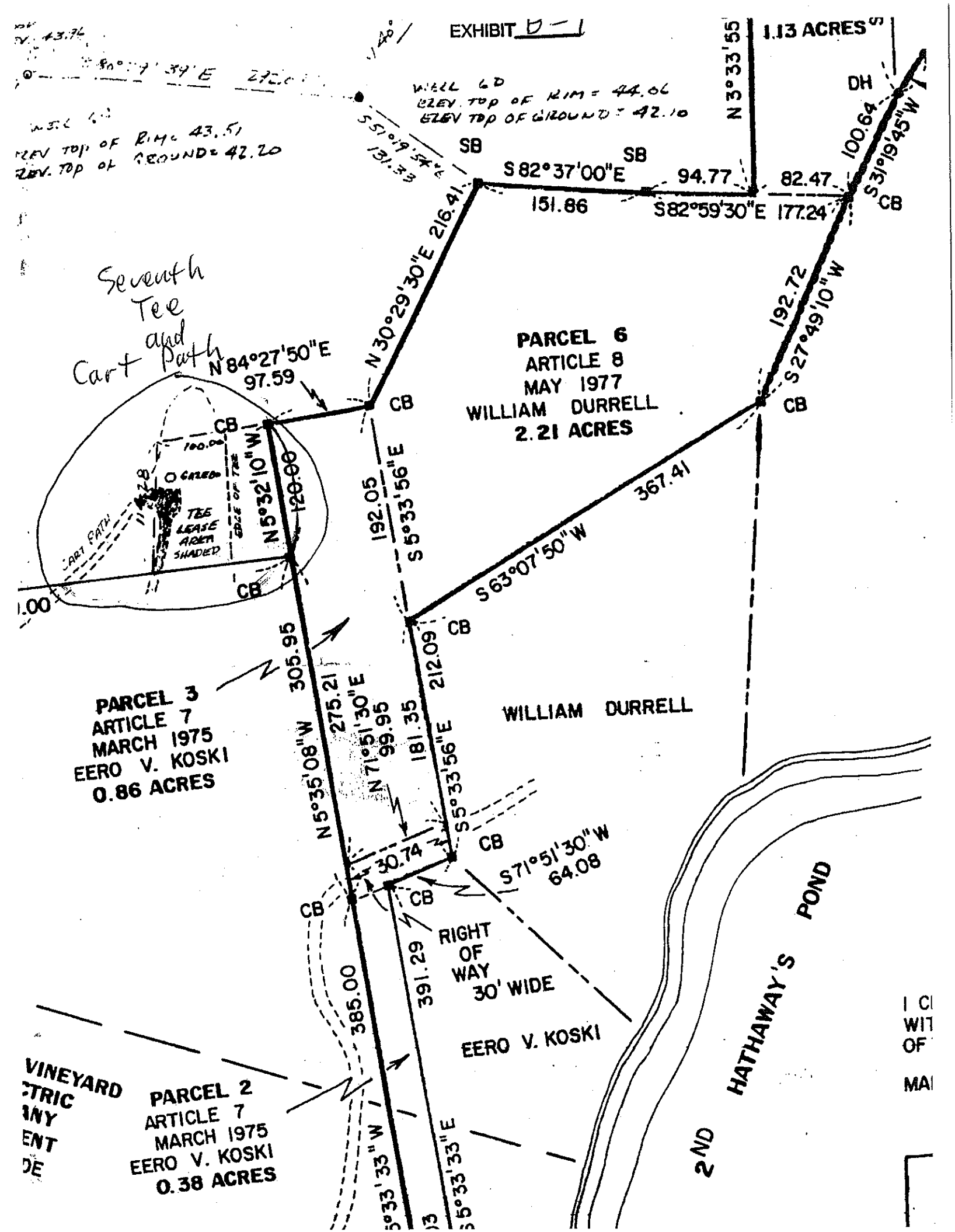
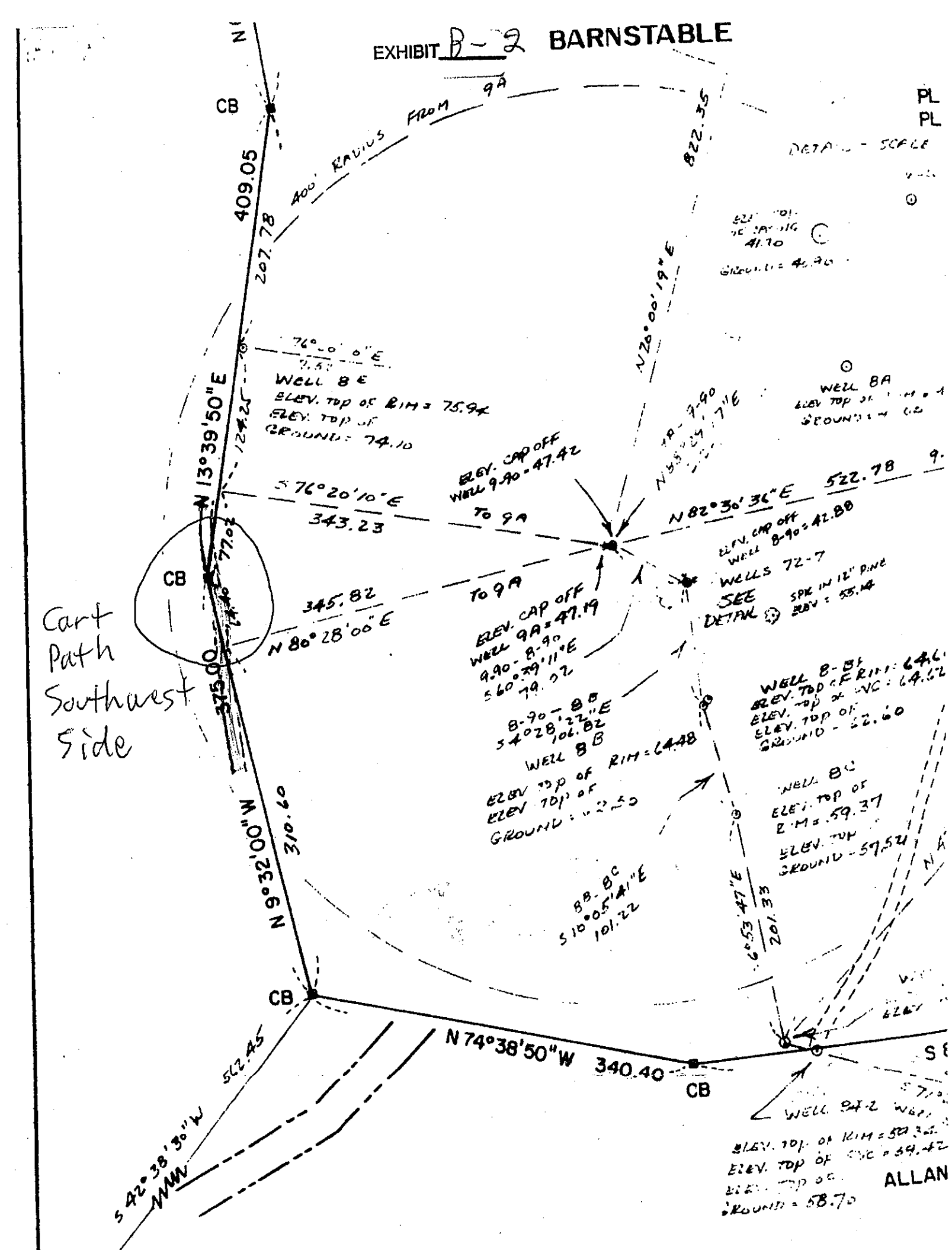


EXHIBIT D-1
1.13 ACRES
N 3°33'55"
DH
100.64
S 31°19'45" W
SB
SB
S 82°37'00" E
94.77
82.47
151.86
S 82°59'30" E 177.24
CB
N 30°29'30" E 216.41
192.72
S 27°49'10" W
Seventh Tee and Cart Path
N 84°27'50" E
97.59
PARCEL 6
ARTICLE 8
MAY 1977
WILLIAM DURRELL
2.21 ACRES
100.0
CALCD
TEE LEASE AREA SHADED
EDGE OF TEE
CART PATH
N 5°32'10" W
120.00
192.05
S 5°33'56" E
367.41
S 63°07'50" W
CB
PARCEL 3
ARTICLE 7
MARCH 1975
EERO V. KOSKI
0.86 ACRES
305.95
N 5°35'08" W
275.21
N 71°51'30" E
99.95
181.35
212.09
S 5°33'56" E
WILLIAM DURRELL
30.74
S 71°51'30" W
64.08
RIGHT OF WAY 30' WIDE
391.29
385.00
EERO V. KOSKI
PARCEL 2
ARTICLE 7
MARCH 1975
EERO V. KOSKI
0.38 ACRES
HATHAWAY'S POND
2ND

EXHIBIT B-2 BARNSTABLE



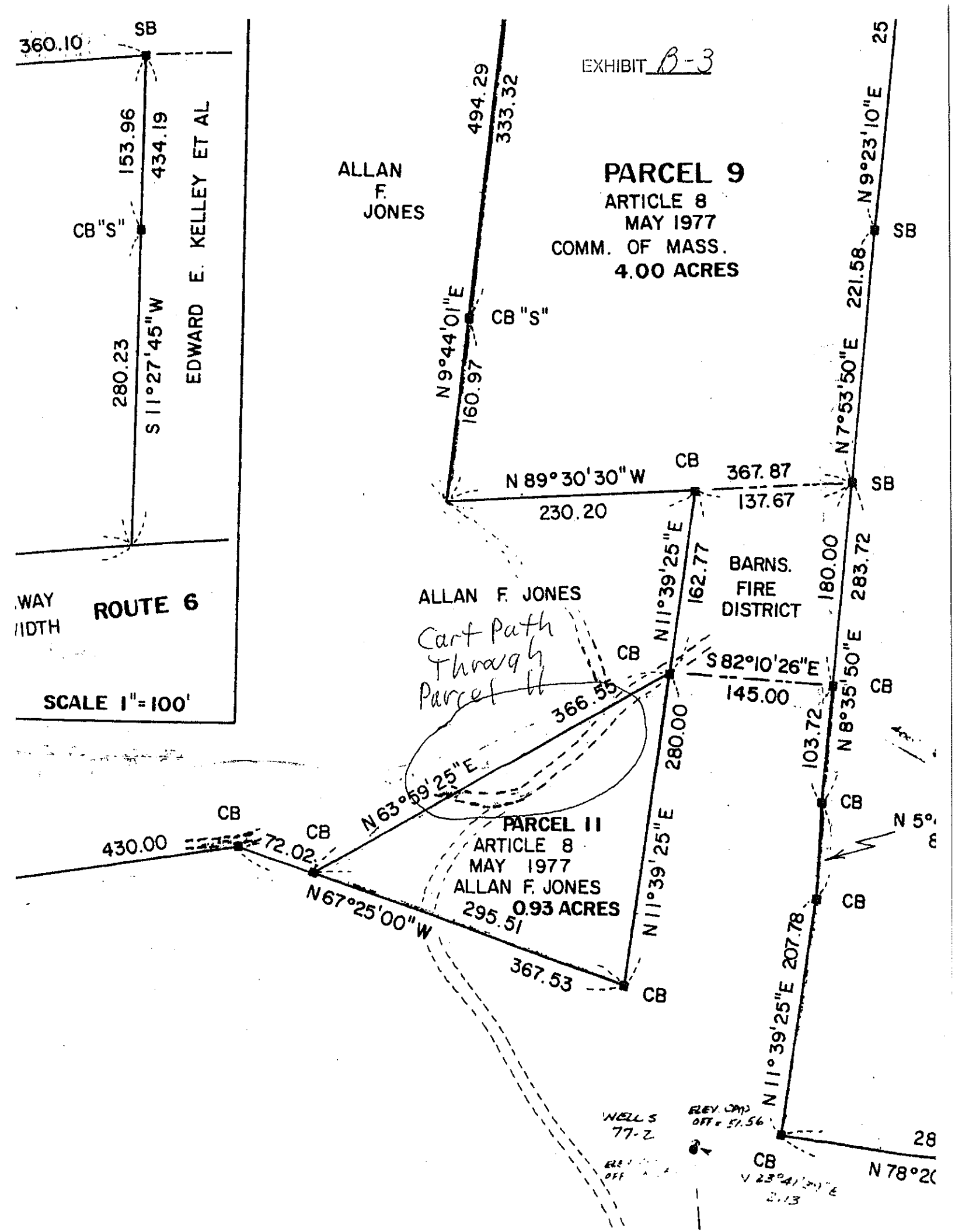


EXHIBIT B-3
PARCEL 9
ARTICLE 8
MAY 1977
COMM. OF MASS.
4.00 ACRES
ALLAN F. JONES
EDWARD E. KELLEY ET AL
ROUTE 6
SCALE 1"=100'
ALLAN F. JONES
Cart Path Through Parcel II
BARNS. FIRE DISTRICT
PARCEL 11
ARTICLE 8
MAY 1977
ALLAN F. JONES
0.93 ACRES
360.10
153.96
434.19
280.23
S 11°27'45"W
CB"S"
SB
494.29
333.32
N 9°44'01"E
160.97
CB"S"
N 89°30'30"W
230.20
CB
367.87
137.67
SB
N 9°23'10"E
221.58
N 7°53'50"E
283.72
180.00
N 8°35'50"E
103.72
N 11°39'25"E
162.77
280.00
N 11°39'25"E
207.78
S 82°10'26"E
145.00
366.55
N 63°59'25"E
430.00
72.02
N 67°25'00"W
295.51
367.53
WELL S 77-2
N 78°2(
28

Attachment C

List of Required Permits

All anticipated local, state, and federal permits that the proposed project will require are listed as follows:

Federal Permits

Permit Name	Review Agency	Status
NPDES Construction General Permit	USEPA	Not yet filed

State Permits

Permit Name	Review Agency	Status
EENF and PEIR	MEPA Office	Filed 6/9/2026 #EEA17080
Project Notification Form	Massachusetts Historical Comision (MCH)	Filed 12/19/2025 RC. 77760
MESA Project Review	NHESP	Filed 12/16/2025 RC-97409
WS 24: Approval to Construct a Water Treatment Facility of 1 million Gallons per Day or Greater	MassDEP	Not yet filed

Local Permits

Permit Name	Review Agency	Status
Site Plan Review	Town of Barnstable Building Division	Filed 6/18/2026 SPR-26-33
Stormwater Management Permit	Town of Barnstable Department of Public Works	Filed 6/18/2026
Disposal System Construction Permit	Town of Barnstable Health Division	Filed 10/20/26
Local Hazardous Materials Registration	Town of Barnstable Health Division	Not yet filed
Building Permit - Commercial	Town of Barnstable Building Division	Not yet filed
Electrical Permit	Town of Barnstable Building Division	Not yet filed
Gas Permit	Town of Barnstable Building Division	Not yet filed
Plumbing Permit	Town of Barnstable Building Division	Not yet filed
Sheet Metal Permit	Town of Barnstable Building Division	Not yet filed

Appendix B: Copy of Filing Fee

HOLD TO LIGHT TO VIEW TRUE WATERMARK IN PAPER · HEAT SENSITIVE RED LOCK DISAPPEARS WHEN HEATED

1206

H2OLSON ENGINEERING, INC.
TEL # -1- 508-375-7007

53-179/113

DATE 10/21/26

PAY TO THE ORDER OF Barnstable County Treasurer $2,923.00

Two thousand Nine hundred Twenty three 00/100 DOLLARS

Eastern Bank
Boston, MA 02110
easternbank.com
1-800-EASTERN

FOR BFD well 3+4 WTP CCC Permit

⑈001206⑈ ⑆011301798⑆ 060139236⑈

Details on back. Security Features.

Appendix C: Certified Abutters List and Labels

Town of Barnstable
Assessing Division
367 Main Street, Hyannis MA 02601
www.barnstable.gov

Office: 508-862-4022
FAX: 508-862-4722

Pamela Taylor, MAA
Acting Director of Assessing

ABUTTERS LIST CERTIFICATION

DATE: October 7, 2026

TO : Abutters List
RE: For Parcel(s): 254/018

As requested, I hereby certify the names and addresses as submitted on the attached sheet(s) as required under Chapter 40A, Section 11 of the Massachusetts General Laws for the above referenced parcel(s) as they appear on the most recent tax list with mailing addresses supplied.

Board of Assessors
Town of Barnstable

Property ID: 253020B00
CAPE COD 5 CENTS SAVINGS BANK
1500 IYANNOUGH RD
HYANNIS. MA 02601

Property ID: 254016
BARNSTABLE. TOWN OF (LB)
367 MAIN STREET
HYANNIS. MA 02601

Property ID: 254018
BARNSTABLE FIRE DISTRICT
PO BOX 546
BARNSTABLE. MA 02630

Property ID: 275001
BARNSTABLE LAND TRUST INC
1540 MAIN STREET
WEST BARNSTABLE. MA 02668

Property ID: 275002
BARNSTABLE. TOWN OF (REC)
367 MAIN STREET
HYANNIS. MA 02601

Property ID: 275005
BARNSTABLE LAND TRUST INC
1540 MAIN STREET
WEST BARNSTABLE. MA 02668

Property ID: 275008
BARNSTABLE LAND TRUST INC
1540 MAIN STREET
WEST BARNSTABLE. MA 02668

Property ID: 275009
BARNSTABLE. TOWN OF (CON)
CONSERVATION COMMISSION
230 SOUTH STREET
HYANNIS. MA 02601

Property ID: 275013
ALWARDT. MARY ELLEN ET ALS
25 ALWARDT WAY
EAST FALMOUTH. MA 02536

Property ID: 275058
LEBEL. CAROL
114 ATTUCKS LANE
HYANNIS. MA 02601

Property ID: 275058001
BARNSTABLE LAND TRUST INC
1540 MAIN STREET
WEST BARNSTABLE. MA 02668

Property ID: 276002
BARNSTABLE. TOWN OF (CON)
CONSERVATION COMMISSION
230 SOUTH STREET
HYANNIS. MA 02601

Cape Cod Commission DRI Abutter List for Subject Parcel 254018

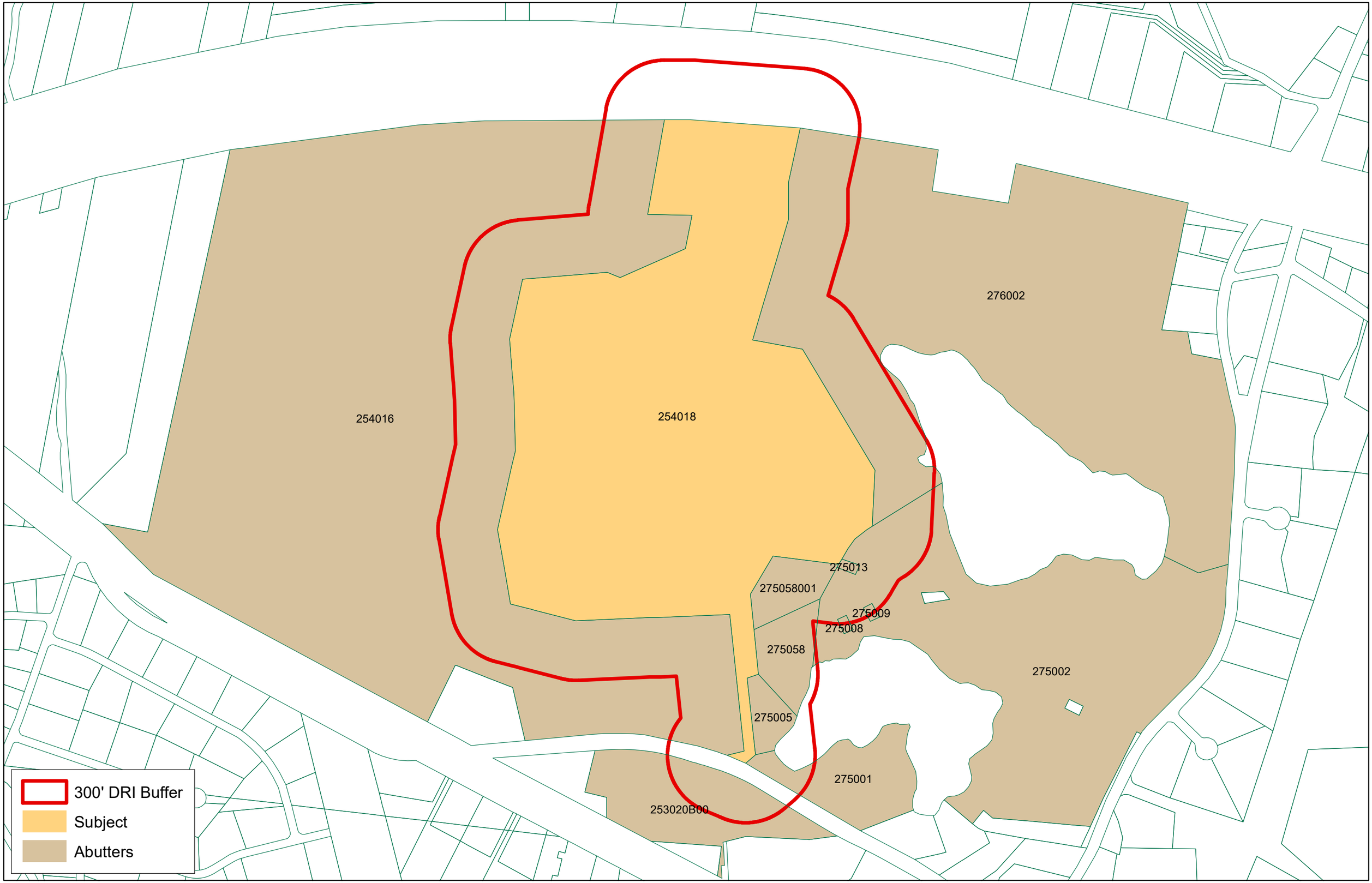
Abutters within 300 feet of subject parcel

Parcel ID	Owner 1	Owner 2	Address Line 1	Address Line 2	City	State	Zip
253020B00	CAPE COD 5 CENTS SAVINGS BANK		1500 IYANNOUGH RD		HYANNIS	MA	02601
254016	BARNSTABLE, TOWN OF (LB)		367 MAIN STREET		HYANNIS	MA	02601
254018	BARNSTABLE FIRE DISTRICT		PO BOX 546		BARNSTABLE	MA	02630
275001	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
275002	BARNSTABLE, TOWN OF (REC)		367 MAIN STREET		HYANNIS	MA	02601
275005	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
275008	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
275009	BARNSTABLE, TOWN OF (CON)	CONSERVATION COMMISSION	230 SOUTH STREET		HYANNIS	MA	02601
275013	ALWARDT, MARY ELLEN ET ALS		25 ALWARDT WAY		EAST FALMOUTH	MA	02536
275058	LEBEL, CAROL		114 ATTUCKS LANE		HYANNIS	MA	02601
275058001	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
276002	BARNSTABLE, TOWN OF (CON)	CONSERVATION COMMISSION	230 SOUTH STREET		HYANNIS	MA	02601

Total Number of Abutters: 12

Report Generated On: 10/6/2026 10:56 AM

This list by itself does NOT constitute a "Certified List of Abutters" and is provided only as an aid to the determination of abutters. If a Certified Abutter List is required, you must contact the Assessing Division to have this list certified.


254016
254018
276002
275013
275058001
275009
275008
275058
275002
275005
275001
253020B00
300' DRI Buffer
Subject
Abutters

Appendix D: Expanded Environmental Notification Form

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

June 9, 2026

MEPA Office
100 Cambridge Street – 9th Floor
Boston, MA 02114

RE: Expanded Environmental Notification Form (EENF)
Barnstable Fire District Wells 3&4 Water Treatment Plant
Barnstable, Massachusetts

To whom it may concern:

On behalf of the Barnstable Fire District Water Department (District; Applicant), please find enclosed a completed Expanded Environmental Notification Form (EENF) for the above referenced project.

The District is proposing to construct a new water treatment plant for the removal of PFAS, iron, and manganese on a parcel of land owned by the District associated with the existing pump houses for Well 3 and Well 4 at 1650 Iyannough Road/Route 132 in Barnstable (Site). The proposed facility will be equipped with three (3) 10.5-foot diameter GreensandPlus™ media filters and associated process mechanical valves and piping, six (6) 10-foot diameter GAC media pressure vessels and associated process mechanical valves and piping, potassium hydroxide (KOH) storage, feed, and handling facilities, and sodium hypochlorite (NaOCl) storage, feed, and handling facilities.

This project also involves the construction of two (2) sand filters and two (2) infiltration basins for the management of water treatment residuals, a paved driveway to the new building, a septic system for the facility bathroom, stormwater best management practices (BMPs), new yard piping to deliver water to and from the building, new underground electrical lines to deliver power to the building, new underground fiberoptic lines to transmit Supervisory Control and Data Acquisition (SCADA) information, two (2) new generators, three (3) new propane tanks, site fencing, and three (3) new water hydrants, one located at the end of the paved access road.

The proposed project triggers review under the Massachusetts Environmental Policy Act (MEPA) as the proposed project requires one or more State Agency Action and exceeds the following review threshold for an Environmental Notification Form (ENF):

- 301 CMR 11.03(4)(b)4.: Construction of a new drinking water treatment plant with a Capacity of 1,000,000 or more gpd.

While the proposed project does not exceed any mandatory Environmental Impact Report (EIR) thresholds, it is located within an Environmental Justice (EJ) Designated Geographic Area (DGA), as the proposed project is located within one mile of mapped EJ Communities. Given that the proposed project is located within the EJ DGA, an EIR is required in accordance with MEPA's Environmental Justice Protocols (effective January 1, 2022).

10 Riverside Drive, Suite 103
Lakeville, MA 02347
Tel: 508-375-7007
www.h2olsonengineering.com

The Applicant respectfully requests that the Secretary apply the Rollover process in accordance with the provisions set forth in 301 CMR 11.06(13). As such, this EENF is being submitted concurrently with a Proposed EIR (PEIR) prepared in accordance with 301 CMR 11.05(9). The attached EENF and separate PEIR address the EJ Protocol requirements, and includes a baseline assessment, description of outreach, initial impact analysis, alternative analysis, and a discussion of mitigation measures for the pertinent MEPA review thresholds.

Enclosed with this submittal are the table of contents, the Environmental Notification Form, a project narrative, an alternatives analysis, figures and plans, and other required materials. This EENF and separate PEIR are being submitted for publication in the June 24, 2026 edition of the Environmental Monitor.

Please feel free to contact me if you have any questions or require additional information. I can be reached at sco@h2olsonengineering.com or (508) 375–7007.

Very Truly Yours,
H_2Olson Engineering, Inc.

Stephen C. Olson, P.E.
President

CC: Sean Anderson, Barnstable Fire District Water Department, Barnstable, MA
Genevieve Cordeiro, E.I.T., H2Olson Engineering, Inc.

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- Town of Barnstable Zoning Map
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- NHESP MESA Determination
- MHC Project Notification Form Determination

PUBLIC NOTICE OF ENVIRONMENTAL REVIEW

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs

MEPA Office

100 Cambridge St., Suite 900
Boston, MA 02114
Telephone 617-626-1020

PUBLIC NOTICE OF ENVIRONMENTAL REVIEW

PROJECT: Barnstable Fire District Wells 3&4 Water Treatment Plant

LOCATION: 1650 Iyannough Road/Route 132 Barnstable, Massachusetts

PROPONENT: Barnstable Fire District Water Department

The undersigned is submitting an Expanded Environmental Notification Form ("EENF") to the Secretary of Energy & Environmental Affairs on or before June 9, 2026.

This will initiate review of the above project pursuant to the Massachusetts Environmental Policy Act ("MEPA," M.G.L. c. 30, ss. 61-62L). Copies of the EENF may be obtained from:
- Steve Olson at sco@h2olsonengineering.com or at (781) 588–6800

Electronic copies of the EENF are also being sent to the Conservation Commission and Planning Board of Barnstable, Massachusetts**.**

The Secretary of Energy & Environmental Affairs will publish notice of the ENF in the Environmental Monitor, receive public comments on the project, and then decide if an Environmental Impact Report is required. A site visit and/or remote consultation session on the project may also be scheduled. All persons wishing to comment on the project, or to be notified of a site visit and/or remote consultation session, should email MEPA@mass.gov or the MEPA analyst listed in the Environmental Monitor. Requests for language translation or other accommodations should be directed to the same email address. Mail correspondence should be directed to the Secretary of Energy & Environmental Affairs, 100 Cambridge St., Suite 900, Boston, Massachusetts 02114, Attention: MEPA Office, referencing the above project.

By: Barnstable Fire District Water Department

Estado de Massachusetts
Executive Office of Energy and Environmental Affairs

MEPA Office

100 Cambridge St., Sala 900
Boston, MA 02114
Telefone 617-626-1020

AVISO PÚBLICO DE REVISÃO AMBIENTAL

PROJETO: Estação de Tratamento de Água dos Poços 3 e 4 do Distrito de Bombeiros de Barnstable

LOCAL: 1650 Iyannough Road / Rodovia 132 Barnstable, Massachusetts

PROPONENTE: Departamento de Água do Distrito de Bombeiros de Barnstable

O(A) signatário(a) está enviando, pelo presente documento, um Formulário de notificação ambiental ("ENF") a(o) Secretário(a) de Energy & Environmental Affairs (Questões Ambientais e de Energia) no dia
9 de junho de 2026.

Isso iniciará a revisão do projeto mencionado acima de acordo com a Lei de Política Ambiental de Massachusetts ("MEPA", L.G.M. c. 30, ss. 61-62L). Cópias do ENF podem ser obtidas com:
-Steve Olson pelo e-mail sco@h2olsonengineering.com ou pelo telefone (781) 588–6800

Cópias eletrônicas do ENF também estão sendo enviadas à Comissão de Conservação e ao Conselho de Barnstable, Massachusetts**.**

O(A) Secretário(a) de Energy & Environmental Affairs publicará o aviso do ENF no Monitor ambiental, receberá os comentários públicos sobre o projeto e, depois, decidirá se um Relatório de impacto ambiental é necessário. Uma visita ao local e/ou sessão de consulta remota sobre o projeto também poderá ser agendada. Todas as pessoas que desejem comentar sobre o projeto, ou serem avisadas de uma visita ao local e/ou sessão de consulta remota, devem enviar um e-mail para: MEPA@mass.gov ou para o(a) analista do MEPA listado(a) no Monitor ambiental. Solicitações de interpretação ou outras acomodações devem ser direcionadas para o mesmo endereço de e-mail. A correspondência postal deve ser direcionada para: Secretary of Energy & Environmental Affairs, 100 Cambridge St., Suite 900, Boston, Massachusetts 02114, Atenção: MEPA Office, referenciando o projeto acima.

Por: Departamento de Água do Distrito de Bombeiros de Barnstable

EXPANDED ENVIRONMENTAL NOTIFICATION FORM

Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs
Massachusetts Environmental Policy Act (MEPA) Office

Environmental Notification Form

For Office Use Only

EEA#: _____

MEPA Analyst: _____

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Information

Project Name: **Barnstable Fire District Wells 3 & 4 WTP**	Street Address: **1650 Iyannough Road/Route 132**
Municipality: **Barnstable**	Watershed: **Wequaquet Lake (010900020206)**
Universal Transverse Mercator Coordinates: **Zone 19** **390,109 (easting)** **4,615,434 (northing)**	Latitude: **41.683099** Longitude: **-70.320359**
Estimated commencement date: **February 2027**	Estimated completion date: **October 2028**
Project Type: **Municipal drinking water supply improvements including a new water treatment plant.**	Status of project design: **50% Complete**
Proponent: **Barnstable Fire District Water Department**	Street Address: **255 Breeds Hill Road PO Box 546**
Municipality: **Barnstable**	State: **MA** Zip Code: **02630**
Name of Contact Person: **Stephen Olson**	Firm/Agency: **H2Olson Engineering, Inc.**
Street Address: **10 Riverside Drive**	Municipality: **Lakeville**
State: **MA**	Zip Code: **02347**
Phone: **508-375-7007** Fax: **508-748-5960**	E-mail: **sco@h2olsonengineering**

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☐Yes ☒No

Is there an Environmental Justice (EJ) population within Designated Geographic Area (DGA)? (see 301 CMR 11.02)? ☒Yes ☐No

What is the DGA for the project? ☒1 mile ☐5 miles ☐N.A.

If required, when was Advanced Notification sent to the EJ Reference List (see 301 CMR 11.05(4))?

The Advanced Notification was sent to the EJ Reference List on March 11, 2026.

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

a Single EIR? (see 301 CMR 11.06(8))	☒Yes ☐No
b Rollover EIR? (see 301 CMR 11.06(13))	☒Yes ☐No
c Special Review Procedure? (see 301CMR 11.09)	☐Yes ☒No
d Waiver of mandatory EIR? (see 301 CMR 11.11)	☐Yes ☒No
e Phase I Waiver? (see 301 CMR 11.11)	☐Yes ☒No

Are you otherwise requesting:

f Qualifying housing criteria? (see 301 CMR 11.01(2)(c)1. & 2.)	☐Yes ☒No

(Note: Greenhouse Gas Emissions analysis must be included in the Expanded ENF, if required by applicable MEPA protocols.)

Is the project proposed as an Ecological Restoration Project or Ecological Restoration Limited Project under Wetlands Protection Act regulations at 310 CMR 10.00? ☐Yes ☒No

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?

301 CMR 11.03(4)(b)4.: Construction of a new drinking water treatment plant with a capacity of 1,000,000 or more gpd.

Which Agency Permits will the project require?

All anticipated local, state, and federal permits that the project will require are listed as follows:

- **MEPA Secretary's Certificate (EEOEA)**
- **Massachusetts Historical Commission Review – Completed**
- **MESA Project Review (NHESP) – Completed**
- **Title 5 Permit (MassDEP, Town of Barnstable)**
- **Local Building, Electrical, Gas, and Sheet Metal Permit (Town of Barnstable)**
- **Local Hazardous Materials Registration (Town of Barnstable Health Division)**
- **Site Plan Review (Town of Barnstable Building Department)**
- **Stormwater Management Permit (Town of Barnstable Department of Public Works)**
- **NPDES Construction General Permit (USEPA)**
- **MassDEP WS 24: Approval to Construct a Water Treatment Facility of 1 million Gallons per Day or Greater**

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:

This project received the Emerging Contaminants (EC) in Small or Disadvantaged Communities Grant (SDC) funded by USEPA. This project is not seeking any land transfer from an Agency of the Commonwealth.

Summary of Project Size & Environmental Impacts	Existing	Change	Total
Land			
Total site acreage	71.77		
New acres of land altered[1]		2.10	
Acres of impervious area	0.71	+0.18	0.89
Square feet of new bordering vegetated wetlands alteration		0	
Square feet of new other wetland alteration		0	
Acres of new non-water dependent use of tidelands or waterways		0	
Structures			
Gross square footage	1,375	+4,040	5,415
Number of housing units	0	0	0
Maximum height (feet)	12	32.75	32.75
Greenhouse Gas (GHG) emissions (tpy)[2]		5.9	
Transportation			
Vehicle trips per day	2	0	2
Parking spaces	7	+4	11
Wastewater			
Water Use (Gallons per day)	1,440,000	0	1,440,000
Water withdrawal (GPD)	1,440,000	0	1,440,000
Wastewater generation/treatment (GPD)	0	+303	303
Length of water mains (miles)	0.050	+0.007	0.057
Length of sewer mains (miles)	0	0	0

[1] All land alteration, as well as all wetlands alteration and tidelands use, should be reported in this table, even if the project site is previously developed and/or the project is considered "redevelopment."
[2] The estimate of GHG emissions can be generated by inserting building type and square footage into the MEPA Emissions Footprint Estimation Tool, available here. This is intended to be an estimate based on conservative assumptions for fuel usage, and should be updated if full GHG analysis is provided for the project.

- **'Total site acreage' and 'Acres of impervious area' include land within the whole property lot. Since the limit of work in the proposed project does not encompass the entire property, the scope was widened to include applicable structures.**
- **'New acres of land altered' represents land within the limit of work for the proposed project. Refer to the Design Drawings in Attachment A and the Site Locus Map in Attachment B for the extent of the limit of work.**
- **Refer to Attachment C for the printout from the MEPA Emissions Footprint Estimation Tool.**

Is the project located within a mapped FEMA floodplain (100-year or 500-year)?
☐Yes ☒No

1. What flood zone(s) is the project located in?

2. Has a base flood elevation(s) (BFE) been determined by FEMA? Yes__ No_X_ If yes, list the elevation(s): _____

3. What is the FEMA FIRM Panel number(s) and effective date(s) for the project site? _____

   FEMA FIRM Panel number: 25001C0562J

   Effective Date: 7/16/2014

   (print and attach, as part of required attachment #4, a FEMA FIRMette from the FEMA Flood Map Service Center website)

   See Attachment B for the FEMA FIRMette Map.

Has this project been filed with MEPA before?
☐ Yes (EEA #_____) ☒No

Has any project on this site been filed with MEPA before?
☒ Yes (EEA #__8857_____) ☐No

General Project Information

All proponents must fill out this section

Project Description:

Describe the existing conditions and land uses on the project site:_____

The project site is located on a portion of District-owned land currently in use for public water supply located at 1650 Iyannough Road/Route 132 Barnstable, Massachusetts. This land consists of a paved access road, Well 3 Pump House, and Well 4 Pump House and water treatment facility. The property is located in the Residential RG and RF-1 zoning districts, as well as the Wellhead Protection Overlay District, as seen in the Town of Barnstable Zoning Map shown in Attachment B. Existing utilities include water mains to transport water from Well 3 and Well 4 into distribution, overhead electrical lines to transmit power to the two Pump Houses, and underground fiberoptic lines to transmit SCADA information between Pump Houses, as seen in the Design Drawings shown in Attachment A. The Design Drawings have been prepared with reference to the Massachusetts State Plane Coordinate System (NAD83 horizontal datum, NAVD88 vertical datum).

Currently, water from Well 3 is pumped to the Well 4 Pump House and water treatment facility, where water from both wells is chemically treated using potassium hydroxide for pH adjustment and sodium hypochlorite for disinfection before being pumped to the distribution system. The current facilities have a combined capacity of 1,500 GPM.

The project site includes a portion of the existing paved access road, a wooded area to the south of the existing paved access road, and a small wooded area to the south of the Well 4 Pump House. Refer to the Site Locus Map shown in Attachment B for the location and extent of the project.

The existing property is predominantly woodlands. Land use in the area surrounding the Project includes undeveloped forest to the north, Hathaway's Pond Recreation Area to the east, and the Hyannis Golf Club to the south and west. The existing paved access road runs east to west, connecting the Site to Iyannough Road/Route 132. Topography at the project site varies, as the site contains numerous depressions, or kettles.

The project site is not within the FEMA 100-year floodplain, an area of critical environmental concern, limits of mapped priority habitats of rare species or estimated habitats of rare wildlife, nor an area that is likely to affect significant historic or archaeological resources, as noted later in the General Project Information Section of this EENF. The project site is, however, within the DGA of EJ communities and, as such, is required to abide by the MEPA EJ Protocols. As noted within the Environmental Justic Section of this EENF, the project is not anticipated to have measurable negative impacts on the nearby EJ communities, either during or after construction, but is anticipated to have measurable positive impacts on the community at large, including the nearby EJ communities.

Describe the proposed project and its programmatic and physical elements: _____

The proposed project involves the construction of a new water treatment plant for the treatment of water from Well 3 and Well 4. Levels of PFAS in Well 3 and Well 4 have been identified to be over the maximum containment level (MCL) set by the United States Environmental Protection Agency (USEPA). A pilot scale treatability study conducted in April of 2025 recommended the use of granular activated carbon (GAC) media to remove PFAS and greensand media to remove source water iron and manganese. The complete Pilot Scale Treatability Study Report is presented in Attachment D. The proposed facility will be equipped with three (3) 10.5-foot diameter GreensandPlus^{TM} media filters and associated process mechanical valves and piping, six (6) 10-foot diameter GAC media pressure vessels and associated process mechanical valves and piping, potassium hydroxide (KOH) storage, feed, and handling facilities, and sodium hypochlorite (NaOCl) storage, feed, and handling facilities.

Along with the 4,040 square foot building, the project consists of a paved driveway to the new building, two (2) sand filters and two (2) infiltration basins for the treatment of water treatment residuals, a septic system for the facility bathroom, best management practices (BMPs) for the treatment and infiltration of stormwater, new yard piping to deliver water to and from the building, new underground electrical lines to deliver power to the building, new underground fiberoptic lines to transmit SCADA information, two (2) new

generators, three (3) new propane tanks, yard fencing, and three (3) new water hydrants, one located at the end of the paved access road. Refer to the Design Drawings included in Attachment A for exact locations.

There will be no changes to the existing easements, zoning, or land use at the site.

As noted in the Climate Change Section of this EENF, the proposed project incorporates the recommendations of the Resilient Massachusetts Action Team (RMAT) Climate Resilience Design Standards (CRDT) Tool Project Report (RMAT Report) within the design. As such, the proposed project can accommodate upgrades to the site to adapt to climate change and sustain infrastructure requirements into the future.

NOTE: The project description should summarize both the project's direct and indirect impacts (including construction period impacts) in terms of their magnitude, geographic extent, duration and frequency, and reversibility, as applicable. It should also discuss the infrastructure requirements of the project and the capacity of the municipal and/or regional infrastructure to sustain these requirements into the future.

Describe the on-site project alternatives (and alternative off-site locations, if applicable), considered by the proponent, including at least one feasible alternative that is allowed under current zoning, and the reasons(s) that they were not selected as the preferred alternative:

_____

Since the raw water from Well 3 and Well 4 contains constituents that require treatment and removal, the District has reduced production at Wells 3 and 4 to minimize the concentration of these constituents in the distribution system. The permitted withdrawal at Well 3 and Well 4 is 0.77 million gallons per day (MGD) and 0.67 MGD, respectively. However, average daily flow from Well 3 and 4 has been substantially lower, as reported in the District's 2024 Annual Statistical Report (ASR) at only 173,051 and 111.243 gallons per day (GPD), respectively. As projections for the District show an increase in water demand, resulting from economic growth and a projected increase in housing, the District has an ever-growing need to meet its permitted withdrawal rates. The District has an obligation as a Public Water Supplier to serve its community in both water capacity and water quality, and as such, seeks this project to improve its current infrastructure. Various alternatives the District considered to achieve these objectives are as follows:

<u>Alternative #1: No-Build</u>
As required by the MEPA regulations, the No-Build Alternative was assessed as a potential project alternative. Under this alternative, the District would retain its existing system of water treatment: water from Well 3 and Well 4 would be pumped to the Well 4 Pump House, where the water is chemically treated for pH adjustment and disinfection before being pumped to distribution. This alternative does not address the District's need for a restored water capacity, nor does it address the District's source water PFAS, iron, and manganese issues. The No-Build Alternative would not serve the needs of the District; therefore, this alternative was not selected.

<u>Alternative #2: Decommissioning Well 3 and Well 4</u>
Another alternative assessed was to decommission Well 3 and Well 4 altogether. This alternative eliminates the District's source water contaminant issues. However, this alternative does not address the District's existing and future water supply needs. Decommissioning Well 3 and Well 4 would put a large strain on the District's remaining three wells, and the District would not meet its current water demand, especially in the summer months when demands increase significantly due to population increases. As such, this alternative was not selected.

<u>Alternative #3: Water Treatment Plant Addition</u>
A third alternative assessed was to construct an addition to the Well 4 Pump House, where water is currently being treated for pH adjustment and disinfection. This pump house addition would include both GAC media pressure vessels and greensand media filters to treat the raw water, as recommended per the Pilot Scale Treatability Study Report. This alternative addresses both the District's source water contaminant issues and its need for a restored water capacity.

The Well 4 Pump house is located in a small depression on the land. As such, it would be difficult to place all required elements of the project (structures for the treatment of water treatment residuals, stormwater BMPs, etc) in this area without drastically changing the topography of the existing site. Additionally, this option places the building more towards the center of the Zone I Wellhead Protection Area, which in turn, requires the construction of a longer septic line to place the septic system outside of the Zone I. The longer this line presents a higher risk of a leak within the Zone I. This location is also within the DGA of the site, thus resulting in no benefit in terms of potential disproportionate adverse effect to the EJ communities. This alternative is feasible under current zoning, but for the reasons stated above it was not selected.

Alternative #4: New Water Treatment Plant Construction

The final alternative assessed was to construct a new building for the treatment of water from Wells 3 and 4, and site it in the wooded area south of the existing paved access road. This alternative addresses both the District's source water contaminant issues and its need for a restored water capacity. The area proposed in this alternative requires much less site grading than Alternative #3, thus requiring fewer site-stabilization methods and being less susceptible to erosion. Additionally, this area provides more room for all required elements of the project and places the building closer to the edge of the Zone I when compared to Alternative #3. For the reasons described above, this alternative was selected as the preferred alternative.

Note*: The purpose of the alternatives analysis is to consider what effect changing the parameters and/or siting of a project, or components thereof, will have on the environment, keeping in mind that the objective of the MEPA review process is to avoid or minimize damage to the environment to the greatest extent feasible. Examples of alternative projects include alternative site locations, alternative site uses, and alternative site configurations.*

Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:

_____

The proposed project will result in vegetative clearing, grading, and construction of approximately 8,000 square feet of new impervious area. See below for a summary of the mitigation measures proposed to offset these impacts. For a full description of mitigation measures, refer to the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan and the Operation and Maintenance Manual within the Stormwater Report located in Attachment E.

Stormwater BMPs

Both construction-period and long-term BMPs are proposed at the project site to catch, treat, and infiltrate stormwater. During construction, BMPs will include erosion control barriers, catch basin inlet protection, and stabilized construction entrances. Post-construction BMPs can be divided into three treatment trains:

- **Deep sump catch basins, oil/grit separator, sediment forebay, infiltration basin**
- **Filtering rain garden, sediment forebay, infiltration basin**
- **Dry wells**

Post-construction BMPs have been designed in accordance with the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Handbook, as well as the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and applicable local regulations and bylaws.

Planting / Landscaping Plan

The proposed project includes planting Bermuda Grass and native shrubs on the site. The locations of the proposed shrubbery are located in the Proposed Watershed Plan within the Stormwater Report located in Attachment E. See Table 1 below for a list of shrubs proposed to be planted on site.

Table 1: Proposed Shrubs

Scientific Name	Common Name
Juniperus Virginiana L.	**Eastern Red Cedar**
Vaccinium Angustifolium	**Lowbush Blueberry**
Ilex Glabra	**Ink Berry**
Clethra Anifolia	**Sweet Pepperbush**
Ilex Verticillata	**Winterberry**
Andreopogon Gerardii	**Big Bluestem**
Schizachyrium Scoparium	**Little Bluestem**
Carex Pensylvania	**Pennsylvania Sedge**
Panicum Virgatum	**Switch Grass**

Erosion and Sedimentation Controls

Existing forested areas near the project site will be protected by a row of erosion control barriers placed at the limit of work. Erosion control locations and typical details are provided in the Design Drawings located in Attachment A. In addition, the following Best Management Practices (BMPs) are incorporated into the design:

- **Erosion control devices will be inspected regularly, and accumulated silt will be removed and properly disposed**
- **Erosion control devices will be inspected after significant precipitation events and repaired, as necessary**

Erosion control devices will be removed and properly disposed upon final stabilization of the project site.

Spill Prevention and Control

The contractor will be required to conduct the work in accordance with all applicable regulations for the management of fuels, waste, oils, and hazardous substances.

Stabilized Construction Entrance

Stabilized construction entrance will include the use of a coarse aggregate stone with an underlying geotextile, non-woven filter fabric, or turf mat placed at the site entrance from Route 132. It will be the site contractor's responsibility to take measures to prevent tracking of sediment throughout the project site or onto public roads. The exit will be maintained in a condition which will minimize tracking of sediment onto the public right of way.

If the project is proposed to be constructed in phases, please describe each phase:

_____

Not applicable. The proposed project is not scheduled to be constructed in phases.

Areas of Critical Environmental Concern:

Is the project within or adjacent to an Area of Critical Environmental Concern?

☐Yes (Specify_____)

☒No

if yes, does the ACEC have an approved Resource Management Plan? ___ Yes ___ No;

If yes, describe how the project complies with this plan.

_____

Will there be stormwater runoff or discharge to the designated ACEC? ___ Yes ___ No;

If yes, describe and assess the potential impacts of such stormwater runoff/discharge to the designated ACEC.

_____

Rare Species:

Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species? (see http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/priority_habitat_home.htm)

☐Yes (Specify_____) ☒No

Historical/Archeological Resources:

Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?

☐Yes (Specify_____) ☒No

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources? ☐Yes (Specify_____) ☐No

Water Resources:

Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site?
___Yes _X__No; if yes, identify the ORW and its location.

_____

(NOTE: Outstanding Resource Waters include Class A public water supplies, their tributaries, and bordering wetlands; active and inactive reservoirs approved by MassDEP; certain waters within Areas of Critical Environmental Concern, and certified vernal pools. Outstanding resource waters are listed in the Surface Water Quality Standards, 314 CMR 4.00.)

Are there any impaired water bodies on or within a half-mile radius of the project site? ___Yes _X__No; if yes, identify the water body and pollutant(s) causing the impairment:_____.

The two water bodies within a half-mile radius of the project site are Hathaway Ponds and Shallow Pond. Neither of these water bodies are reported as impaired by EPA. Refer to the Site Orthophoto Map in Attachment B for the water body locations.

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? ___Yes _X__No

Stormwater Management:

Generally describe the project's stormwater impacts and measures that the project will take to comply with the standards found in MassDEP's Stormwater Management Regulations:_____

The proposed project involves the construction of approximately 8,000 square feet of new impervious surface area: 4,040 square feet of new treatment plant and 3,960 square feet of new pavement comprising of a driveway and parking area. See below for a summary of the stormwater impacts and measures proposed to comply with the standards found in MassDEP's Stormwater Management Handbook (Standards). For a full description of the above, refer to the Stormwater Report located in Attachment E.

Standard 1: No New Untreated Discharges

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

There will be no direct discharge of untreated stormwater to nearby wetlands or waters of the Commonwealth.

Standard 2: Peak Rate Attenuation

Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

The existing and proposed hydrologic conditions were modeled using HydroCAD™ version 10.20-9a to demonstrate that post-development stormwater runoff rates will be less than or equal to the pre-development runoff rates. The analysis utilized precipitation data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the 2-, 10-, 25- and 100-year 24-hour storms, along with the RMAT projected 2070 50-year 24-hour storm.

The sub-catchments on the project site were divided into six design points for direct comparison between pre- and post-development conditions. The results from this analysis show that the post-development peak discharge rates do not exceed pre-development discharge rates for the 2- and 10-year 24-hour storms at all design points, as is required by the Standards. However, during the 25-, 100- and RMAT projected 50-year 24-hour storms, the post-development peak discharges do exceed pre-development discharge rates at up

to three design points. Since the results showed an increased runoff post-construction for these storms, further analysis was made. An offsite flooding analysis was completed for the 100-year 24-hour storm, which indicates that the site is not subject to an increase in offsite flooding. The current design also allows for future upgrades to the site to adapt to climate change as the RMAT model suggests through the results of the projected 50-year 24-hour storm.

Standard 3: Recharge

Loss of annual recharge to groundwater shall be eliminated or minimized. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from predevelopment conditions based on soil type.

Natural Recourses Conservation Service (NRCS) mapping indicates the presence of loamy fine sand with a Hydraulic Soil Group (HSG) A. Site visits, test pits, and soil borings conducted at the site also indicate the soils are mainly composed of fine to medium sand. For the proposed increase in impervious area, the required recharge volume is 962 cubic feet.

The project proposes to mitigate loss of annual groundwater recharge via an infiltration basin and six dry wells. The total provided recharge volume is 1,214 cubic feet. All proposed infiltration BMPs have been designed to drain within 72 hours and maintain a separation of two feet or greater from the seasonal high groundwater table.

Limited portions of the Site's impervious area will not receive treatment nor drain to the proposed infiltration BMPs due to the need to meet existing grades and the goal to minimize the project disturbance area. As such, the total recharge volume was adjusted to reflect this, as per the procedure set forth in the Standards. No new impervious area falls into this category; all imperious areas that do not drain to the proposed infiltration BMPs were previously existing at the site. Although the proposed design does not account for all impervious area on site, the percentage of impervious area treated is at 71%, above the required 65% as per the Standards.

Standard 4: Water Quality

Stormwater management systems shall be designed to remove 80% of the average annual postconstruction load of Total Suspended Solids (TSS).

The project proposes treatment of stormwater from impervious areas via three treatment trains as follows:

1. **Deep sump hooded catch basins, oil/grit separator, sediment forebay, infiltration basin**
2. **Filtering rain garden, sediment forebay, infiltration basin**
3. **Dry wells**

Treatment Train 1 contains runoff from the new pavement and roof runoff from two building down spouts. Treatment Train 2 contains runoff from the remainder of the new paved driveway and portions of the existing paved access road. Both Treatment Train 1 and 2 will provide at least 80% TSS removal in total and 44% TSS removal in pre-treatment. Treatment Train 3 contains runoff from the remaining 6 down spouts. Since the proposed roof will not be made of metal, as described in the Standards, this runoff is considered clean, and does not require pre-treatment.

The project is required to treat the 1-inch water quality volume due to the presence of soils with rapid infiltration rates and the location of the project within a Zone I and Zone II Wellhead Protection Area, both considered Critical Areas. The resulting required 1-inch water quality volume is 1,136 cubic feet. Proposed treatment BMPs have been designed to provide a total water quality volume of 2,282 cubic feet.

The proposed Project is located within the Barnstable Harbor embayment within the Wequaquet Lake Watershed, which has a final Total Maximum Daily Load (TMDL) issued for fecal coliform. The most likely runoff to contribute to this TMDL is from the pavement. As such, the infiltration BMP for this impervious area, the infiltration basin, was chosen as it has a 90% removal efficiency for pathogens.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)
Land use with high potential pollutant loads must have source control and pollution prevention measures implemented in accordance with the Massachusetts Stormwater Handbook.

The project site is not a land use with higher potential pollutant loads, as defined by the Standards.

Standard 6: Critical Areas
Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of specific source control, pollution prevention measures.

The proposed project discharges to both the Zone I and Zone II Wellhead Protection Areas, and all proposed stormwater BMPs are located within the Zone I. Although Standard 6 generally prohibits stormwater discharges and the construction of stormwater BMPs within a Zone I, the regulations provide an exception when proposed work is essential to the operation of a public water supply. As the proposed project involves the construction of a new water treatment plant for a public water supply, this project is exempt from this standard.

Infiltration basins, sediment forebays, oil/grit separators, rain gardens, deep sump catch basins, and dry wells are considered suitable BMPs for Zone Is. Treatment trains have been designed to provide 44% pretreatment prior to discharge to an infiltration BMP and will treat the 1-inch water quality volume.

Standard 7: Redevelopment
A redevelopment project is required to meet certain Stormwater Management Standards only to the maximum extent practicable.

Although a portion of the site was previously developed, this Project is considered new development as the proposed project includes a net increase in impervious area. As such, the project is required to fully meet all the Massachusetts Stormwater Management Standards.

Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control
A plan to control construction related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities shall be developed and implemented.

The Project will disturb more than one acre of land and will therefore be required to obtain coverage under the NPDES Construction General Permit. A Stormwater Pollution Prevention Plan (SWPPP) will be provided before the start of construction; however, erosion and sediment controls are identified in the Design Drawings and a Construction Period Pollution Prevention and Erosion and Sediment Control Plan is provided as part of the Stormwater Report located in Attachment E.

Standard 9: Long Term Operation and Maintenance Plan
A Long-Term Operation and Maintenance Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

A Long-Term Operation and Maintenance Plan has been included within the Stormwater Report in Attachment E. Operations and maintenance of stormwater management systems will be the responsibility of the District.

Standard 10: Prohibition of Illicit Discharges
All illicit discharges to the stormwater management system are prohibited.

There are no existing illicit discharges to the project site. New illicit discharges to the project site are prohibited. An illicit discharge compliance statement is included in the Stormwater Report located in Attachment E.

Massachusetts Contingency Plan:

Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan?
Yes ___ No __X_ ; if yes, please describe the current status of the site (including Release Tracking Number (RTN),
cleanup phase, and Response Action Outcome classification):_____

Is there an Activity and Use Limitation (AUL) on any portion of the project site? Yes ___ No _X__;
if yes, describe which portion of the site and how the project will be consistent with the AUL:
_____.

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN?
Yes ___ No _X__ ; if yes, please describe:_____

Soil and Hazardous Waste:

If the project will generate solid waste during demolition or construction, describe alternatives considered for re-use, recycling, and disposal of, e.g., asphalt, brick, concrete, gypsum, metal, wood:_____

The solid waste generated from this project may include asphaltic pavement, concrete, and/or metal associated with the construction of the new water treatment plant and associated structures. The disposal will be completed according to local, state, and federal regulations.

(NOTE: Asphalt pavement, brick, concrete and metal are banned from disposal at Massachusetts landfills and waste combustion facilities and wood is banned from disposal at Massachusetts landfills. See 310 CMR 19.017 for the complete list of banned materials.)

Will your project disturb asbestos containing materials? Yes ___ No _X__ ;
if yes, please consult state asbestos requirements at http://mass.gov/MassDEP/air/asbhom01.htm

Describe anti-idling and other measures to limit emissions from construction equipment: _____

Contract Specifications will require the contractor to comply with the provisions of MGL Chapter 90, section 16A and the DEP Anti-Idling Regulations (310 CMR 7.11(b)), which prohibit unnecessary engine idling and require engines to be shut down if the vehicle is stopped for more than five minutes.

The contractor shall also abide by the MassDOT diesel retrofit specification, which states that any diesel-powered non-road construction equipment with engine horsepower ratings of 50 and above to be used for 30 or more days over the course of construction will either be EPA Tier 4-compliant or will be retrofitted with EPA-verified (or equivalent) emission control devices such as oxidation catalysts or other comparable technologies (to the extent that they are commercially available) installed on the exhaust system side of the diesel combustion engine.

Designated Wild and Scenic River:

Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? Yes ___ No __X_ ;
if yes, specify name of river and designation:

If yes, does the project have the potential to impact any of the "outstandingly remarkable" resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River?
Yes ___ No ___ ; if yes, specify name of river and designation: _____;
if yes, will the project will result in any impacts to any of the designated "outstandingly remarkable" resources of the Wild and Scenic River or the stated purposes of a Scenic River.
Yes ___ No ___;
if yes, describe the potential impacts to one or more of the "outstandingly remarkable" resources or stated purposes and mitigation measures proposed.

Attachments:

1. List of all attachments to this document

   Refer to the Table of Contents.

2. U.S.G.S. map (good quality color copy, 8-½ x 11 inches or larger, at a scale of 1:24,000) indicating the project location and boundaries.

   Refer to Attachment B.

3. Plan, at an appropriate scale, of existing conditions on the project site and its immediate environs, showing all known structures, roadways and parking lots, railroad rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.

   Refer to Sheet C-1 of Attachment A.

4. Plan, at an appropriate scale, depicting environmental constraints on or adjacent to the project site such as Priority and/or Estimated Habitat of state-listed rare species, Areas of Critical Environmental Concern, Chapter 91 jurisdictional areas, Article 97 lands, wetland resource area delineations, water supply protection areas, and historic resources and/or districts. For all projects, attach FEMA FIRMette from the FEMA Flood Map Service Center website.

   Refer to Attachment B.

5. Plan, at an appropriate scale, of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).

   Refer to Sheet C-3 through C-9 of Attachment A.

6. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).

   Refer to Attachment F.

7. List of municipal and federal permits and reviews required by the project, as applicable.

   Refer to the Project Information Section of this EENF.

8. Printout of output report from RMAT Climate Resilience Design Standards Tool.

   Refer to Attachment G.

9. Printout from the EEA EJ Maps Viewer showing the project location relative to Environmental Justice (EJ) Populations located in whole or in part within a 1-mile and 5-mile radius of the project site.

   Refer to the EJ Screening Form located in Attachment H.

Land Section

All proponents must fill out this section

I. Thresholds / Permit

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1)
___ Yes _X__ No; if yes, specify each threshold:

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

Land Impacts	Existing	Change	Total
Footprint of buildings[1]	0.032	+0.093	0.124
Internal roadways[1]	0.536	+0	0.536
Parking and other paved areas[1]	0.141	+0.085	0.226
Other altered areas[1]	0.005	+0.456	0.461
Undeveloped areas[2]	1.388	-0.634	0.749
Total: Project Site Acreage[1]	0.714	+1.968	2.682
Total: Project Site Acreage[2]	0.129	+1.968	2.097

1. **Calculation includes land within the property lot as a whole. Including both existing and proposed conditions, the developed area on the property lot will be 2.682 acres.**
2. **Calculation includes land within the limit of work. The limit of work for the proposed project is 2.097 acres, including 1.968 acres of new developed area. Refer to the Design Drawings in Attachment A and the Locus Map in Attachment B for the extent of the limit of work.**

B. Has any part of the project site been in active agricultural use in the last five years?
___ Yes _X__ No; if yes, how many acres of land in agricultural use (with prime state or locally important agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use?
___ Yes _X__ No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a forest management plan approved by the Department of Conservation and Recreation:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97?
___ Yes __X_ No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction?
___ Yes__X_ No; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A?
___ Yes __X_ No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B?
Yes ___ No __X_; if yes, describe

III. Consistency

A. Identify the current municipal comprehensive land use plan
Title:___Town of Barnstable Local Comprehensive Plan____ Date_June 9, 2025_____

B. Describe the project's consistency with that plan with regard to:
i) Economic development

Under the Economic Development Goals & Actions Section of The Town of Barnstable Local Comprehensive Plan (Comprehensive Plan), it is the Towns goal to enhance the overall well-being of the community (Goal #9). The proposed project supports this goal by improving a portion of the Town's water quality through the construction of a new water treatment plant to those residents served by the District.

ii) Adequacy of infrastructure

Under the Infrastructure Targeted Action Plan Section of the Comprehensive Plan, it is the Town's goal to explore future expansion of water treatment plants for emerging contaminants (Goal #12). The proposed project supports this goal by providing the construction of a GAC media treatment facility for the removal of PFAS.

iii) Open space impacts

Under the Land Use Goals & Actions Section of The Comprehensive Plan and the Open Space and Recreation Plan (2018), the Town emphasizes the importance of preserving open space. Under Section 8 of the Open Space and Recreation Plan, it is the Town's objective to execute open space protection measures that complement community efforts to protect water supply (Goal #2). Although the proposed project impacts approximately 2.10 acres of open space, it closely aligns with the Town's goal to protect the public water supplies located within the Town of Barnstable and aligns with this goal.

iv) Compatibility with adjacent land uses

The proposed project will not result in a change in the existing land use of the site, which is a is a public water supply protection area. Because of this, the project is compatible with the adjacent land uses.

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)
RPA: __Cape Cod Commission_____

Title:__Cape Cod Regional Policy Plan_____ Date__December 2025_____

D. Describe the project's consistency with that plan with regard to:
i) Economic development

Under the Community Systems Goals of the Cape Cod Regional Policy Plan (Regional Policy Plan), the Cape Cod Commission (CCC) emphasizes the importance of promoting a resilient regional economy that protects the Cape's advantages. The proposed project supports this goal by improving the District's water quality, thus promoting a health and strong economy.

ii) Adequacy of infrastructure

Under the Built Systems Goals of the Regional Policy Plan, the CCC emphasizes the importance of ensuring infrastructure promotes efficiency, sustainability, and resiliency. The proposed project supports this goal by improving the District's water quality, thus promoting a strong water system for the Town.

iii) Open space impacts

Under the Natural Systems Goals of the Regional Policy Plan, the CCC emphasizes the importance of preserving open space that contributes to the region's natural and community resources and

systems. The proposed project supports this goal as it involves the construction of a new water treatment plant on the lot of existing water supply facilities, thus compacting development and preserving high-quality open space.

Rare Species Section

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? ___ Yes _X__ No; if yes, specify, in quantitative terms: Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1) ___ Yes ___ No; if yes, specify each threshold:

(NOTE: If you are uncertain, it is recommended that you consult with the Natural Heritage and Endangered Species Program (NHESP) prior to submitting the ENF.)

The proposed project will not result in a prohibited take of state-listed rare species. A Massachusetts Endangered Species Act (MESA) Project Review Checklist was submitted to NHESP on December 16, 2025. Refer to Attachment I for the response from NHESP.

B. Does the project require any state permits related to **rare species or habitat**?
___ Yes _X__ No

C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)?
___ Yes __X_ No

D. If you answered "No" to all questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes ___ No. If yes,

i) Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? ___Yes ___No; if yes, have you received a determination as to whether the project will result in the “take” of a rare species? ___ Yes ___ No; if yes, attach the letter of determination to this submission.

ii) Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate rare species impacts.

iii) Which rare species are known to occur within the Priority or Estimated Habitat?

iv) Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? ___ Yes ___ No

v) If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:

Wetlands, Waterways, and Tidelands Section

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? ___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? ___ Yes ___ No; if yes, has a Notice of Intent been filed? ___ Yes ___ No; if yes, list the date and MassDEP file number: _____; if yes, has a local Order of Conditions been issued? ___ Yes ___ No; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes ___ No.

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site:

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

Wetlands Impacts	Area (square feet) or Length (linear feet)	Temporary or Permanent Impact?
Coastal Wetlands		
Land Under the Ocean		
Designated Port Areas		
Coastal Beaches		
Coastal Dunes		
Barrier Beaches		
Coastal Banks		
Rocky Intertidal Shores		
Salt Marshes		
Land Under Salt Ponds		
Land Containing Shellfish		
Fish Runs		
Land Subject to Coastal Storm Flowage		
Inland Wetlands		
Bank (lf)		
Bordering Vegetated Wetlands		
Isolated Vegetated Wetlands		
Land Under Water		
Isolated Land Subject to Flooding		
Bordering Land Subject to Flooding		
Riverfront Area		

D. Is any part of the project:
   i) proposed as a **limited project**? ___ Yes ___ No; if yes, what is the area (in sf)?____
   ii) the construction or alteration of a **dam**? ___ Yes ___ No; if yes, describe:
   iii) fill or structure in a **velocity zone** or **regulatory floodway**? ___ Yes ___ No
   iv) dredging or disposal of dredged material? ___ Yes ___ No; if yes, describe the volume of dredged material and the proposed disposal site:
   v) a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical Environmental Concern (ACEC)**? ___ Yes ___ No
   vi) subject to a wetlands restriction order? ___ Yes ___ No; if yes, identify the area (in sf):
   vii) located in buffer zones? ___Yes ___No; if yes, how much (in sf) _____

E. Will the project:
   i) Be subject to a local wetlands ordinance or bylaw? ___ Yes ___ No
   ii) Alter any federally-protected wetlands not regulated under state law? ___ Yes ___ No; if yes, what is the area (sf)? _____

III. Waterways and Tidelands Impacts and Permits

A. Does the project site contain waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? ___ Yes ___ No; if yes, is there a current Chapter 91 License or Permit affecting the project site? ___ Yes ___ No; if yes, list the date and license or permit number and provide a copy of the historic map used to determine extent of filled tidelands:

B. Does the project require a new or modified license or permit under M.G.L.c.91? ___ Yes ___ No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent use? Current ____ Change ____ Total ____; of yes, how many square feet of solid fill or pile-supported structures (in sf)? _____

C. For non-water-dependent use projects; indicate the following:
   i) Area of filled tidelines on the site: _____
   ii) Area of filled tidelines covered by buildings: _____
   iii) For portions of the site on filled tidelands, list ground floor uses and area of each use: _____
   iv) Does the project include new non-water-dependent uses located over flowed tidelands? Yes ___ No ___
   v) Height of building on filled tidelands: _____

Also show the following on a site plan: Mean High Water, Mean Low Water, Water-dependent Use Zone, location of uses within buildings on tidelands, and interior and exterior areas and facilities dedicated for public use, and historic high and historic low water marks.

D. Is the project located on landlocked tidelands? ___ Yes ___ No; if yes, describe the project's impact on the public's right to access, use and enjoy jurisdictional tidelands and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

E. Is the project located in an area where low groundwater levels have been identified by a municipality or by a state or federal agency as a threat to building foundations? ___Yes ___ No; if yes, describe the project's impact on groundwater levels and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

F. Is the project non-water-dependent **and** located on landlocked tidelands **or** waterways or tidelands subject to the Waterways Act **and** subject to a mandatory EIR? ___ Yes ___ No; *Note: If yes, then the project will be subject to Public Benefit Review and Determination.)*

G. Does the project include dredging? ___ Yes ___ No; if yes, answer the following questions:
   i) What type of dredging? Improvement ___ Maintenance ___ Both ____
   ii) What is the proposed dredge volume, in cubic yards (cys) _____
   iii) What is the proposed dredge footprint ____length (ft) ___width (ft)____depth (ft)

iv) Will dredging impact the following resource areas?
(1) Intertidal ___ Yes ___ No; if yes, ___ sq ft
(2) Outstanding Resource Waters ___ Yes ___ No; if yes, ___ sq ft
(3) Other resource area (i.e. shellfish beds, eel grass beds) ___Yes ___ No; if yes, ___ *sq ft*

If yes to any of the above, have you evaluated appropriate and practicable steps to: 1) avoidance; 2) if avoidance is not possible, minimization; 3) if either avoidance or minimize is not possible, mitigation?

If no to any of the above, what information or documentation was used to support this determination?

Provide a comprehensive analysis of practicable alternatives for improvement dredging in accordance with 314 CMR 9.07(1)(b). Physical and chemical data of the sediment shall be included in the comprehensive analysis.

Sediment Characterization:
Existing gradation analysis results? __Yes ___No: if yes, provide results.
Existing chemical results for parameters listed in 314 CMR 9.07(2)(b)6? ___Yes ____No; if yes, provide results.
Do you have sufficient information to evaluate feasibility of the following management options for dredged sediment? If yes, check the appropriate option.

Beach Nourishment ___
Unconfined Ocean Disposal ___
Confined Disposal:
Confined Aquatic Disposal (CAD) ___
Confined Disposal Facility (CDF) ___
Landfill Reuse in accordance with COMM-97-001 ___
Shoreline Placement ___
Upland Material Reuse____
In-State landfill disposal____
Out-of-state landfill disposal ____
(NOTE: This information is required for a 401 Water Quality Certification.)

IV. Consistency:

A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone? ___ Yes ___ No; if yes, describe these effects and the projects consistency with the policies of the Office of Coastal Zone Management:

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes ___ No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

Water Supply Section

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? _X__ Yes ___ No; if yes, specify, in quantitative terms:

The proposed project will exceed the following threshold related to water supply:

- **301 CMR 11.03(4)(b)4.: The Project will construct a water treatment plant with a maximum capacity greater than 1,000,000 GPD.**

B. Does the project require any state permits related to **water supply**? _X__ Yes ___ No; if yes, specify which permit:

The proposed project will require the following state water supply permit from MassDEP:

- **MassDEP WS 24: Approval to Construct a Water Treatment Facility of 1 million Gallons per Day or Greater**

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits

A. Describe, in gallons per day (gpd), the volume and source of water use for existing and proposed activities at the project site:

Water Supply Impacts	Existing	Change	Total
Municipal or regional water supply	**1,440,000**	**0**	**1,440,000**
Withdrawal from groundwater	**1,440,000**	**0**	**1,440,000**
Withdrawal from surface water	**0**	**0**	**0**
Interbasin transfer	**0**	**0**	**0**

(NOTE: Interbasin Transfer approval will be required if the basin and community where the proposed water supply source is located is different from the basin and community where the wastewater from the source will be discharged.)

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? __X_ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source, has a pumping test been conducted? ___ Yes ___ No; if yes, attach a map of the drilling sites and a summary of the alternatives considered and the results. _____

The proposed project does not involve new or expanded withdrawal from groundwater or surface water.

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons per day)? ___Will the project require an increase in that withdrawal? ___Yes _X__No; if yes, then how much of an increase (gpd)? _____

The currently permitted withdrawal at the proposed water supply source is as follows:

- **Well 3: 0.77 MGD**
- **Well 4: 0.67 MGD**
- **Total Site: 1.44 MGD**

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? __X_ Yes ___No. If yes, describe existing and proposed water supply facilities at the project site:

The existing facilities located at 1650 Iyannough Road/Route 132 include a paved access road and two well pump houses. Water from Well 3 is pumped to the Well 4 pump house, where water from both wells is treated with KOH for pH adjustment and NaOCl for disinfection before entering the distribution system. The Well 3 Pump House consists of a raw water pump with a capacity of 800 GPM at 256 TDH, a right-angle drive, and associated electrical equipment. The Well 4 Pump House consists of a raw water pump with a capacity of 600 GPM at 253 TDH, a right-angle drive, associated electrical equipment, and associated chemical handling, storage, and feed equipment. This equipment includes a bulk and day tank for KOH, a bulk and day tank for NaOCl, chemical containment, and chemical feed pumps. The water quality of the existing facilities is impaired, as there is no treatment for PFAS, iron, or manganese, which have prompted the District to limit water production at the site.

The District is proposing a new water treatment plant at the site to restore lost water supply capacity and improve water quality. The new water treatment plant will consist of a 4,040-square foot single-story building with an interior mezzanine. The plant will contain three (3) 10.5-foot diameter GreensandPlus™ media filters and associated process mechanical valves and piping for the removal of source water iron and manganese, and six (6) 10-foot diameter GAC media pressure vessels and associated process mechanical valves and piping for the removal of source water PFAS. Both KOH and NaOCl storage, feed, and handling facilities will be moved into the new building. As such, the building will contain a 4,350-gallon bulk tank and 330-gallon day tank for KOH, and a 545-gallon bulk tank and two 55-gallon day tanks for NaOCl. There will be three high lift finished water pumps with a combined capacity of 1,200 GPM at 175 TDH, and one backwash pump with a capacity of 1,040 GPM at 53 TDH. Additionally, there will be a facility bathroom, control room/lab to conduct chemical analysis, and 67,000-gallon wash water supply tank/clear well underneath the first-floor slab. The washwater will be used for backwashing both the GreensandPlus™ media filters and GAC media pressure vessels. The backwash waste will then drain to one of the two sand filters for treatment, prior to the discharge to one of the two infiltration basins for groundwater recharge. This residuals system, with one sand filter and infiltration basin offline, is designed to manage 55,000 gallons of backwash waste. Refer to the Design Drawings located in Appendix A for locations.

Existing/Proposed Water Supply Facilities	Permitted Flow	Existing Avg Daily Flow	Project Flow	Total
Capacity of water supply well(s) (gpd)	**1,440,000**	**284,300**	**1,155,300**	**1,440,000**
Capacity of water treatment plant (gpd)	**1,440,000**	**0**	**1,440,000**	**1,440,000**

The following should be noted for the above-referenced data:

- **Existing average daily flow is based on the District's 2024 Annual Statistical Report (ASR) and includes average flow from both Well 3 (173,051 gpd) and Well 4 (111,243 gpd). The maximum single day pumped volume was 393,000 gallons (8/10/2024) from Well 3 and 377,000 gallons (6/27/2024) from Well 4.**
- **The goal of the proposed project is to restore the District's water capacity which has been lost due to water quality concerns. As such, the average existing daily flow from Well 3 and Well 4 is projected to increase.**

F. If the project involves a new interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

No new interbasin transfers are proposed in this project.

G. Does the project involve:
   i) New water service by the Massachusetts Water Resources Authority or other agency of the Commonwealth to a municipality or water district? ___ Yes __X_ No
   ii) A Watershed Protection Act variance? ___ Yes __X_ No; if yes, how many acres of alteration? ____
   iii) A non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes __X_ No

III. Consistency

A. Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

Under the Water Supply Section under Chapter 2: Built Systems Section of The Comprehensive Plan, the Town of Barnstable emphases the importance of seeking new wells and treating the water from existing wells to ensure the distribution of clean drinking water. Under the Natural Systems Goals of the Regional Policy Plan, the CCC emphasizes the importance of maintaining a sustainable supply of high-quality drinking water. The proposed project includes the treatment of PFAS, iron, and manganese from Wells 3 and 4 through the use of GAC media and GreensandPlus™ media. By treating these contaminants, this project will ensure the District customers and residents of the Town of Barnstable are receiving clean, safe drinking water, and is in alignment with both the Town's goals and the goals of the CCC.

Wastewater Section

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe the volume (in gallons per day) and type of disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00 for septic systems or 314 CMR 7.00 for sewer systems):

Wastewater Impacts	Existing	Change	Total
Discharge of sanitary wastewater			
Discharge of industrial wastewater			
Total			
Discharge to groundwater			
Discharge to outstanding resource water			
Discharge to surface water			
Discharge to municipal or regional wastewater facility			
Total			

B. Is the existing collection system at or near its capacity? ___ Yes ___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

N/A. There is no existing wastewater collection system at the existing site.

C. Is the existing wastewater disposal facility at or near its permitted capacity? __ Yes___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

N/A. There is no existing wastewater disposal facility at the existing site.

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No; if yes, describe as follows:

Existing/Proposed Wastewater Facility	Permitted	Existing Avg Daily Flow	Project Flow	Total
Capacity of wastewater treatment plant (gpd)				

E. If the project requires an interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or new?

(NOTE: Interbasin Transfer approval may be needed if the basin and community where wastewater will be discharged is different from the basin and community where the source of water supply is located.)

F. Does the project involve new sewer service by the Massachusetts Water Resources Authority (MWRA) or other Agency of the Commonwealth to a municipality or sewer district?
___ Yes ___ No

G. Is there an existing facility, or is a new facility proposed at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, wastewater reuse (gray water) or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (tons per day):

Existing/Proposed Wastewater Residuals Facility	Existing	Change	Total
Storage			
Treatment			
Processing			
Combustion			
Disposal			

H. Describe the water conservation measures to be undertaken by the project, and other wastewater mitigation, such as infiltration and inflow removal.

III. Consistency

A. Describe measures that the proponent will take to comply with applicable state, regional, and local plans and policies related to wastewater management:

B. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EEA number for the plan and whether the project site is within a sewer service area recommended or approved in that plan:

Transportation Section

Traffic Generation:

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to traffic generation (see 301 CMR 11.03(6))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to state-controlled roadways? ___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

Traffic Impacts	Existing	Change	Total
Number of parking spaces:			
Number of vehicle trips per day:			
ITE Land Use Code(s):			

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1. _____			
2. _____			
3. _____			

C. If applicable, describe proposed mitigation measures on state-controlled roadways that the project proponent will implement:

D. How will the project implement and/or promote the use of transit, pedestrian and bicycle facilities and services to provide access to and from the project site?

E. Is there a Transportation Management Association (TMA) that provides transportation demand management (TDM) services in the area of the project site? ____ Yes ____ No; if yes, describe if and how will the project will participate in the TMA:

F. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation facilities? ____ Yes ____ No; if yes, generally describe:

G. If the project will penetrate approach airspace of a nearby airport, has the proponent filed a Massachusetts Aeronautics Commission Airspace Review Form (780 CMR 111.7) and a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) (CFR Title 14 Part 77.13, forms 7460-1 and 7460-2)?

H. If the project is located near Boston Logan International Airport (BOS), Worcester Regional Airport (ORH) or Hanscom Field (BED) and may penetrate arrival or departure airspace, has the proponent contacted the Massachusetts Port Authority to conduct a review of the project and to inform the proponent's filing of a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (forms 7460-1 and 7460-2)?

III. Consistency

A. Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

Roadways and Other Transportation Facilities:

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to roadways or other transportation facilities (see 301 CMR 11.03(6))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **roadways or other transportation facilities**? ___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the Energy Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities in the immediate vicinity of the project site:

B. Will the project involve any
   i) Alteration of bank or terrain (in linear feet)? _____
   ii) Cutting of living public shade trees (number)? _____
   iii) Elimination of stone wall (in linear feet)? _____

III. Consistency

A. Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

Energy Section

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **energy**? ___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

Energy Impacts	Existing	Change	Total
Capacity of electric generating facility (megawatts)			
Length of fuel line (miles)			
Length of transmission lines (miles)			
Capacity of transmission lines (kilovolts)			

B. If the project involves construction or expansion of an electric generating facility, what are:
   i) The facility's current and proposed fuel source(s)?
   ii) The facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___Yes ___No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency

A. Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

Air Quality Section

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)? ___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

Air Quality Impacts	Existing	Change	Total
Particulate matter (PM)			
Carbon monoxide			
Sulfur dioxide			
Volatile organic compounds (VOC)			
Oxides of nitrogen (NO_x)			
Lead			
Any hazardous air pollutant			
Carbon dioxide			

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

Solid and Hazardous Waste Section

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes __X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**?
___ Yes _X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

Solid Waste Impacts	Existing	Change	Total
Storage			
Treatment/Processing			
Combustion			
Disposal			

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

Haz Waste Impacts	Existing	Change	Total
Storage			
Recycling			
Treatment			
Disposal			

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos?
___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. Consistency

A. Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

Historical and Archaeological Resources Section

I. Thresholds / Impacts

A. Have you consulted with the Massachusetts Historical Commission? _X__ Yes ___ No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ____Yes ____ No; if yes, attach correspondence.

The proposed project does not involve lands under water. Refer to Attachment I for correspondence with the Massachusetts Historical Commission (MHC).

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _X__ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes ___ No; if yes, please describe:

C. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes __X_ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe:

D. If you answered "No" to all parts of both questions A, B and C, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts

A. Describe and assess the project's impacts, direct and indirect, on listed or inventoried historical and archaeological resources:

No impacts to historical or archaeological resources are anticipated to result from the proposed project. A Project Notification Form (PNF) was mailed to the MHC on December 16, 2025. Refer to Attachment I for this determination from MHC.

III. Consistency

A. Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:

In the event that unanticipated historical and/or archaeological resources are encountered during construction, the construction activities will halt and the appropriate local, state, and/or federal agencies will be notified.

Climate Change Adaptation and Resiliency Section

All Proponents must complete the following section based on the output report generated by the MA Climate Resilience Design Standards (CRDS) Tool required attachment #8 to the ENF).

I. Project Information

A. What is the useful life (e.g., 50 years, 70 years) and planning horizon (e.g., 2070) identified for the project on the output report?

The criteria identified on the output report for the proposed project are as follows:

- **Useful life: 30 years**
- **Planning horizon: 2070**

Refer to Attachment G for the Resilient Mass Action Team (RMAT) CRDS Output Report.

B. List the exposure score (High / Moderate / Low / Not Exposed) and key scoring rationale (from "Scoring Rationale – Exposure" section) from the CRDS Tool output report as indicated below.

Climate Parameter	Exposure Score (High / Moderate / Low / Not Exposed)	Scoring Rationale
Sea Level Rise/ Storm Surge	**Not Exposed**	• Is project located within the predicted mean high water shoreline by 2030? __Y _X_N • Does the project site have a history of coastal flooding? __Y _X_N
Extreme Precipitation (Urban/Stormwater Flooding)	**High Exposure**	• Will project result in net increase in impervious area? _X_Y __N • Is existing impervious area over 50%? __Y _X_N • Is there historic flooding at the site? __Y _X_N
Extreme Precipitation (Riverine Flooding)	**Not Exposed**	• Is project in current 100-year floodplain? __Y _X_N • Is project in current 500-year floodplain? __Y _X_N • Is there historic riverine flooding at the site? __Y _X_N
Extreme Heat	**High Exposure**	• Is the project removing tree cover? _X_Y __N • List existing tree cover % (value or range) _90%_

II. Asset Information

A. List each asset analyzed through the Tool:[3]

Facility Building – Water Treatment Plant (potable water)

B. List the below from the CRDS Tool output report for at least one representative asset (if the

[3] Guidance from the CRDS Tool should be consulted to determine the appropriate asset and sub-asset types applicable to the project. The Proponent should not enter "Other" for both the "Asset" and "Sub-asset" type, as the Tool will not generate recommended design standards in such instance.

project proposes only natural resource assets, leave blank).

Asset: Facility Building

Climate Parameter	Asset Risk Rating	Target Planning Horizon	Intermediate Planning Horizon (if applicable)	Recommended Return Period or Design Guideline (##-year storm event or ##-percentile)
Sea Level Rise/ Storm Surge	**Low Risk**			
Extreme Precipitation (Urban Flooding)	**High Risk**	**2070**		**50-yr (2%)**
Extreme Precipitation (Riverine Flooding)	**Low Risk**			
Extreme Heat	**High Risk**	**2070**		**90th percentile**

III. Climate Change Adaptation and Resiliency Strategies

A. Is the project anticipated to meet the recommendations of the CRDS Tool for any building/facility or infrastructure asset identified in Section II.A. above? _X__Yes ___ No ___ Unknown

i) If yes, explain how the project design is consistent with Tool recommendations (e.g., consistency with planning horizon and return periods with respect to key project components such as building elevation, stormwater sizing, and heat mitigation).

The project met the recommendations of the RMAT CRDS Tool for both extreme precipitation and extreme heat. To mitigate for extreme precipitation, the RMAT CRDS Tool recommended the use of a projected 2070 50-year 24-hour storm with a precipitation depth of 8.7 inches. The proposed design used this projected precipitation depth as part of the HydroCAD™ hydrologic analysis to determine pre- and post-development runoff rates. The post-development runoff volumes are less than the pre-development runoff volumes for the whole site. Design Points 2, 3, and 4 all show greater post-development peak discharge rates, even though the post-development runoff volumes for Design Points 2 and 4 are lower. As such, the proposed site was designed to accommodate future upgrades to the site to adapt to climate change as the RMAT CRDS Tool suggests. Refer to the Stormwater Report located in Attachment E for more detailed information.

To mitigate for extreme heat, the RMAT CRDS Tool recommended to incorporate increased vegetation on site. The proposed design incorporates the use of shrubs on site, both to attenuate peak runoff rates and to provide opportunities to decrease the temperature and relative humidity on site. The project was also designed to minimize tree clearing to the greatest extent possible. This was achieved by utilizing the existing site's access road and providing two infiltration trenches to help attenuate peak runoff rates without clearing enough space for full BMP treatment trains. The remainder of the site's clearing is necessary for the operation of the water treatment facility. Refer to the Design Drawings located in Attachment A for the extent of the clearing, shrub planting, and infiltration trenches.

ii) If no or unknown, explain how best available climate change data and projections were otherwise used to inform the design of the project. If the project will contribute to, or is otherwise dependent on, regional adaptation solutions or flexible adaptive strategies, please specify.

N/A

B. For all projects, describe how the project design has incorporated climate change adaptation and resilience strategies, or otherwise serves to promote climate resiliency. Discuss whether the project has taken steps to employ nature-based solutions.

The proposed project has taken the following steps to promote climate resiliency:

- **Project site is located outside of the 100-year and 500-year floodplain, as seen in the FEMA FIRMette Map located in in Attachment B.**
- **Country drainage is being utilized for stormwater runoff to promote nature-based solutions.**
- **Shrubs are proposed on site to attenuate peak runoff rates and to help mitigate for extreme heat.**
- **The project is designed to minimize tree clearing to the greatest extent possible.**
- **The project is designed to accommodate future upgrades to adapt to climate change.**

Note: Climate adaptation and resiliency strategies include actions that seek to reduce vulnerability to anticipated climate risks and improve resiliency for future climate conditions. Examples of climate adaptation and resiliency strategies include flood barriers, increased stormwater infiltration, living shorelines, elevated infrastructure, increased tree canopy, etc. Projects should address any planning priorities identified by the affected municipality through the Municipal Vulnerability Preparedness (MVP) program or other planning efforts, and should consider a flexible adaptive pathways approach, an adaptation best practice that encourages design strategies that adapt over time to respond to changing climate conditions. General guidance and best practices for designing for climate risk are available at https://resilient.mass.gov/rmat_home/designstandards/.

IV. Inland and Coastal Flooding

A. Is the project located in Land Subject to Coastal Storm Flowage (LSCSF) or Bordering Land Subject to Flooding (BLSF) as defined in the Wetlands Protection Act? ____Yes __X__No

B. If yes, describe how/whether proposed changes to the site's topography (including the addition of fill) will result in changes to floodwater flow paths and/or velocities that could impact adjacent properties or the functioning of the floodplain. General guidance on providing this analysis for coastal projects can be found in the CZM/MassDEP Coastal Wetlands Manual.

Environmental Justice Section

I. Identifying Characteristics of EJ Populations

A. If an Environmental Justice (EJ) population has been identified as located in whole or in part within 5 miles of the project site, describe the characteristics of each EJ populations as identified in the EJ Maps Viewer (i.e., the census block group identification number and EJ characteristics of "Minority," "Minority and Income," etc.). Provide a breakdown of those EJ populations within 1 mile of the project site, and those within 5 miles of the site.

Using the Environmental Justice (EJ) Maps Viewer, EJ populations have been identified within both a 1 mile and 5 mile radius of the proposed WTP site. The EJ populations located, in part, within a 1 mile radius are as follows:

- **Block Group 1, Census Tract 153 - Minority and Income**
- **Block Group 1, Census Tract 126.01 - Minority**
- **Block Group 2, Census Tract 126.01 - Minority**

The EJ populations located, in whole, within a 5 mile radius are as follows:

- **Block Group 2 Census Tract 121.01 - Minority**
- **Block Group 3 Census Tract 121.02 - Income**
- **Block Group 4 Census Tract 121.02 - Minority**
- **Block Group 2 Census Tract 125.02 - Minority and Income**
- **Block Group 3 Census Tract 125.02 - Minority and English Isolation**
- **Block Group 4 Census Tract 125.02 - Minority**
- **Block Group 1 Census Tract 126.01 - Minority**
- **Block Group 2 Census Tract 126.01 - Minority**
- **Block Group 1 Census Tract 126.02 - Minority and Income**
- **Block Group 2 Census Tract 126.02 - Minority, Income, and English isolation**
- **Block Group 3 Census Tract 126.02 - Minority**
- **Block Group 4 Census Tract 126.02 - Minority and Income**
- **Block Group 1 Census Tract 153 - Minority and Income**
- **Block Group 2 Census Tract 153 - Minority and Income**
- **Block Group 3 Census Tract 153 - Minority and Income**

The EJ populations located, in part, within a 5 mile radius are as follows:

- **Block Group 4 Census Tract 121.01 - Minority**
- **Block Group 1 Census Tract 121.02 - Income**

B. Identify all languages identified in the "Languages Spoken in Massachusetts" tab of the EJ Maps Viewer as spoken by 5 percent or more of the EJ population who also identify as not speaking English "very well." The languages should be identified for each census tract located in whole or in part within 1 mile and 5 miles of the project site, regardless of whether such census tract contains any designated EJ populations.

According to the "Languages Spoken in Massachusetts" tab on the EJ Maps Viewer, there are two communities identified in which greater than five percent of the community speak a language other than English, or who do not identify speaking English "very well.". Located, in part, within a 1 mile radius of the proposed WTP site is Census Tract 153, where 7.1% of the population are identified as speaking Portuguese/Portuguese Creole. Located, in whole, within a 5 mile radius of the proposed WTP site is Census Tract 126.02, where 8.3% of the population are identified as speaking Portuguese/Portuguese Creole.

C. If the list of languages identified under Section I.B. has been modified with approval of the EEA

EJ Director, provide a list of approved languages that the project will use to provide public involvement opportunities during the course of MEPA review. If the list has been expanded by the Proponent (without input from the EEA EJ Director), provide a list of the additional languages that will be used to provide public involvement opportunities during the course of MEPA review as required by Part II of the MEPA Public Involvement Protocol for Environmental Justice Populations ("MEPA EJ Public Involvement Protocol"). If the project is exempt from Part II of the protocol, please specify.

The list of languages has not been modified. As required by Part II of the MEPA Public Involvement Protocol for Environmental Justice Populations, both languages English and Portuguese will be used to provide public involvement opportunities during the course of MEPA review.

II. Potential Effects on EJ Populations

A. If an EJ population has been identified using the EJ Maps Viewer within 1 mile of the project site, describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

The construction is not anticipated to result in any short-term public health impacts. Construction period impacts including noise, dust, and emissions are only expected to impact areas immediately adjacent to the Site, which comprises of a dense, wooded area and the Hyannis Golf Course, and will be mitigated in accordance with local, state, and federal requirements.

Long term public health impacts associated with the Project include a slight increase in GHG emissions compared to the existing Well Pump Houses due to the increase in size and power requirements for the building and treatment equipment. Mitigation for this potential increase in GHG emissions includes adherence to the 2024 International Energy Conservation Code.

The project will supply improved water quality and provide increased reliability of clean and safe public drinking water to customers serviced by the District, and members of the general public that make use of the businesses and facilities which use or serve public drinking water serviced by the District. Please refer to the Water District EJ Population Map located in Attachment B for the extent of the District's water distribution system in regards to the locations of the EJ populations within 1 mile of the project.

B. If an EJ population has been identified using the EJ Maps Viewer within 5 miles of the project site, will the project: (i) meet or exceed MEPA review thresholds under 301 CMR 11.03(8)(a)-(b) __ Yes _X_ No; or (ii) generate150 or more new average daily trips (adt) of diesel vehicle traffic, excluding public transit trips, over a duration of 1 year or more. ___ Yes __X_ No

C. If you answered "Yes" to either question in Section II.B., describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

N/A

III. Public Involvement Activities

A. Provide a description of activities conducted prior to filing to promote public involvement by EJ populations, in accordance with Part II of the MEPA EJ Public Involvement Protocol. In particular:

i) If advance notification was provided under Part II.A., attach a copy of the Environmental Justice Screening Form and provide list of CBOs/tribes contacted (with dates). Copies of email correspondence can be attached in lieu of a separate list.

On March 11, 2025 an Environmental Justice (EJ) Screening Form was circulated to all entities on the provided contact list. Refer to Attachment H for a copy of the EJ Screening Form, in both English and Portuguese, and list of CBOs/tribes contacted.

ii) State how CBOs and tribes were informed of ways to request a community meeting, and if any meeting was requested. If public meetings were held, describe any issues of concern

that were raised at such meetings, and any steps taken (including modifications to the project design) to address such concerns.

CBOs and tribes were informed of ways to request a community meeting through the EJ Screening Form that was circulated based on the distribution list provided in Attachment H. No requests for public meetings have been received as of this filing.

iii) If the project is exempt from Part II of the protocol, please specify.

N/A

B. Provide below (or attach) a distribution list (if different from the list in Section III.A. above) of CBOs and tribes, or other individuals or entities the Proponent intends to maintain for the notice of the MEPA Site Visit and circulation of other materials and notices during the course of MEPA review.

The distribution list is the same as in Section III.A. above. Refer to Attachment H.

C. Describe (or submit as a separate document) the Proponent's plan to maintain the same level of community engagement throughout the MEPA review process, as conducted prior to filing.

The distribution list mentioned in Section III.A. above will be used to circulate notices of the MEPA Site Visit, summaries of supplemental information submitted to the MEPA office, and any other relevant notices or materials generated during the course of MEPA review. Any information distributed will be written in English and translated into Portuguese.

IV. For Projects seeking to meet qualifying housing criteria at 301 CMR 11.01(2)(c)1. and 2.

A. Identify any municipality or census tract meeting the definition of "vulnerable health EJ criteria" in the DPH EJ Tool located in whole or in part within the DGA of the Project site. *[Information can be reproduced from Environmental Justice Screening Form, used to provide Advance Notification under 301 CMR 11.05(4).]*

B. Identify the sources of potential pollution within the boundaries of the identified EJ populations within the DGA, using the mapping layers available in the DPH EJ Tool.

C. Describe the benefits provided for the identified EJ populations within the DGA, including but not limited to the following (complete applicable items below):
   i) Affordable units provided: __ units or __% (appx)
   ii) Is the project retaining or increasing existing affordability: __Y __N *[if decreasing existing affordability, provide rationale]*
   iii) Tree plantings: __ [number or acreage] *[Locations for plantings can be identified with input from local or state agencies, or using the i-tree landscape tool to identify census blocks with low tree canopy: https://landscape.itreetools.org/maps/]*
   iv) Open space/parks: ___
   v) Air quality/public health benefits: _____ *[e.g., air quality monitoring, indoor air quality, contributions to local health clinics, etc]*
   vi) Stormwater/flooding reduction measures: ____
   vii) Retail activation / community space: ___
   viii) Affirmative marketing efforts: __ [home ownership, rental, etc]
   ix) Construction period: __ [air/noise monitoring, traffic controls, etc]
   x) Others: ___

Qualifying Housing Criteria Section

Complete the items below to demonstrate compliance with qualifying housing criteria at 301 CMR 11.01(2)(c)1. or 2.

Criterion	Metric	Project
a. **Housing-centered**	Devotes 67% or more of the gross floor area of the Project to residential uses, with the remainder devoted to supportive commercial, cultural, educational, community and/or civic uses. Gross floor area shall not include parking, utility space, and other ancillary spaces not intended for exclusive occupancy by the user or tenant	Gross floor area (GFA) of project: ___ sq (from ENF impacts table on p. 2) GFA % residential: __% (must be ≥67%) GFA of residential use: ___ sq GFA of non-residential uses: __ sq (specify uses: ___, , _) Excluded areas: ___ sq (specify exclusions: __, ___, ___)
b. **Dense**	Achieves density of: • at least 8 units per acre for single-family; • at least 12 units per acre for two- or three-family buildings; and • at least 15 units per acre for multi-family housing of more than three-family residential uses	Single family Number of units: __ Density: __ units per acre (calculated under local zoning requirements; include citation to local requirements and any approvals received) 2- or 3-family buildings Number of units: __ Density: __ units per acre (calculated under local zoning requirements; include citation to local requirements and any approvals received) Multi-family over 3-family Number of units: __ Density: __ units per acre (calculated under local zoning requirements; include citation to local requirements and any approvals received) ***Note:** Projects seeking to proceed under 301 CMR 11.01(2)(c)2. may qualify if **either** criterion (b) or (c) is met.*
c. Infill	Alters up to 5 acres of previously undeveloped land. Redevelopment of previously developed land, or redevelopment of land within or appurtenant to an office or industrial park or large institutional property, shall not be defined as alteration of previously undeveloped land. **OR**	Alteration of previously undeveloped land: __ acres (must be ≤10 acres) If >5 acres but ≤10 acres, specify the following: • # or acreage of trees removed: __ (appx) • # or acreage of trees to be replaced: __ (appx) (indicate # on-site and off-site) • Describe tree retention and replanting plan: _____

Criterion	Metric	Project
c. **Infill** *(cont.)*	Alters up to 10 acres of previously undeveloped land and the Project proposes a tree retention and replanting plan that demonstrates measures to minimize tree removal and replace removed trees to the maximum extent practicable. **AND** No portion of the Project site shall include any land where projected total ecosystem carbon stocks are in the top quintile statewide, as defined by the Massachusetts Forest Carbon Top Quintile data layer issued by EEA; any designated priority habitat, as defined in 321 CMR 10.02; or any land with soils classified as prime farmland by the United States Department of Agriculture which is currently in active agricultural use or was in active agricultural use within the past five years.	**Attach locus map showing the Project site in relation to the 3 natural resource areas specified in this criterion (this should be combined with map of highest hazard areas for flood and erosion criterion below), using the MEPA Qualifying Housing Map Viewer.** Is the Project site located outside the 3 natural resource areas specified: • Top quintile carbon __Y __N • Designated rare species habitat __Y __N • Prime farmland soils __Y __N Has the site been in active agricultural use within the past five years? __Y __N ***Note**: all layers on the MEPA Qualifying Housing Map Viewer must be turned on, even if the site has not been in active agricultural use within the past 5 years.* ***Note:** the locus map must be provided for all Projects, even if seeking to proceed under 301 CMR 11.01(2)(c)2.*
d. **Flood and Erosion**	**For Any Project:** Located outside highest hazard areas and outside the Special Flood Hazard Area as defined by the Wetlands Protection Act regulations at 310 CMR 10.00. **OR** **If Redevelopment**: Located outside highest hazard areas and complies with the American Society of Civil Engineers Guidance on Structural Safety in Flood Areas (ASCE 24-24). **OR** **If Redevelopment and does not exceed any mandatory EIR threshold:** Complies with the American Society of Civil Engineers Guidance on Structural Safety in Flood Areas (ASCE 24-24) and demonstrates absence of off-site flood impacts. **Redevelopment** means replacement, rehabilitation, or expansion of existing structures, improvement of existing roads or reuse of degraded or previously developed areas. **Highest hazard areas** shall be those areas	Is the Project considered Redevelopment? __Y _N *[Note: if any portion of the Project does not qualify as redevelopment, the entire project must be considered new.]* Is the Project site located outside the Special Flood Hazard Area as defined by the Wetlands Protection Act regulations at 310 CMR 10.00: __Y __N *[Note: this must be documented by printing and attaching a FEMA FIRMette from the FEMA Flood Map Service Center website, as part of required attachment #4 to the ENF. If the Proponent intends to rely on other information, please specify.]* Is the Project site located outside highest hazard areas as designated by the Executive Office of Energy and Environmental Affairs: : __Y __N ****Attach locus map showing the Project site in relation to the highest hazard areas as designated by the Executive Office of Energy and Environmental**

Criterion	Metric	Project
d. Flood and Erosion *(cont.)*	subject to high erosion or with exposure to flooding characterized by factors such as high-velocity flows, high-velocity wave action, breaking wave heights, sheet flow and scour and flash flooding. Such highest hazard areas shall include, but not be limited to, the following areas as defined by the Federal Emergency Management Agency: V, Coastal A and AO zones on a Flood Insurance Rate Map (FIRM) and floodways and A zones along the banks of waterbodies. The Secretary shall set forth in guidance methodology for delineating highest hazard areas.	**Affairs (can combine with map of 3 layers for infill criterion above), using the MEPA Qualifying Housing Map Viewer.** Specify whether any portion of the Project site is located in: FEMA V Zone: __Y __N FEMA Coastal A: __Y __N FEMA AO Zone: __Y __N Within 200 feet of waterbody: __Y __N Barrier Beach: __Y __N *[note: this must be documented with environmental constraints map as part of required attachment #4].* ***Note**: If the Proponent intends to rely on information other than the MEPA Qualifying Housing Map Viewer to demonstrate eligibility under this criterion, please provide detailed justification. However, the "high erosion" areas as mapped in the Viewer shall be definitive.* ***Note**: this locus map must be provided for all Projects, even if seeking to proceed under 301 CMR 11.01(2)(c)2.* To demonstrate compliance with ASCE 24-24, provide a certification by a qualified professional and a narrative description of key project components, including building elevations relative to established base flood elevations. If applicable, provide documentation to demonstrate the absence of off-site flood impacts from the Project (provide information consistent with Section IV. of Climate Change Adaptation and Resiliency Section, including flow path analysis or topographic maps as applicable).
e. Energy Efficient	Complies with the Massachusetts Stretch Energy Code adopted pursuant to Chapter 169 of the Acts of 2008	Does Project comply with the Massachusetts Stretch Energy Code: __Y __N Specify the following: Fuel source for space heating: ___ (air source heat pump, ground source heat pump, gas, etc) Fuel source for water heating: ___ (air source heat pump, ground source heat pump, gas, etc) Passivehouse certified: __Y __N

Criterion	Metric	Project
f. Adequately served by utilities	**1.** Does not require approval of a new interbasin transfer of water or wastewater, other than a transfer determined to be insignificant pursuant to the Interbasin Transfer Act and implementing regulations at 313 CMR 4.00. **AND** **2.** Does not require a new or expanded gas main	*Note: this criterion is not applicable to Projects seeking to qualify under 301 CMR 11.01(2)(c)2.* Will Project require approval of a new interbasin transfer of water or wastewater, other than a transfer determined to be insignificant: __Y __N Will Project require a new or expanded gas main (not individual hookups): __Y __N
g. Accessible	1. Generates fewer than 3,000 New unadjusted average daily trips (adt) on roadways leading to a single location. **OR** 2. Generates fewer than 6,000 New adt of traffic on roadways providing access to a single location if the Project is located within one-half mile of a public transit stop with an existing or proposed safe and accessible path of travel to the Project site. Projects with 3,000 or more New adt, prior to filing the ENF, must consult with the Massachusetts Department of Transportation and with the Massachusetts Bay Transportation Authority or applicable local or regional transit authority established pursuant to M.G.L. c. 161B, § 3 or § 14.	***Note:*** *this criterion is not applicable to Projects seeking to qualify under 301 CMR 11.01(2)(c)2.* Specify New unadjusted average daily trips (adt) for Project: __ (must be <6,000 adt) If unadjusted adt if ≥3,000 but <6,000, specify the following: • Is the Project site located within ½ mile of a transit stop: __Y __N • Does the Project provide existing or proposed safe and accessible path of travel to the transit stop: __Y __N • Specify any proposals to provide access as part of the Project: ___ ***Note****: "Transit stop" shall be defined to include a commuter rail station, subway station, transit station, ferry terminal or bus station serviced by MBTA or local or regional transit authority established pursuant to M.G.L. c. 161B, § 3 or § 14.* If unadjusted adt if ≥3,000 but <6,000, specify the following: • Did the Proponent conduct consultation with MassDOT: __Y __N • Did the Proponent conduct consultation with MBTA or local/regional transit authority: _Y_N • Describe the results of consultation: __ (agreements for mitigation, traffic scoping, etc) ***Note****:* for Projects requiring MassDOT permitting, attach Traffic Impact Analysis (TIA) if required by MEPA/MassDOT Guidelines. For other Projects, attach traffic study if completed for local permitting.

Certifications

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

   (Name) Cape Cod Times (Date) on or before 6/24/2026

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

6/3/26		6/4/26	
Date	Signature of Responsible Officer or Proponent	Date	Signature of person preparing ENF (if different from above)

Sean Anderson	Stephen Olson
Name (print or type)	Name (print or type)
Barnstable Fire District Water Department	H2Olson Engineering, Inc.
Firm/Agency	Firm/Agency
255 Breeds Hill Road PO Box 546	10 Riverside Drive Suite #103
Street	Street
Barnstable, MA 02630	Lakeville, MA 02347
Municipality/State/Zip	Municipality/State/Zip
(508) 362-6498	(781) 588-6800
Phone	Phone

ATTACHMENT A

Design Drawings

BARNSTABLE WATER DEPARTMENT
WELLS 3 & 4 WTP

Hyannis Golf Course, Barnstable, Massachusetts

Prepared For:

BARNSTABLE FIRE DISTRICT, WATER DEPARTMENT

P.O. Box 546
Barnstable, Massachusetts
Sean Anderson, Superintendent

Index of Drawings

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2	G-1	WELL 3 AND 4 PROCESS FLOW DIAGRAM
3	G-2	GREENSAND SYSTEM PROCESS FLOW DIAGRAM
4	G-3	GAC SYSTEM PROCESS FLOW DIAGRAM
		CIVIL SHEETS
5	C-1	EXISTING CONDITIONS
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7	C-3	SITE PREPARATION PLAN
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9	C-5	STORMWATER MANAGEMENT PLAN
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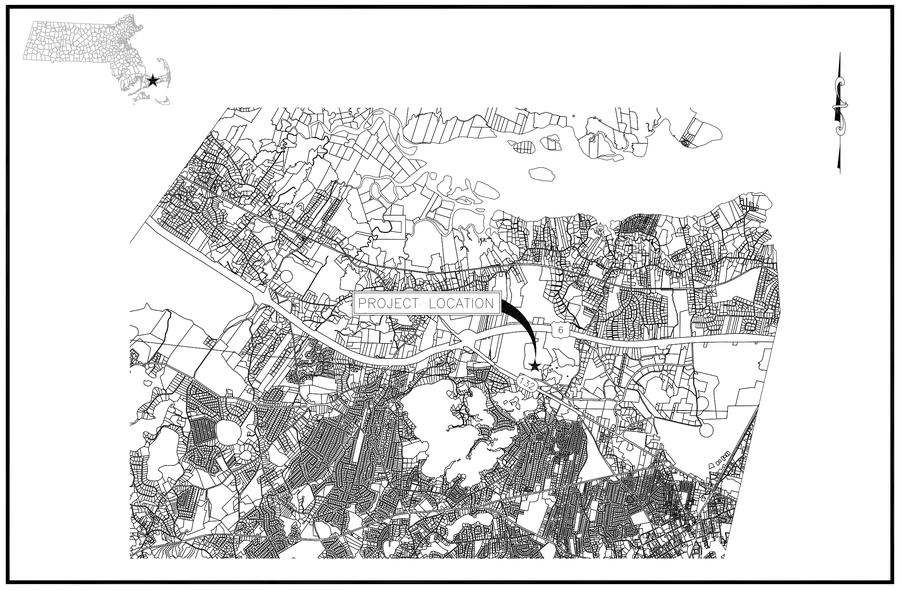

Locus Plan
SCALE: 1"=5000'

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Contract No. 127.25.01
FOR PERMITTING
JUNE 2026

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 6498
REGISTERED PROFESSIONAL ENGINEER
6498

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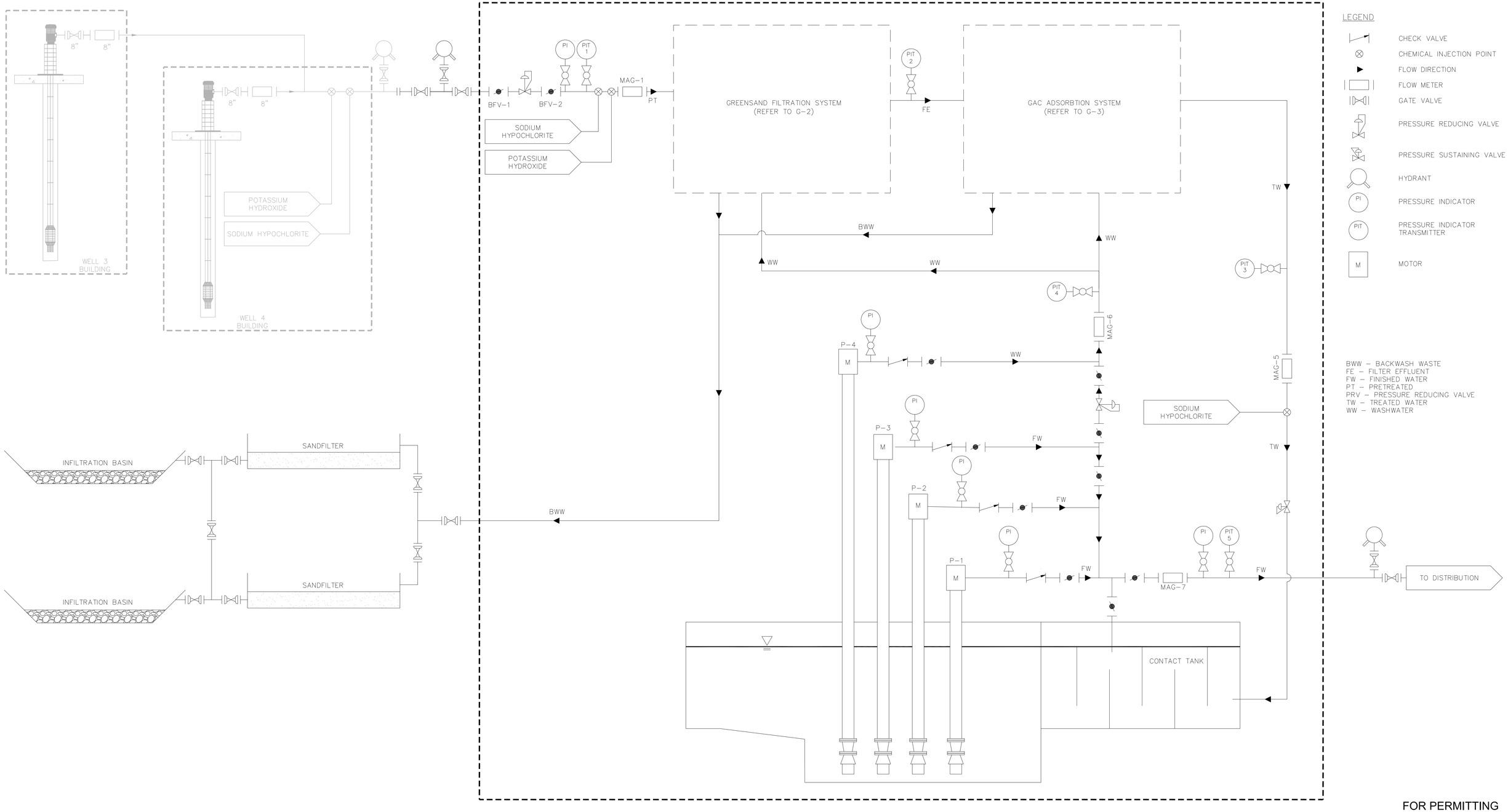

LEGEND

- CHECK VALVE
- CHEMICAL INJECTION POINT
- FLOW DIRECTION
- FLOW METER
- GATE VALVE
- PRESSURE REDUCING VALVE
- PRESSURE SUSTAINING VALVE
- HYDRANT
- PI — PRESSURE INDICATOR
- PIT — PRESSURE INDICATOR TRANSMITTER
- M — MOTOR

BWW – BACKWASH WASTE
FE – FILTER EFFLUENT
FW – FINISHED WATER
PT – PRETREATED
PRV – PRESSURE REDUCING VALVE
TW – TREATED WATER
WW – WASHWATER

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SCALE ADJUSTMENT GUIDE
0" 1"
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NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 49076
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
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DRAWN BY:	RAT
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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
WELL 3 AND 4 PROCESS FLOW DIAGRAM

DRAWING NO.: G-1

SHEET NO. 2 OF 57

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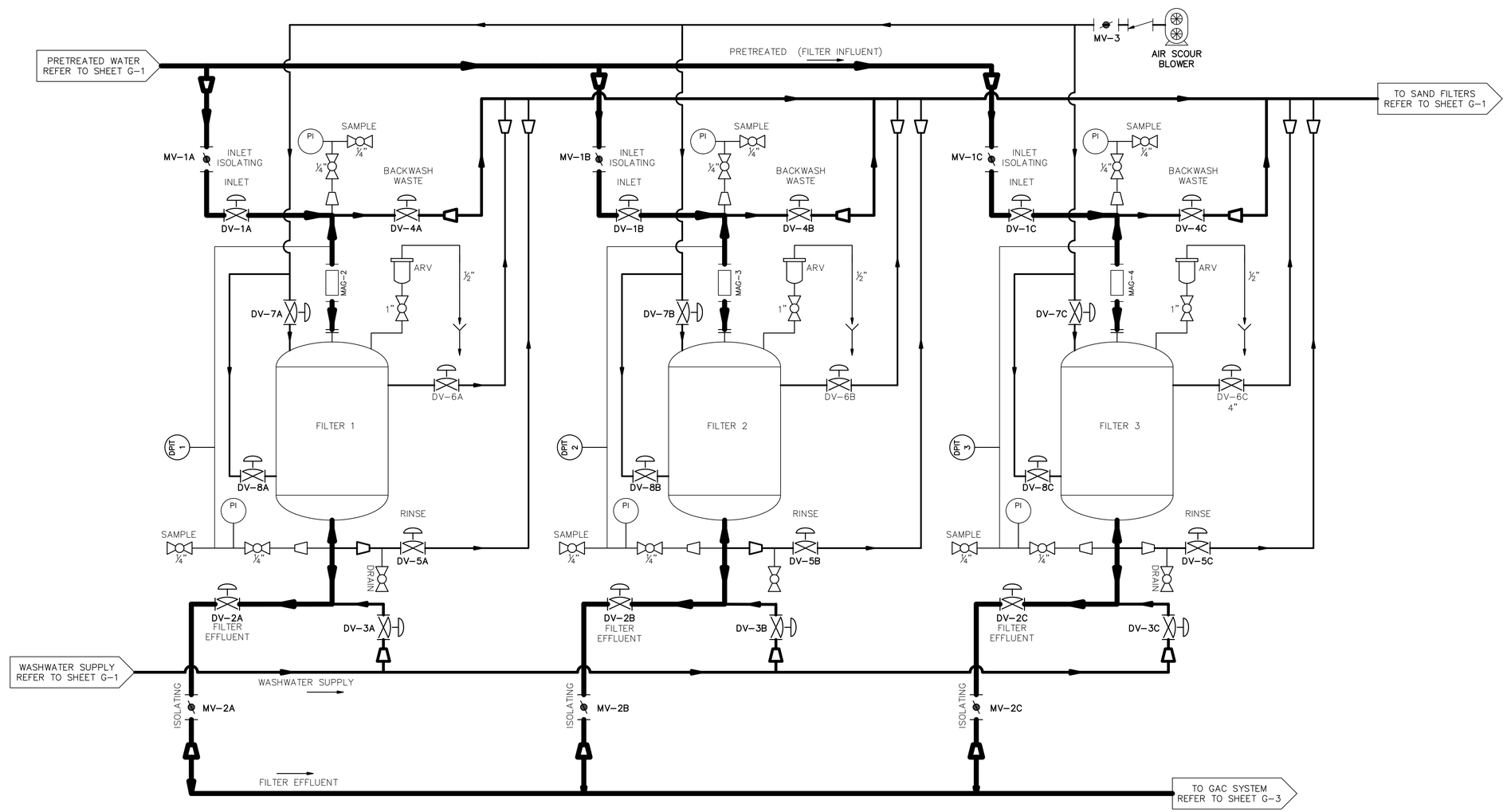

LEGEND

- BALL VALVE
- BUTTERFLY VALVE
- HYDROPNEUMATICALLY ACTUATED VALVE
- REDUCER
- COUPLING
- AIR RELIEF VALVE
- MAGNETIC FLOW METER
- FLOW DIRECTION
- PI — PRESSURE INDICATOR
- DPIT — DIFFERENTIAL PRESSURE INDICATOR/TRANSMITTER
- PRIMARY FLOW
- SECONDARY FLOW
- TERTIARY FLOW
- ANAILLARY FLOW

ARV – AIR RELIEF VALVE
CV – CONTROL VALVE
DI – DUCTILE IRON
FCV – FLOW CONTROL VALVE
MV – MANUAL VALVE
SmV – SAMPLE VALVE

- DRAIN

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DRAWING TITLE:
GREENSAND SYSTEM PROCESS FLOW DIAGRAM

DRAWING NO.:
G-2

SHEET NO. 3 OF 57

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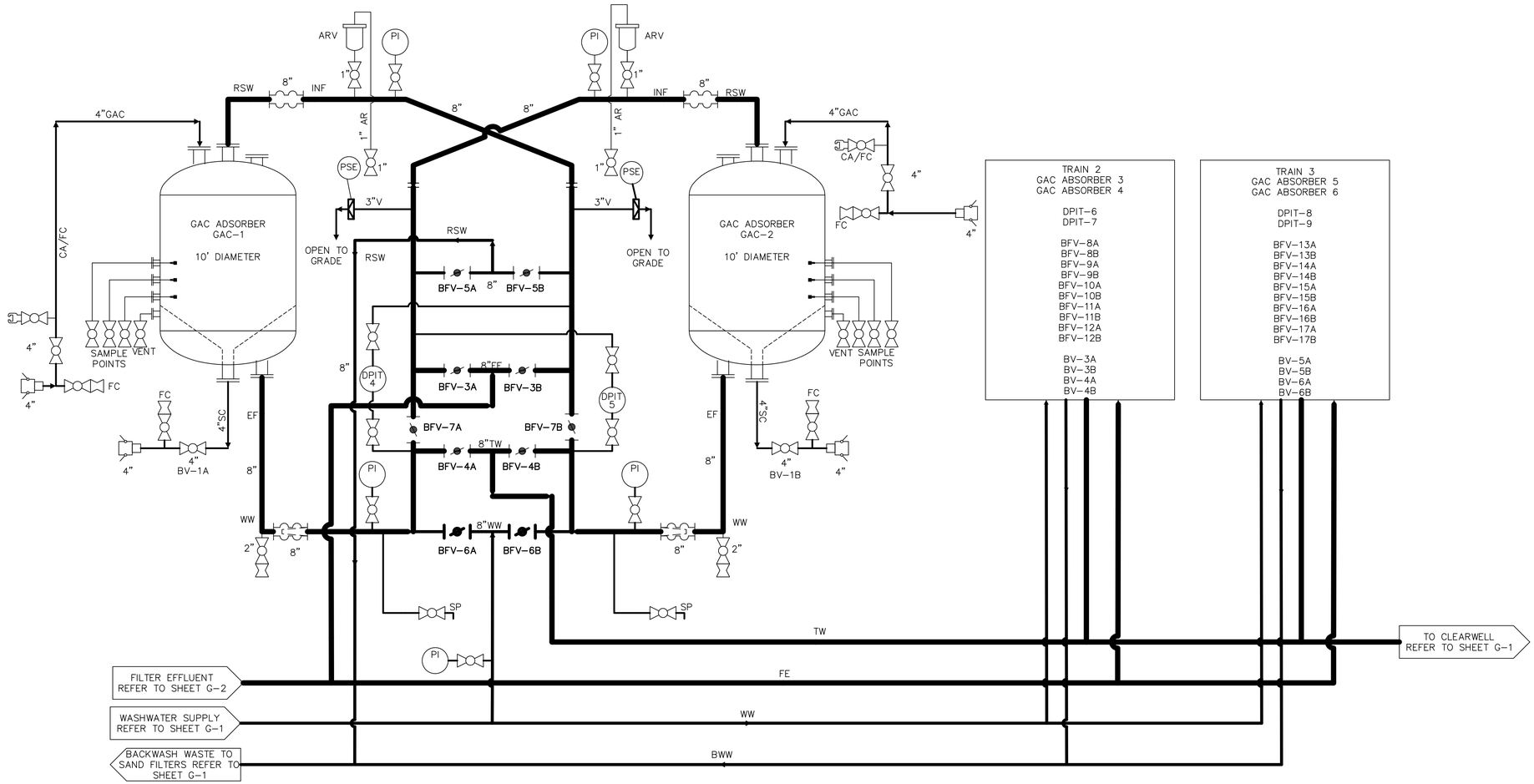

LEGEND

- BALL VALVE
- BUTTERFLY VALVE
- PI — PRESSURE INDICATOR
- DPIT — DIFFERENTIAL PRESSURE INDICATOR TRANSMITTER
- QUICK DISCONNECT MALE ADAPTOR
- AIR RELIEF VALVE
- QUICK DISCONNECT FEMALE COUPLET
- FLOW DIRECTION
- HOSE COUPLING
- EXPANSION JOINT
- PRIMARY FLOW
- SECONDARY FLOW
- TERTIARY FLOW
- ANAILLARY FLOW

AR – AIR RELIEF
ARV – AIR RELIEF VALVE
BWW – BACKWASH WASTE
FC – FLUSH CONNECTION
FE – FILTER EFFLUENT
INF – INFLUENT
RSW – RINSEWATER
SC – SPENT CARBON
SP – SAMPLE PORT
TW – TREATED WATER
WW – WASHWATER

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WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
GAC SYSTEM PROCESS FLOW DIAGRAM

DRAWING NO.:
G-3

SHEET NO. 4 OF 57

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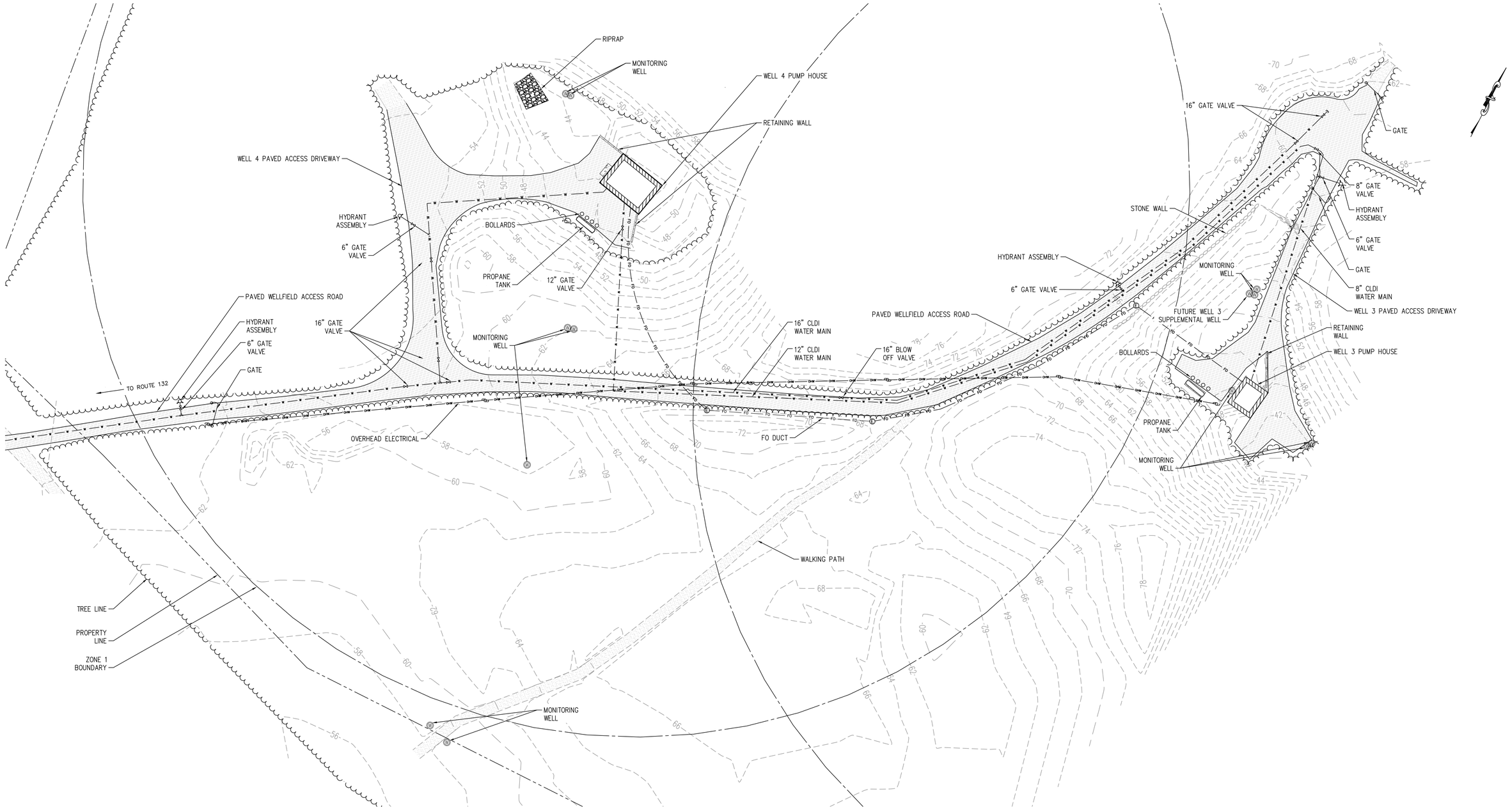

PLAN VIEW

SCALE: 1" = 35'

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COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

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WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
EXISTING CONDITIONS

DRAWING NO.:
C-1

SHEET NO. 5 OF 57

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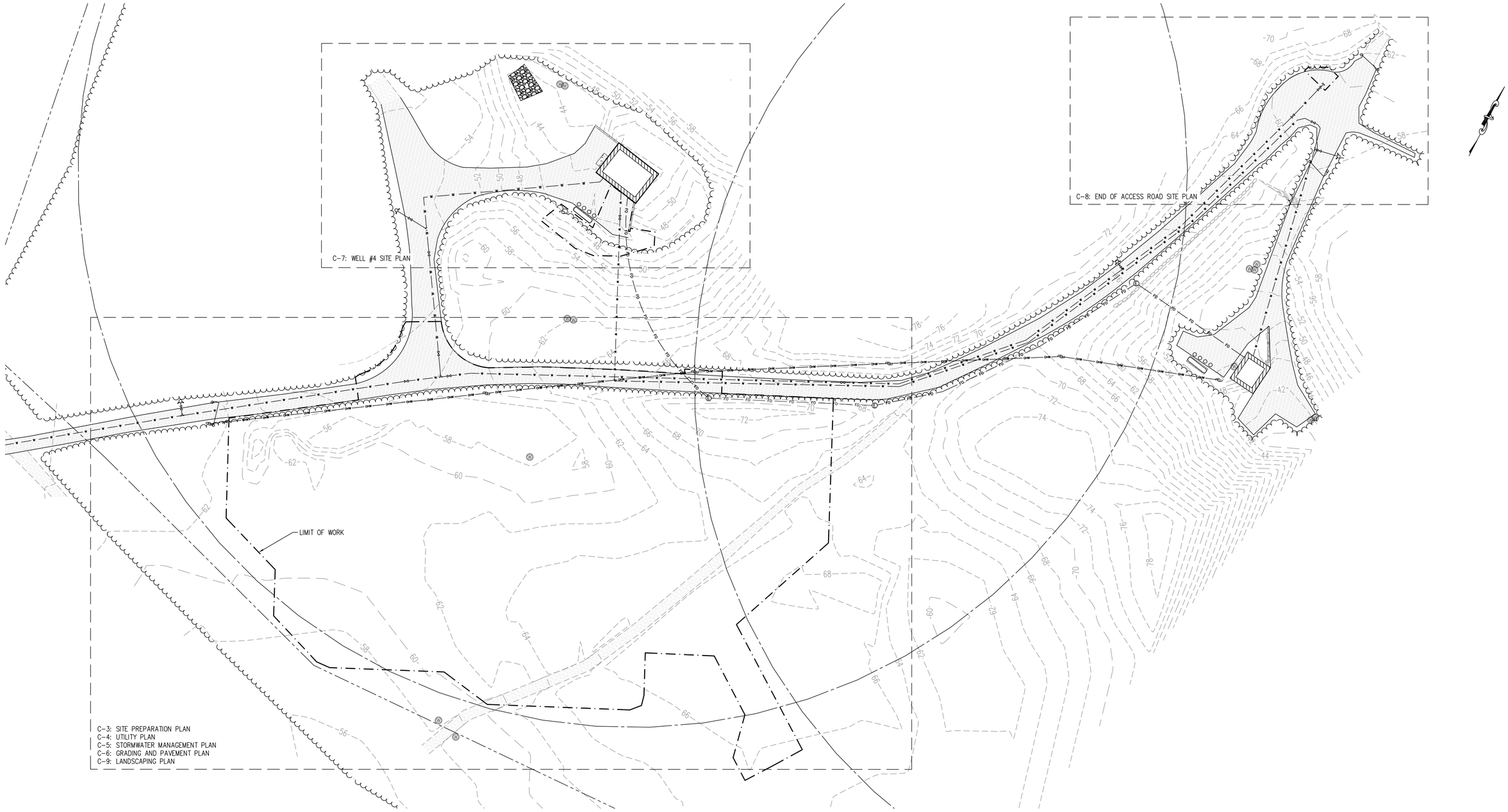

PLAN VIEW

SCALE: 1" = 35'

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STEPHEN C. OLSON
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REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
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BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: SITE LAYOUT

DRAWING NO.: C-2

SHEET NO. 6 OF 57

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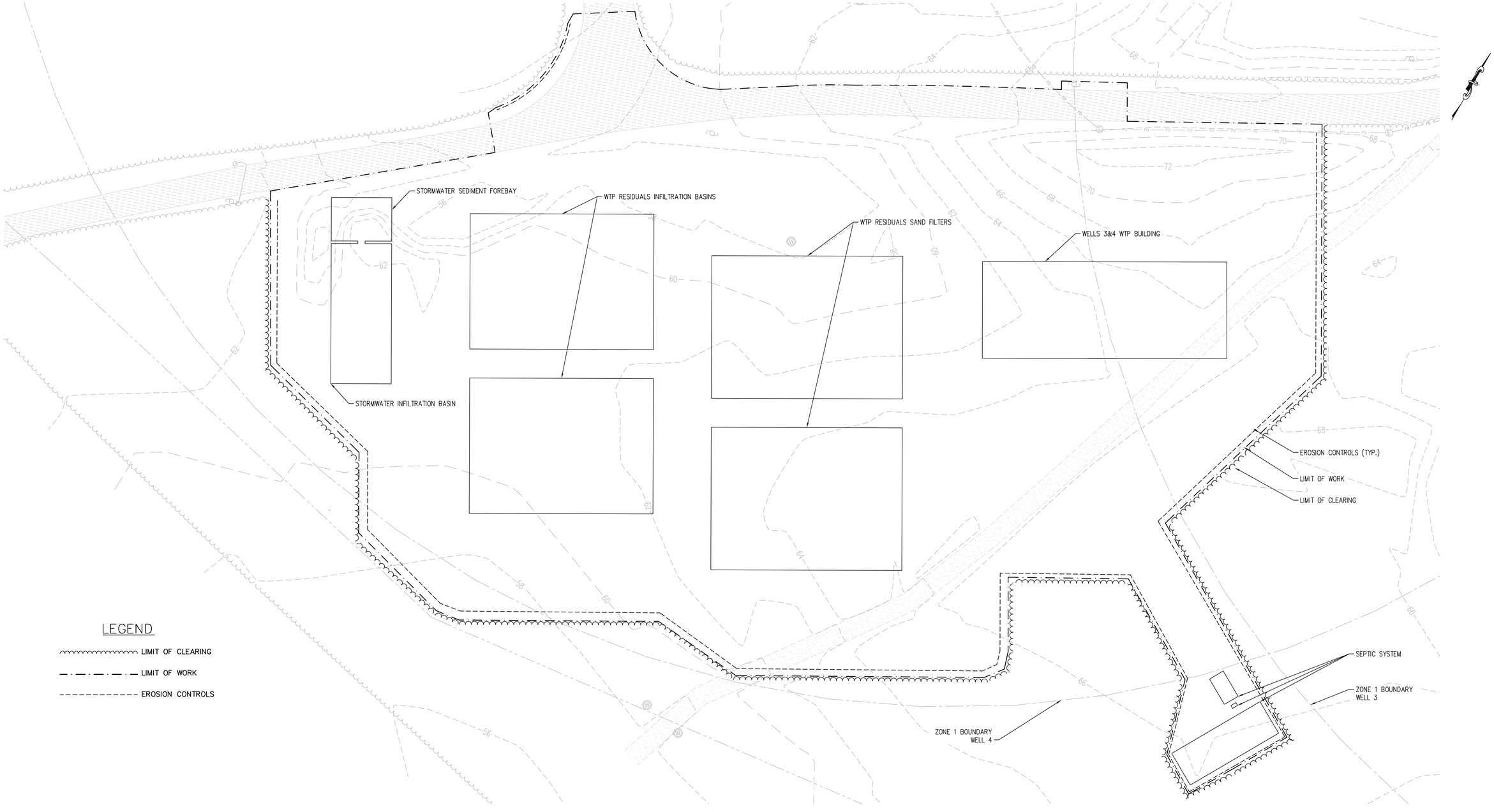

PLAN VIEW

SCALE: 1" = 20'

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DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
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DRAWING TITLE:
SITE PREPARATION PLAN

DRAWING NO.:
C-3

SHEET NO. 7 OF 57

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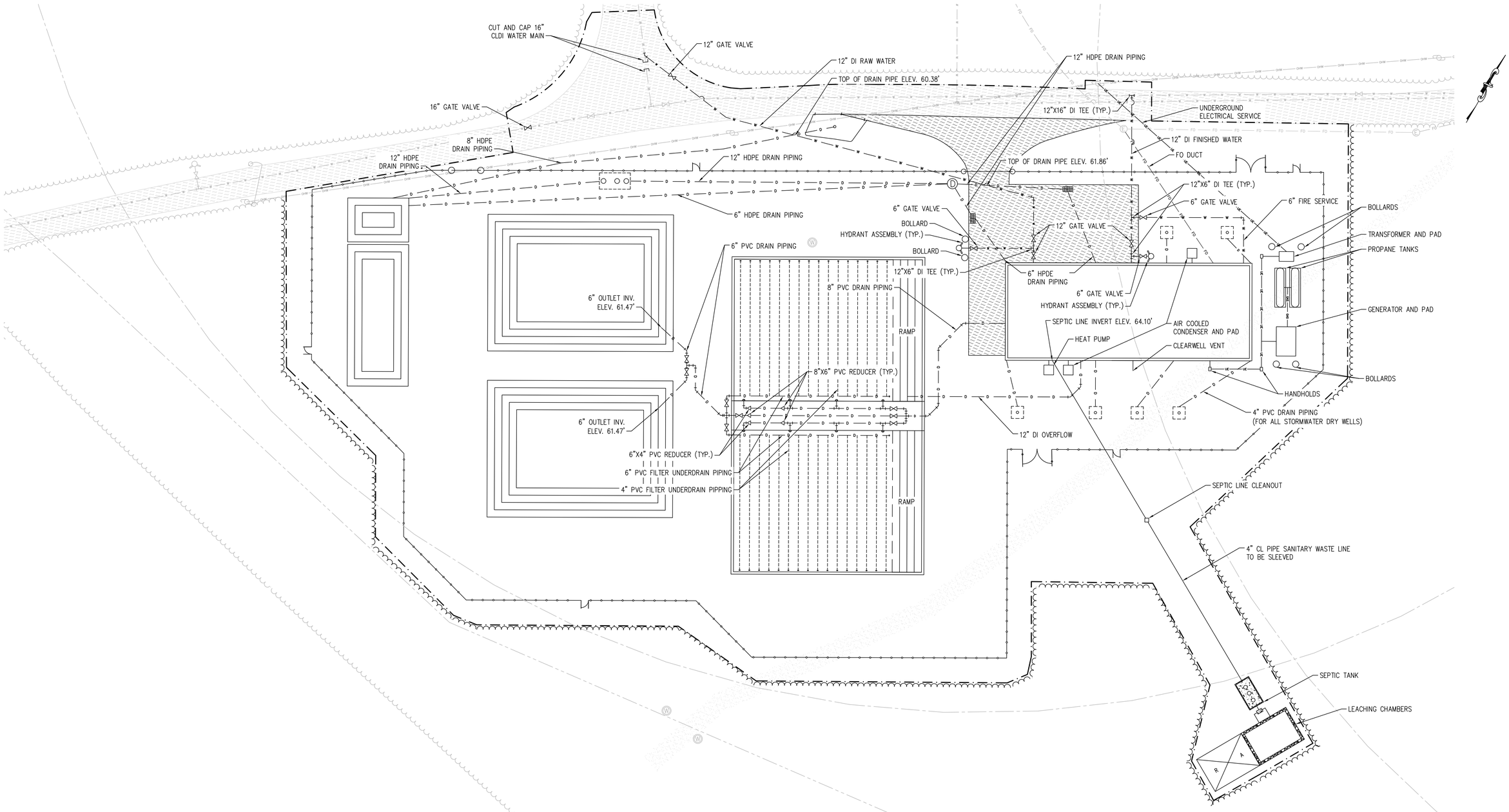

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WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: UTILITY PLAN

DRAWING NO.: C-4

SHEET NO. 8 OF 57

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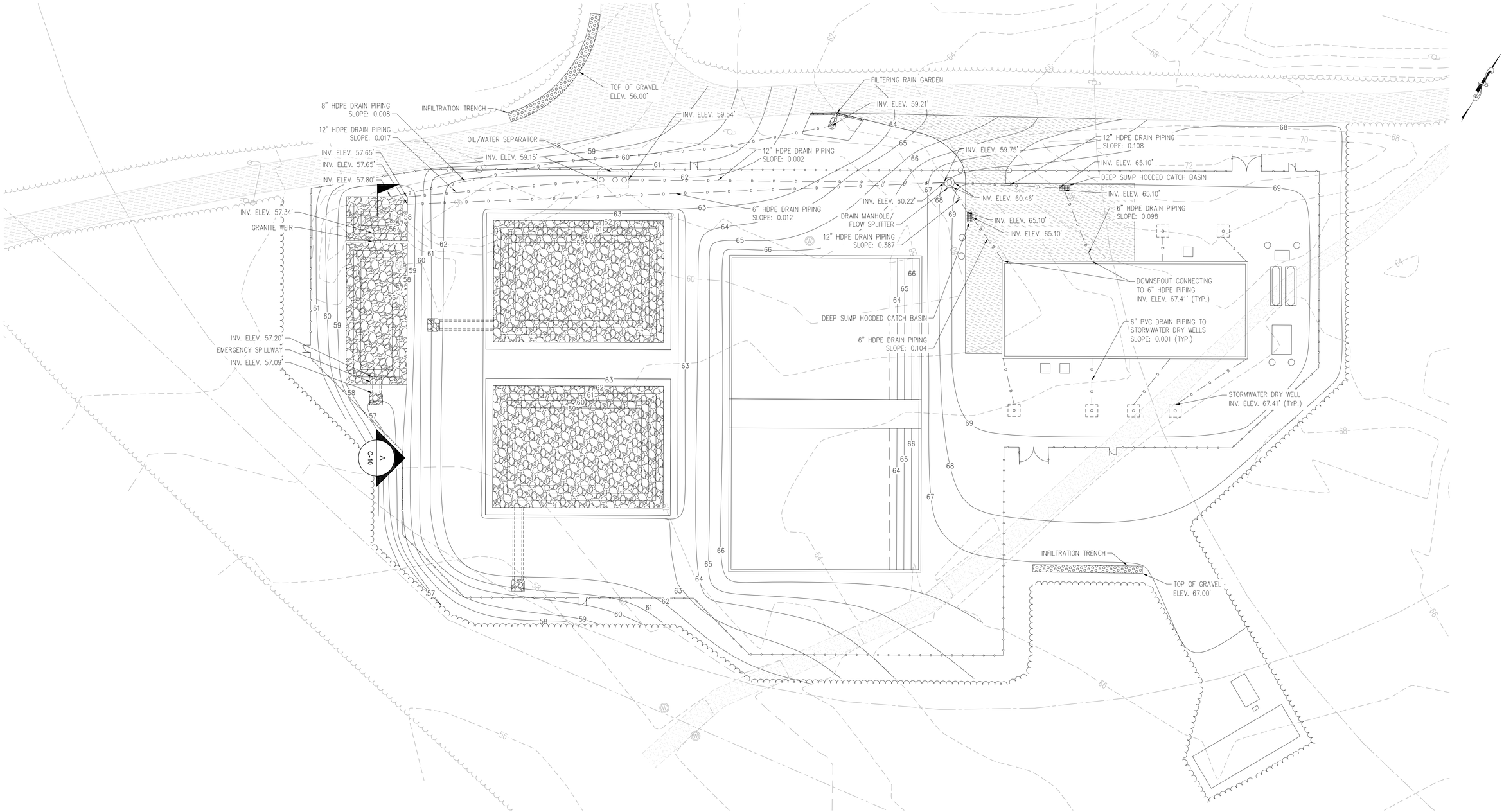

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SCALE: 1" = 20'

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BARNSTABLE FIRE DISTRICT
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BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
STORMWATER MANAGEMENT PLAN

DRAWING NO.:
C-5

SHEET NO. 9 OF 57

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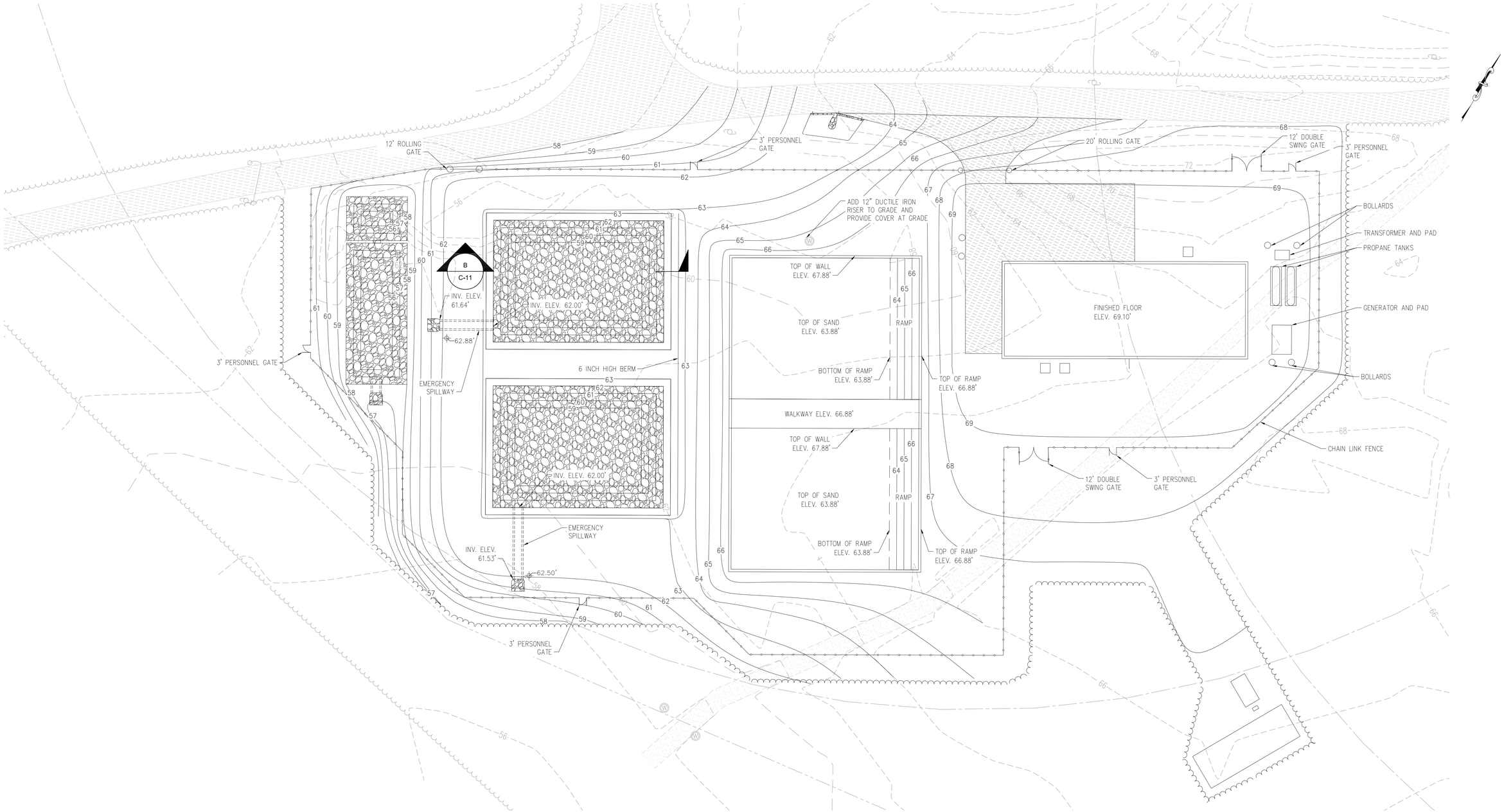

PLAN VIEW

SCALE: 1" = 20'

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DRAWING TITLE:
GRADING AND PAVEMENT PLAN

DRAWING NO.:
C-6

SHEET NO. 10 OF 57

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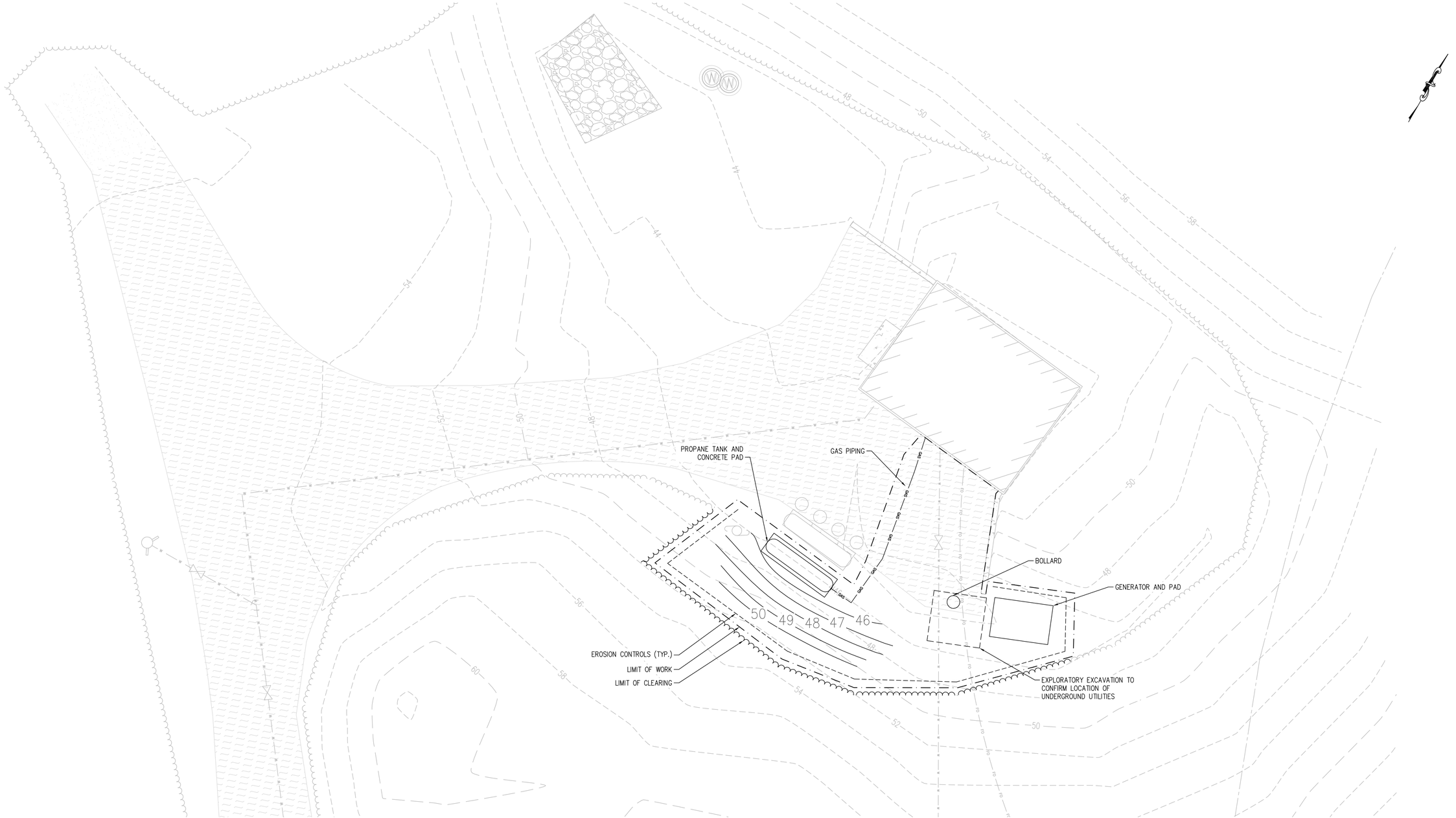

PLAN VIEW

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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
WELL #4
SITE PLAN

DRAWING NO.:
C-7

SHEET NO. 11 OF 57

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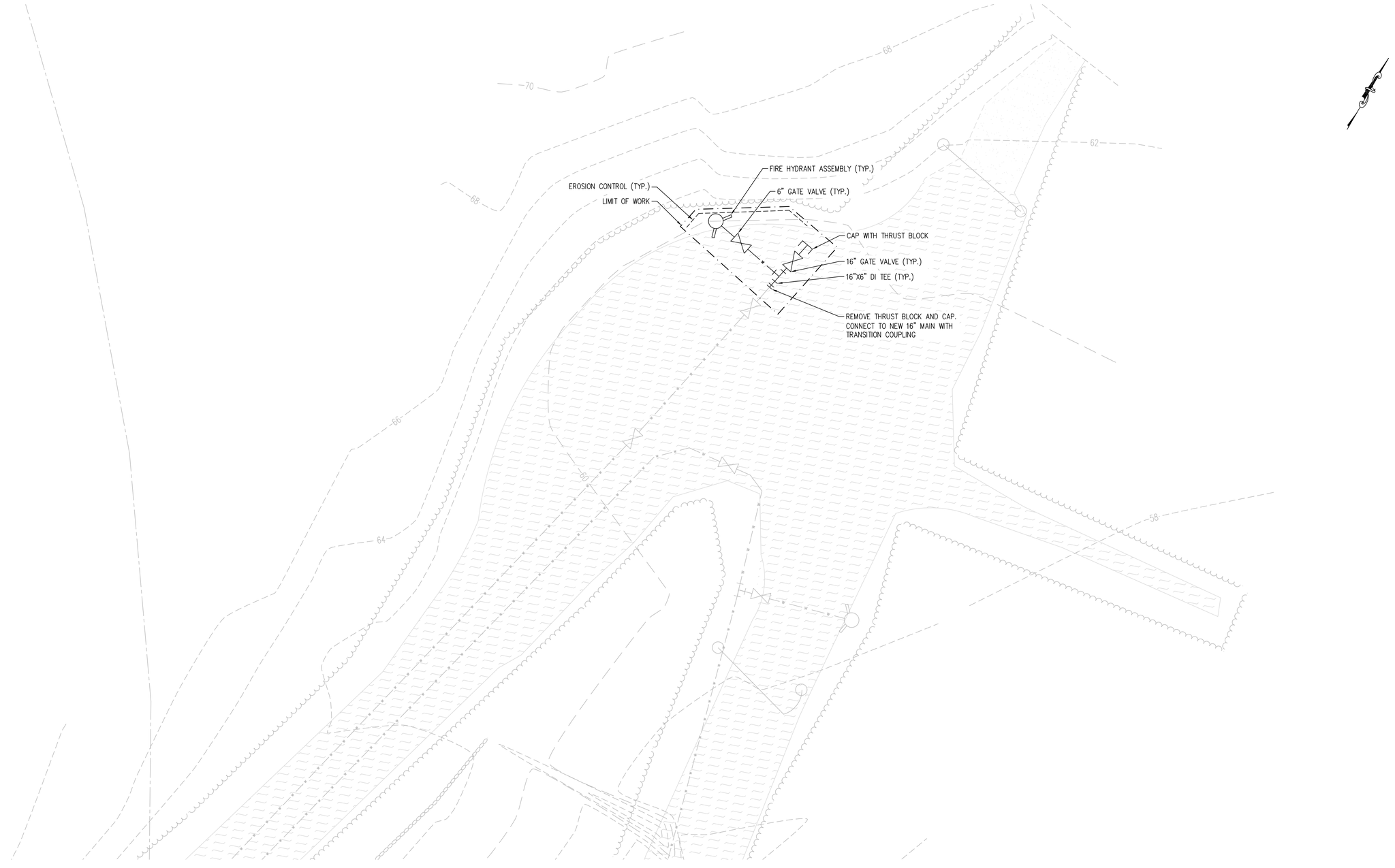

PLAN VIEW

SCALE: 1" = 8'

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COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 49386
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
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BARNSTABLE FIRE DISTRICT
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BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
END OF ACCESS ROAD SITE PLAN

DRAWING NO.:
C-8

SHEET NO. 12 OF 57

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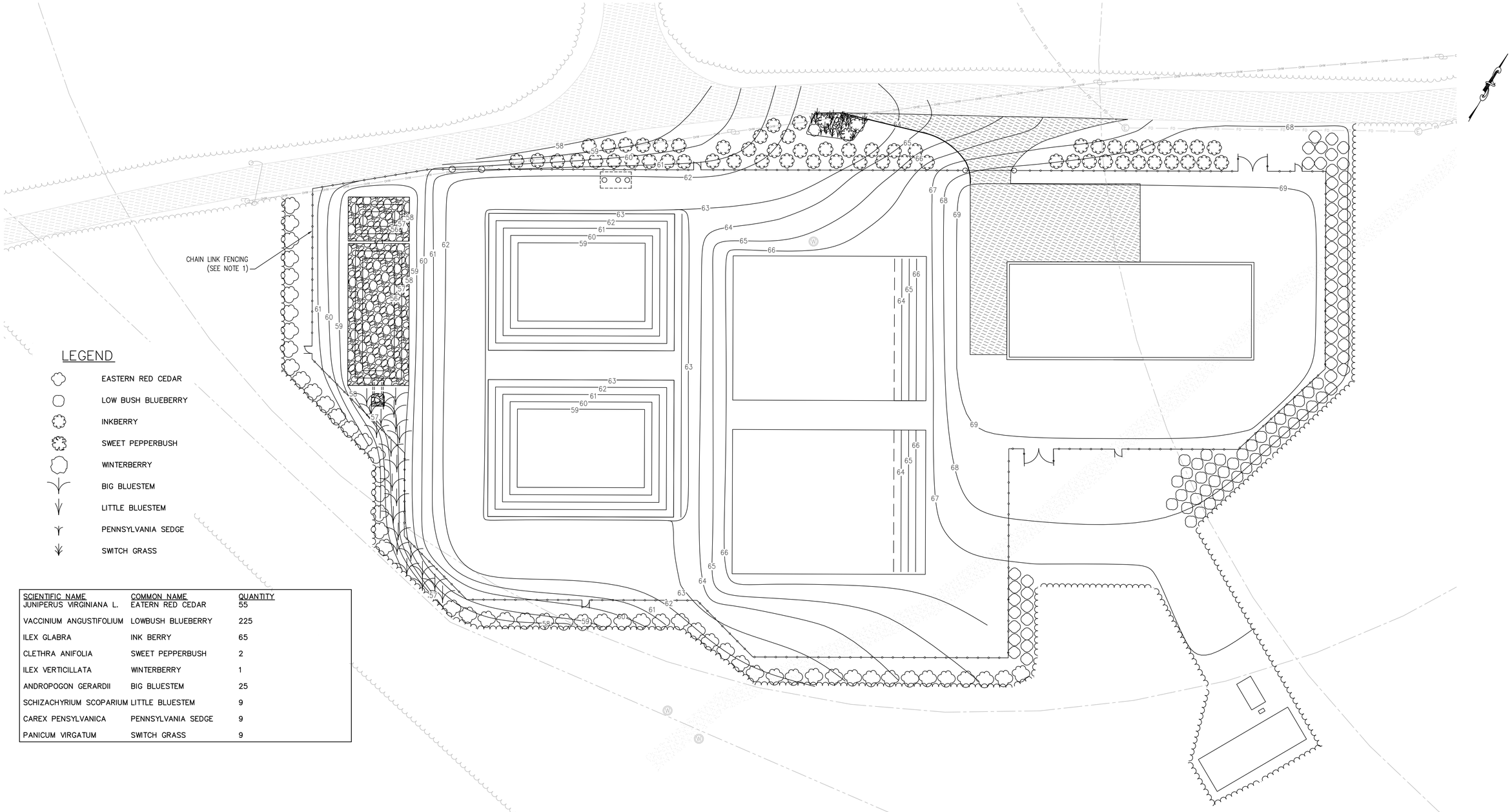

SCIENTIFIC NAME	COMMON NAME	QUANTITY
JUNIPERUS VIRGINIANA L.	EATERN RED CEDAR	55
VACCINIUM ANGUSTIFOLIUM	LOWBUSH BLUEBERRY	225
ILEX GLABRA	INK BERRY	65
CLETHRA ANIFOLIA	SWEET PEPPERBUSH	2
ILEX VERTICILLATA	WINTERBERRY	1
ANDROPOGON GERARDII	BIG BLUESTEM	25
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	9
CAREX PENSYLVANICA	PENNSYLVANIA SEDGE	9
PANICUM VIRGATUM	SWITCH GRASS	9

NOTES:

1. CHAIN LINK FENCING SHALL BE SEVEN FEET TALL.

PLAN VIEW

SCALE: 1" = 20'

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BARNSTABLE FIRE DISTRICT

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BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
LANDSCAPING PLAN

DRAWING NO.:
C-9

SHEET NO. 13 OF 57

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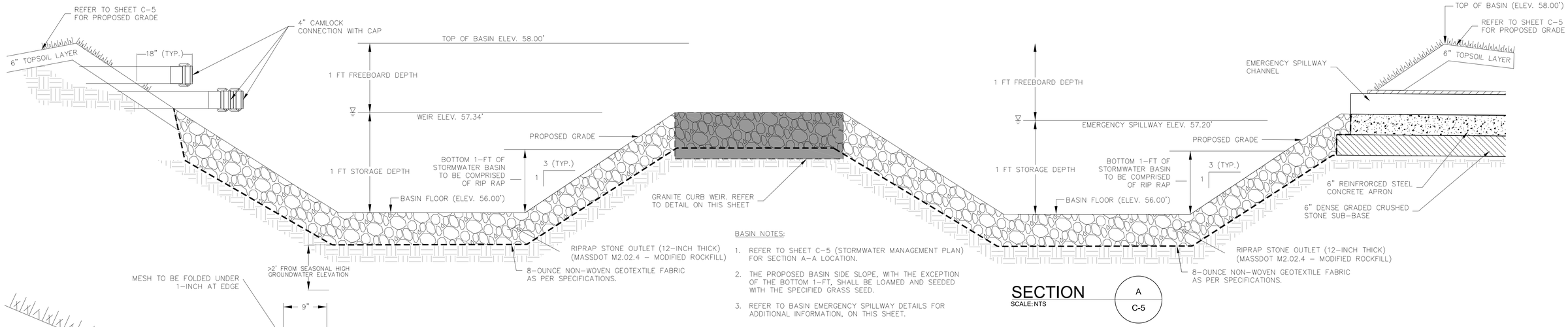
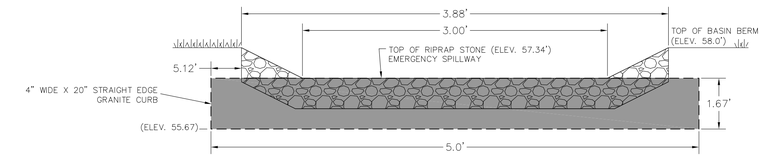


BASIN NOTES:

1. REFER TO SHEET C-5 (STORMWATER MANAGEMENT PLAN) FOR SECTION A-A LOCATION.
2. THE PROPOSED BASIN SIDE SLOPE, WITH THE EXCEPTION OF THE BOTTOM 1-FT, SHALL BE LOAMED AND SEEDED WITH THE SPECIFIED GRASS SEED.
3. REFER TO BASIN EMERGENCY SPILLWAY DETAILS FOR ADDITIONAL INFORMATION, ON THIS SHEET.

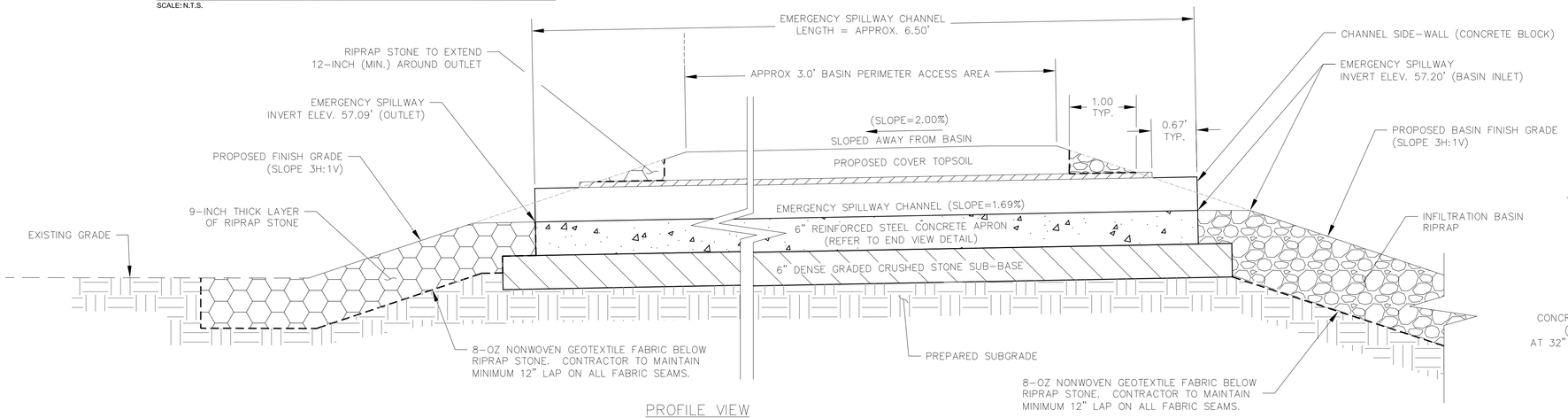
SECTION A
SCALE: NTS

C-5

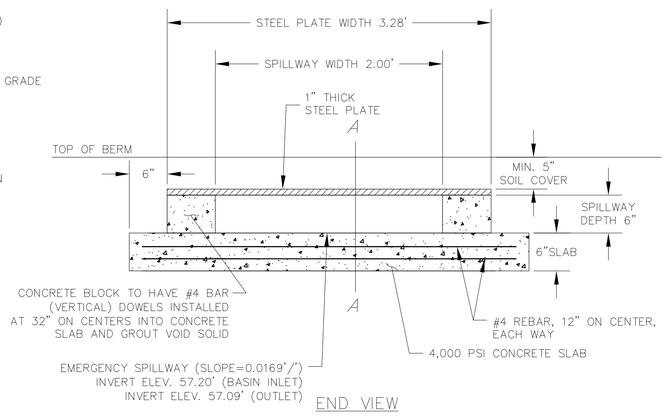


GRANITE CURB WEIR DETIAL
SCALE: N.T.S.

STORMWATER OUTLET DETIAL
SCALE: N.T.S.



PROFILE VIEW



END VIEW

EMERGENCY SPILLWAY DETAIL
SCALE: N.T.S.

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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS STEPHEN C. OLSON 49836 REGISTERED PROFESSIONAL ENGINEER

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: STORMWATER BASIN SECTIONS

DRAWING NO.: C-10

SHEET NO. 14 OF 57

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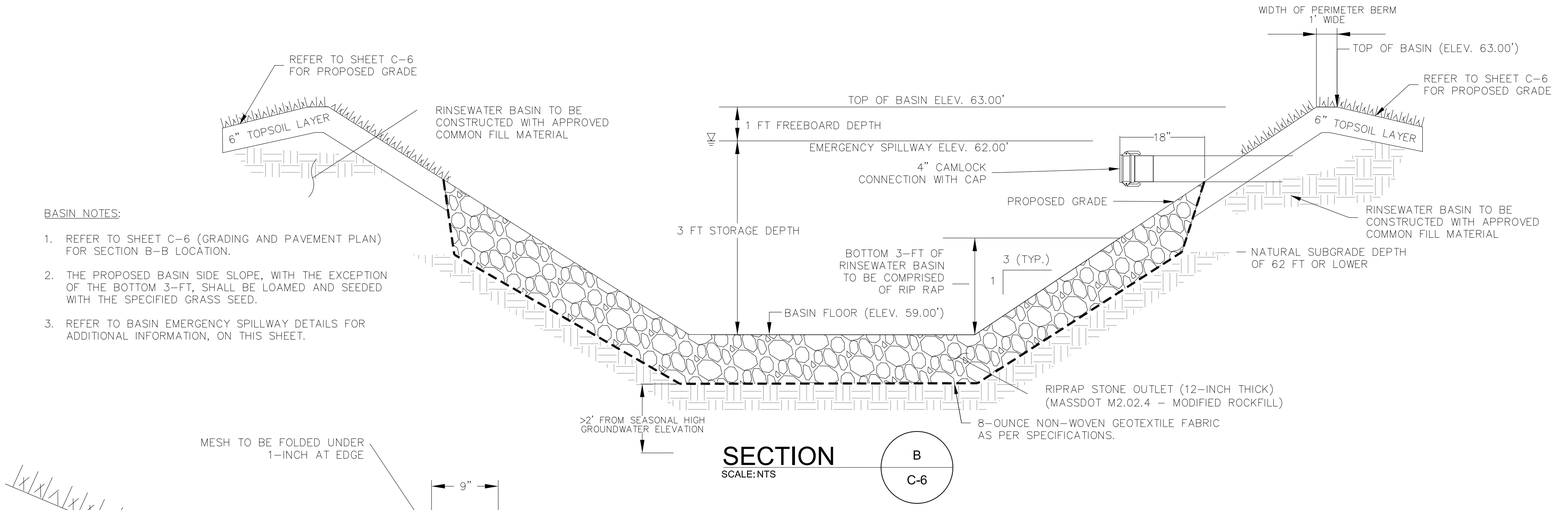


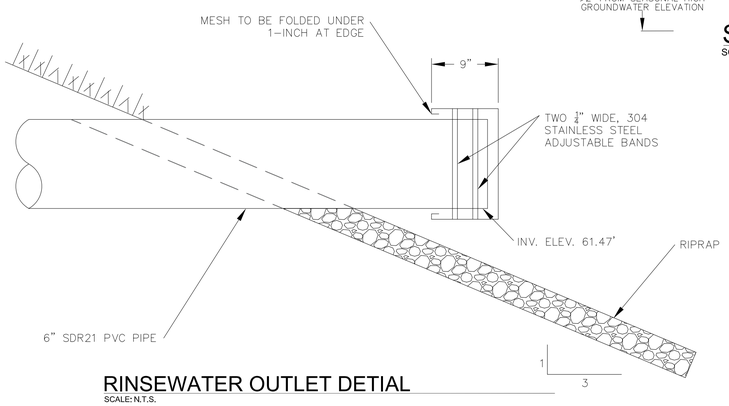
BASIN NOTES:

1. REFER TO SHEET C-6 (GRADING AND PAVEMENT PLAN) FOR SECTION B-B LOCATION.
2. THE PROPOSED BASIN SIDE SLOPE, WITH THE EXCEPTION OF THE BOTTOM 3-FT, SHALL BE LOAMED AND SEEDED WITH THE SPECIFIED GRASS SEED.
3. REFER TO BASIN EMERGENCY SPILLWAY DETAILS FOR ADDITIONAL INFORMATION, ON THIS SHEET.

SECTION

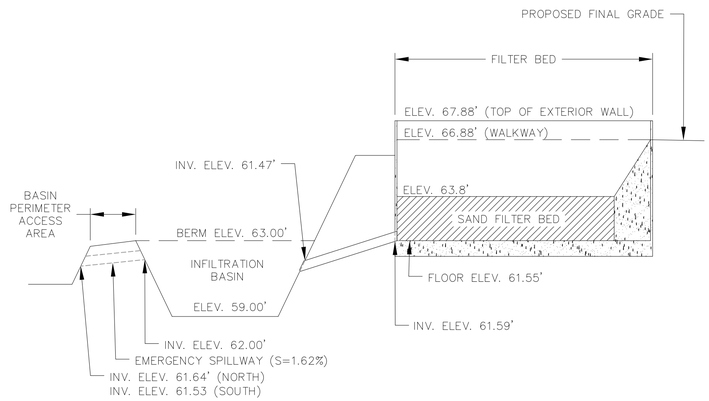
SCALE: NTS

B / C-6



RINSEWATER OUTLET DETIAL

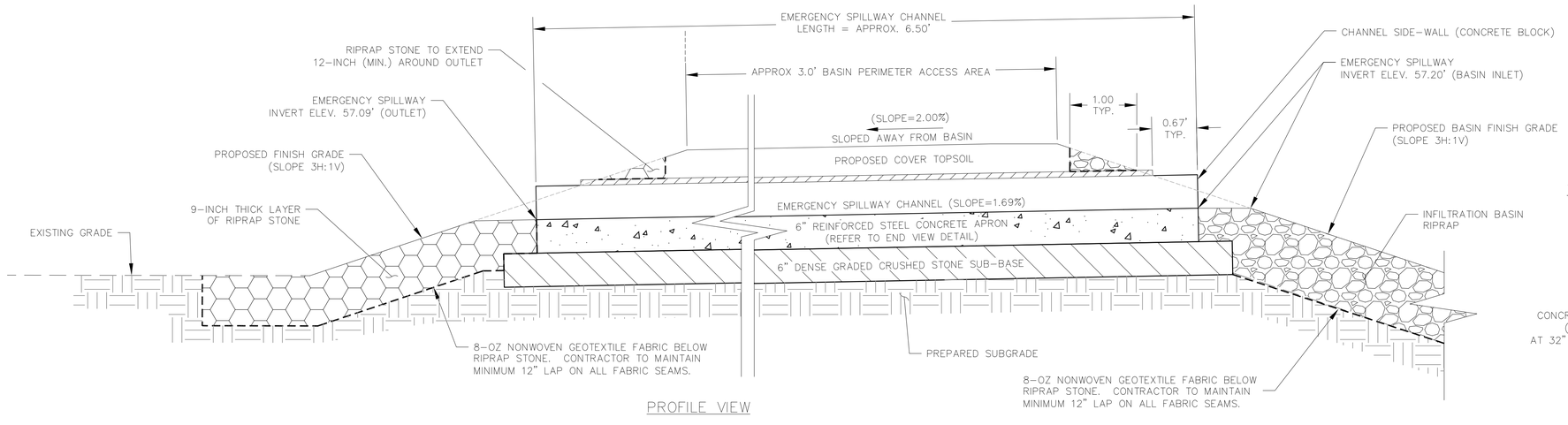
SCALE: N.T.S.



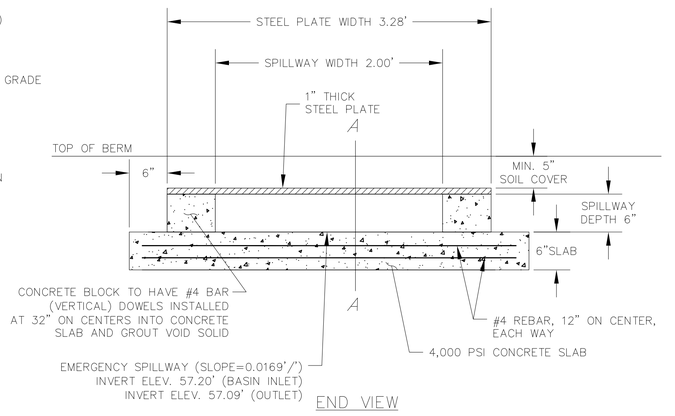
NOTE:
1. PROPOSED SYSTEM IS COMPRISED OF 2 SAND FILTER BEDS AND TWO INFILTRATION BASINS. SECTION SHOWN IS REPRESENTATIVE OF TYPICAL SYSTEM ELEVATIONS.

FILTER BED & INFILTRATION BASIN SYSTEM SECTION

SCALE: N.T.S.



PROFILE VIEW



END VIEW

EMERGENCY SPILLWAY DETAIL

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STEPHEN C. OLSON
No. 37880
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
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DRAWN BY:	GAC
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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
RINSEWATER INFILTRATION BASIN SECTIONS

DRAWING NO.:
C-11

SHEET NO. 15 OF 57

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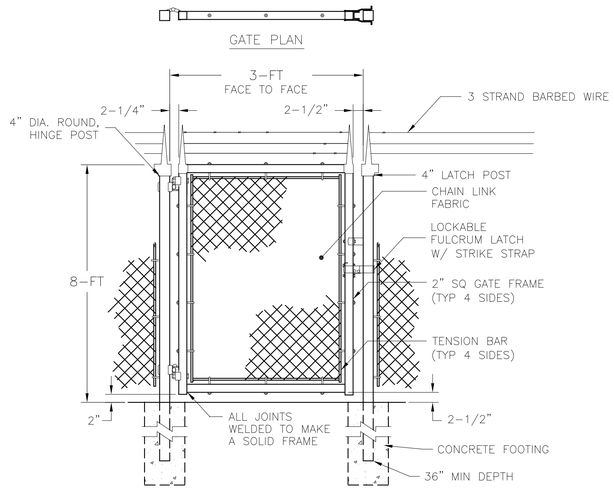
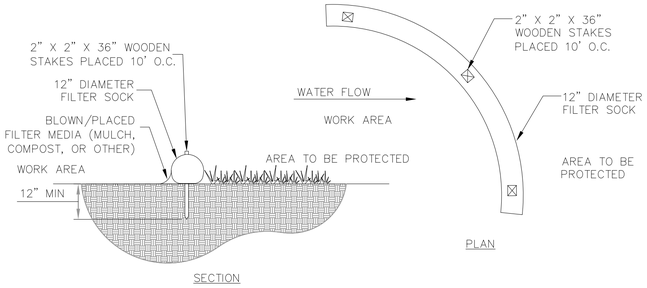


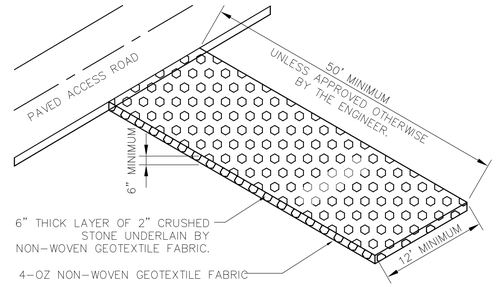
PERSONEL GATE DETAIL

SCALE: N.T.S.



SEDIMENTATION CONTROL BARRIER

SCALE: NOT TO SCALE

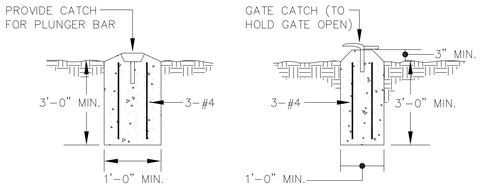


ENTRANCE PAD NOTES:

1. NON–WOVEN GEOTEXTILE FABRIC SHALL BE PLACED OVER THE ENTIRE AREA OF THE CONSTRUCTION ENTRANCE PRIOR TO PLACING STONE.
2. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING SEDIMENT ONTO PUBLIC RIGHT–OF WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, WASHED, OR TRACKED ONTO PUBLIC RIGHT–OF–WAY MUST BE REMOVED PROMPTLY.
3. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR SHALL REMOVE THE CONSTRUCTION ENTRANCE PAD AND RESTORE THE SURFACE TO ORIGINAL CONDITION.

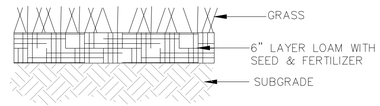
CONSTRUCTION ENTANCE PAD

SCALE: NOT TO SCALE



TYPICAL GATE KEEPER & CATCH DETAIL

SCALE: N.T.S.

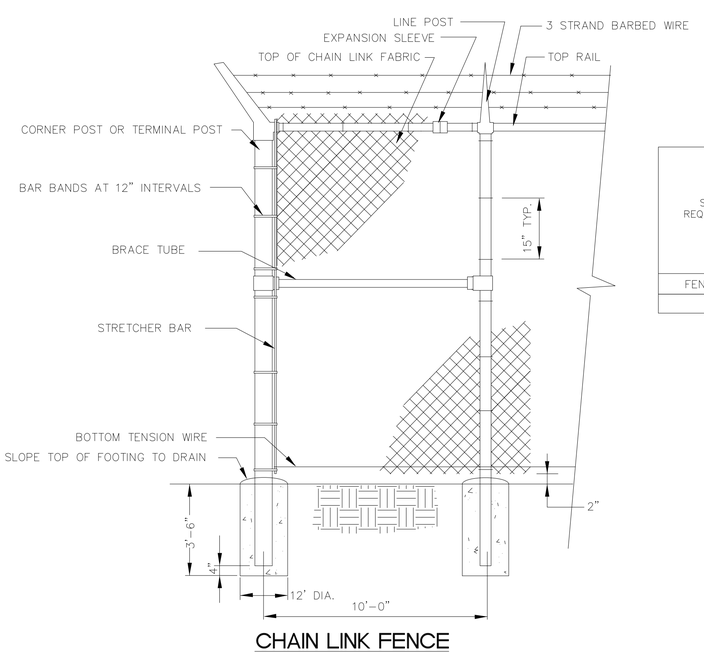


NOTES

1. ALL GRASSED SURFACE SLOPES STEEPER THAN 7H:1V SLOPE SHALL INCLUDE THE INSTALLATION OF EROSION CONTROL BLANKET AFTER THE LOAM, SEED AND FERTILIZER HAVE BEEN PLACE.
2. MATERIAL SPECIFICATIONS FOR THE EROSION CONTROL BLANKET SHALL MEET CURLEX II EROSION CONTROL BLANKET AS MANUFACTURED BY AMERICAN EXCELSIOR COMPANY, OR EQUAL.

GRASSED VEGETATED SURFACE

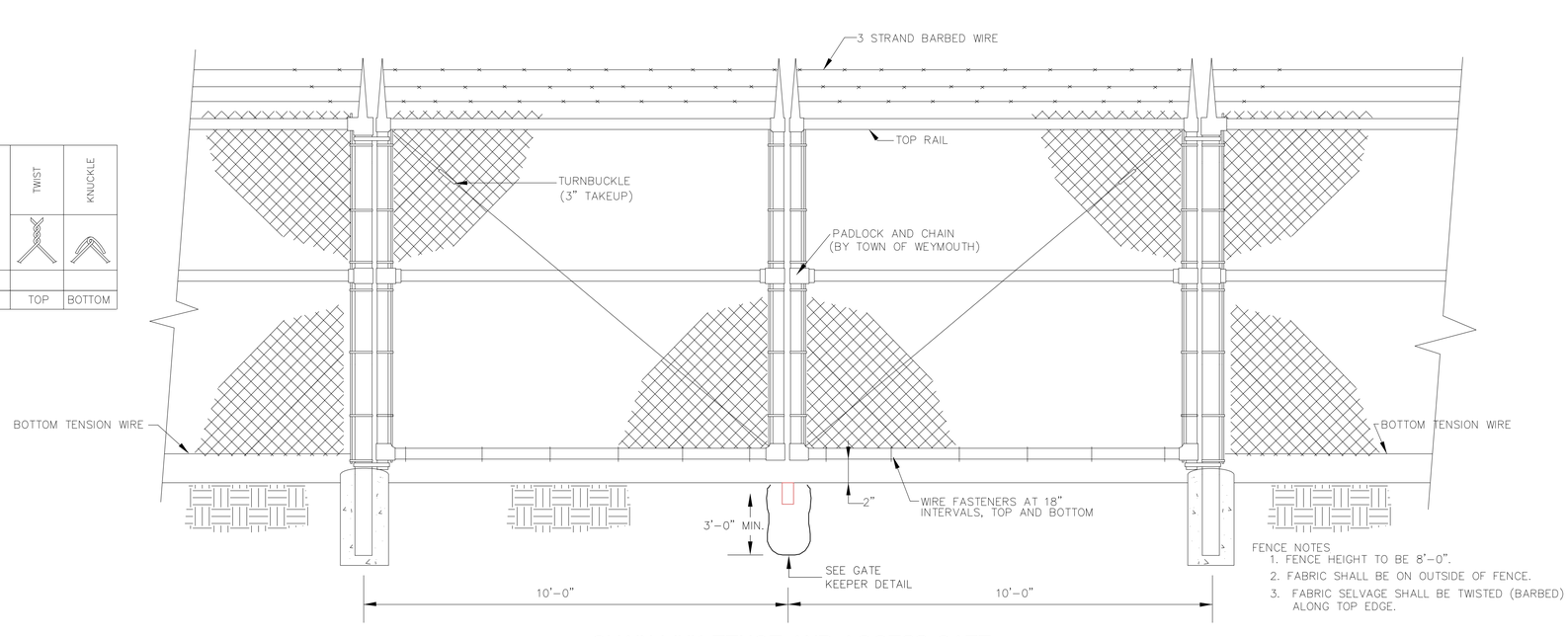
SCALE: NOT TO SCALE



SELVAGE REQUIREMENTS	TWIST	KNUCKLE
FENCE HEIGHT		
8'–0"	TOP	BOTTOM

CHAIN LINK FENCE

N.T.S.



FENCE NOTES

1. FENCE HEIGHT TO BE 8'–0".
2. FABRIC SHALL BE ON OUTSIDE OF FENCE.
3. FABRIC SELVAGE SHALL BE TWISTED (BARBED) ALONG TOP EDGE.

CHAIN LINK FENCE AND ACCESS GATE

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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS I

DRAWING NO.:
C-12

SHEET NO. 16 OF 57

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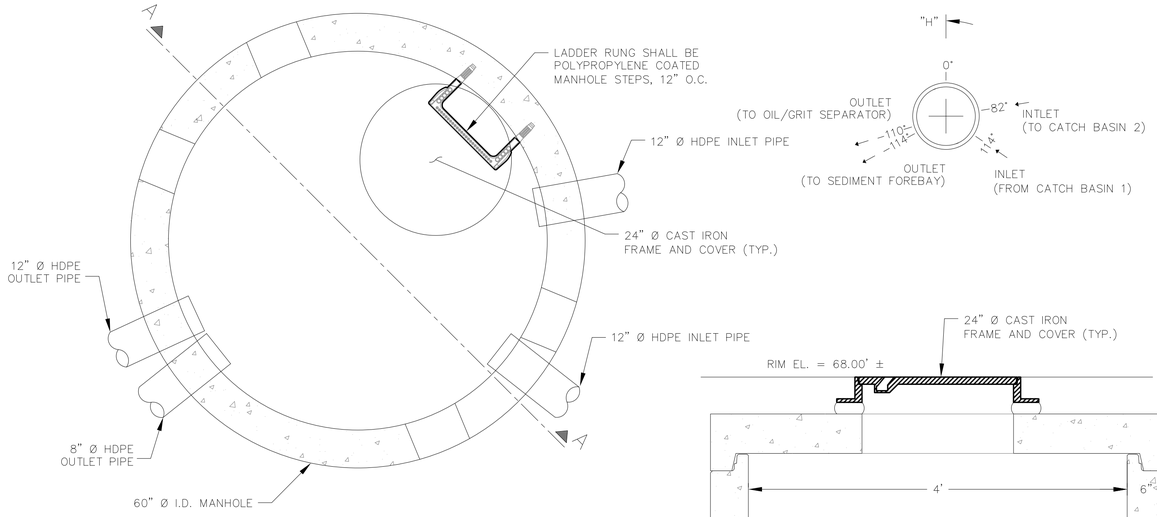
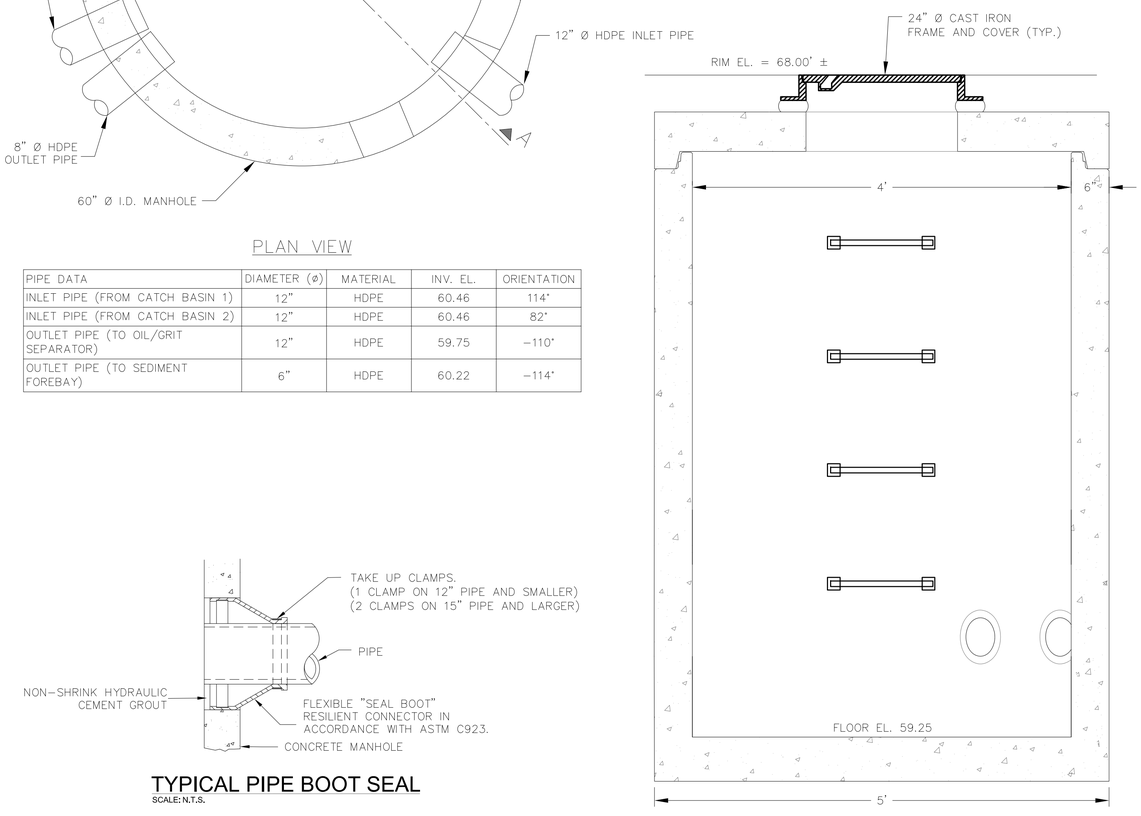


PLAN VIEW

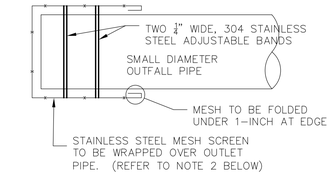
PIPE DATA	DIAMETER (ø)	MATERIAL	INV. EL.	ORIENTATION
INLET PIPE (FROM CATCH BASIN 1)	12"	HDPE	60.46	114°
INLET PIPE (FROM CATCH BASIN 2)	12"	HDPE	60.46	82°
OUTLET PIPE (TO OIL/GRIT SEPARATOR)	12"	HDPE	59.75	-110°
OUTLET PIPE (TO SEDIMENT FOREBAY)	6"	HDPE	60.22	-114°



SECTION A-A

OUTLET CONTROL STRUCTURE DETAIL
SCALE: N.T.S.

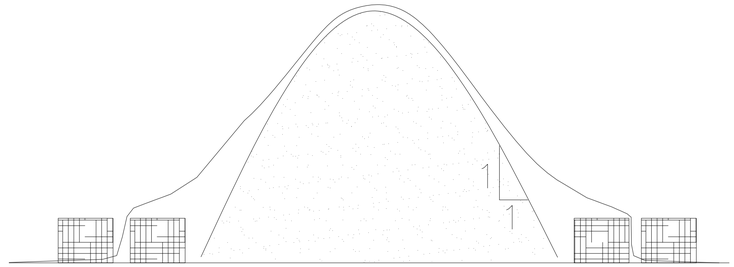
TYPICAL PIPE BOOT SEAL
SCALE: N.T.S.



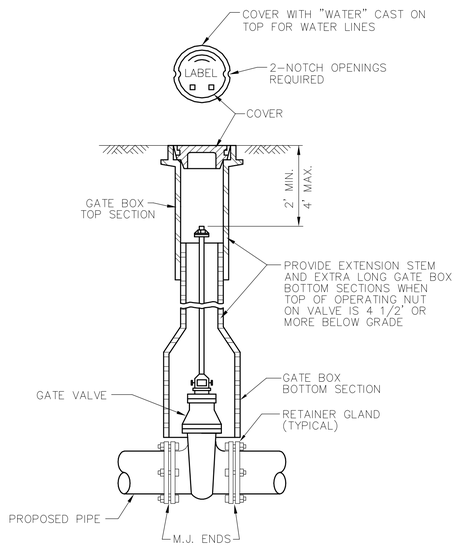
OUTLET SCREEN NOTE:

1. OUTLET SCREEN TO BE INSTALL ON SMALL DIAMETER OUTFALL PIPING, AS CALLED OUT ON THE PLANS.
2. MESH SCREEN SHALL BE SQUARE, STAINLESS STEEL, TYPE 304, WELDED 2 X 2 MESH (SQUARE), 0.4370" X 0.4370" OPENING, 0.063" THICK (16 GAUGE) WIRE DIAMETER, 76% OPEN AREA.

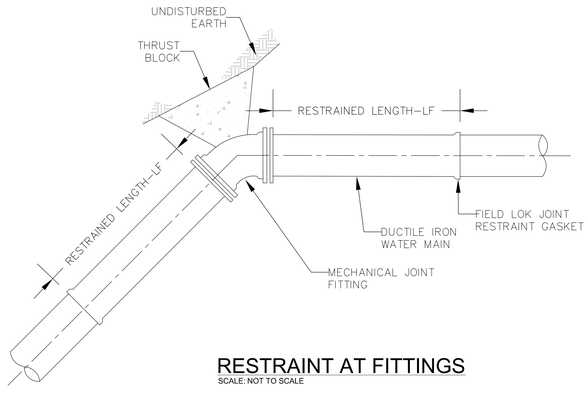
OUTLET SCREEN DETAIL
SCALE: N.T.S.



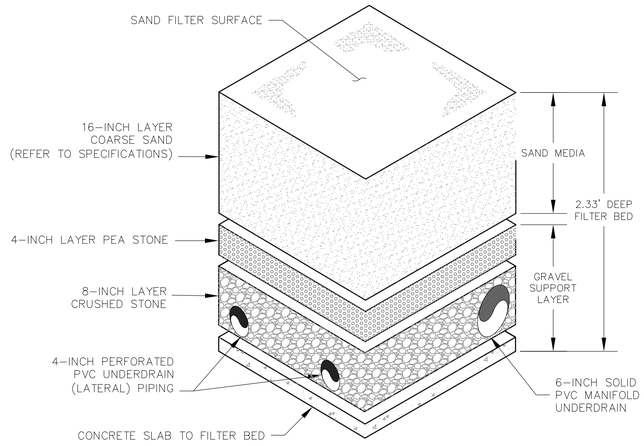
STOCKPILE DETAIL
SCALE: N.T.S.



GATE VALVE AND VALVE BOX DETAIL
SCALE: N.T.S.



RESTRAINT AT FITTINGS
SCALE: NOT TO SCALE



SAND MEDIA NOTES:

1. PERFORATED LATERAL UNDERDRAIN PIPING SHALL BE SPACED AT 4-FT (ON CENTER). PERFORATIONS SHALL BE 1/4-INCH DIA., 6 HOLES PER FOOT LOCATED ON THE BOTTOM. REFER TO PERFORATION DETAIL ON SHEET C-11.

SAND FILTER - MEDIA BED
SCALE: N.T.S.

PIPE SIZE	PLUG SF	PLUG LF	TEE SF	TEE LF	90° BEND SF	90° BEND LF	45° BEND SF	45° BEND LF	22 1/2° BEND SF	22 1/2° BEND LF	11 1/4° BEND SF	11 1/4° BEND LF
6"	2.8	37	2.8	32	4.0	18	2.1	7	1.1	4	1.0	2
8"	4.8	48	4.8	43	6.8	23	3.7	10	1.9	5	1.0	2
10"	7.3	58	7.3	53	10.3	28	5.6	12	2.8	6	1.4	3
12"	10.3	69	10.3	63	14.5	33	7.9	14	4.0	6	2.0	3
16"	17.8	89	17.8	83	25.2	42	13.6	17	7.0	8	3.5	4
20"	27.5	108	27.5	102	38.9	51	21.0	21	10.7	10	5.4	5
24"	39.2	127	39.2	121	55.4	59	30.0	25	15.3	12	7.7	6

RESTRAINT NOTES:

1. MINIMUM SURFACE AREA OF CONCRETE THRUST BLOCK AGAINST UNDISTURBED EARTH – SF (SQUARE FEET)
2. MINIMUM RESTRAINED LENGTH OF PIPE ON EITHER SIDE OF FITTING – LF (LINEAR FEET)
3. THE "SF" VALUES IN THE ABOVE TABLE ARE BASED ON 3,000 P.S.F. SOIL BEARING CAPACITY, 150 P.S.I. TEST PRESSURE AND A 1.5 FACTOR OF SAFETY.
4. THE "LF" VALUES IN THE ABOVE TABLE ARE BASED ON A TYPE 3 LAYING CONDITION, A SAND SILT SOIL DESIGNATION, A 5 FOOT RUN LENGTH, 150 P.S.I. TEST PRESSURE AND A 1.5 FACTOR OF SAFETY.

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DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: CIVIL DETAILS II

DRAWING NO.: C-13

SHEET NO. 17 OF 57

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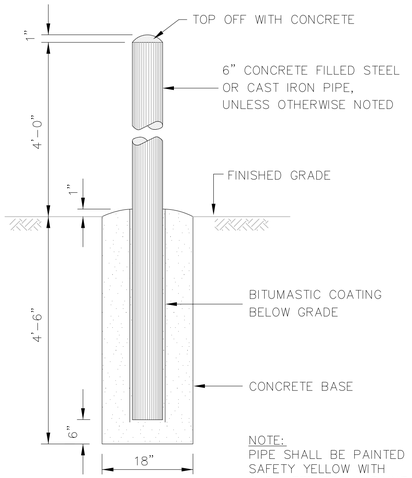
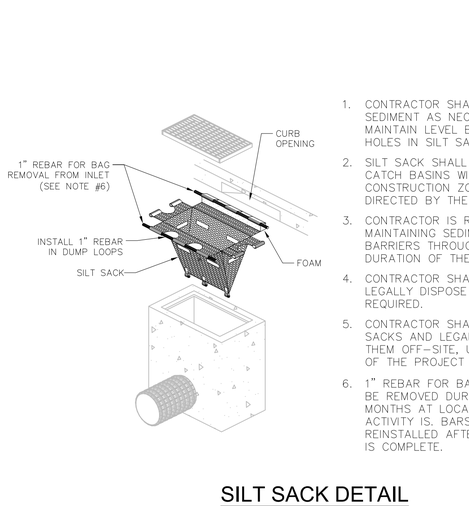


NOTE:
PIPE SHALL BE PAINTED SAFETY YELLOW WITH CATALIZED EPOXY PAINT

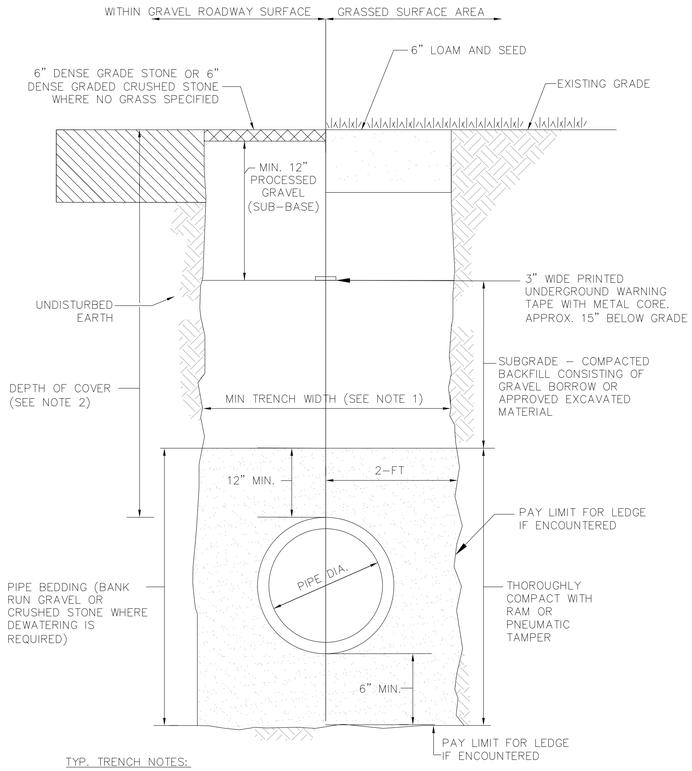
BOLLARD DETAIL

N.T.S.



1. CONTRACTOR SHALL REMOVE SEDIMENT AS NECESSARY TO MAINTAIN LEVEL BELOW OVERFLOW HOLES IN SILT SACK.
2. SILT SACK SHALL BE USED ON ALL CATCH BASINS WITHIN CONSTRUCTION ZONE OR AS DIRECTED BY THE AUTHORITY.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SEDIMENTATION BARRIERS THROUGHOUT THE DURATION OF THE PROJECT.
4. CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF SEDIMENT AS REQUIRED.
5. CONTRACTOR SHALL REMOVE SILT SACKS AND LEGALLY DISPOSE OF THEM OFF-SITE, UPON COMPLETION OF THE PROJECT AND AS REQUIRED.
6. 1" REBAR FOR BAG REMOVAL SHALL BE REMOVED DURING WINTER MONTHS AT LOCATIONS WHERE PLOW ACTIVITY IS. BARS SHALL BE REINSTALLED AFTER SNOW SEASON IS COMPLETE.

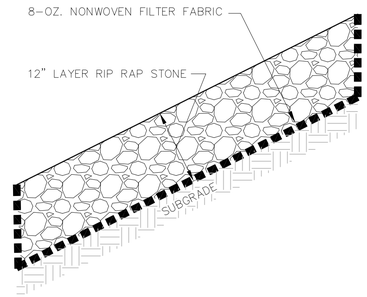
SILT SACK DETAIL



TYP. TRENCH NOTES:
1. MIN. COVER 5' COVER FOR WATER MAIN
2. MIN. 3' COVER FOR STORM DRAIN

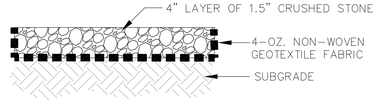
TYPICAL TRENCH DETAIL

SCALE: N.T.S.



RIPRAP SLOPE PROTECTION DETAIL

SCALE: N.T.S.



NOTE:
1. CRUSHED STONE SHALL MEET MASSDOT M2.01.7 SPECIFICATION AND GRADATION REQUIREMENTS.
2. CONTRACTOR SHALL PREPARE SUBGRADE TO RECEIVE THE CRUSHED STONE AND SHALL PERFORM AT A MINIMUM PROOF ROLLS THE SUBGRADE FOUR TIMES WITH A PLATE COMPACTOR OR AS DIRECTED BY THE ENGINEER BEFORE PLACING CRUSHED STONE.
3. UPON PLACEMENT OF MATERIAL AND REACHING FINAL GRADE, CONTRACTOR SHALL TAMP CRUSHED STONE WITH PLATE COMPACTOR TO ENSURE MATERIAL IS WELL CONSOLIDATED.

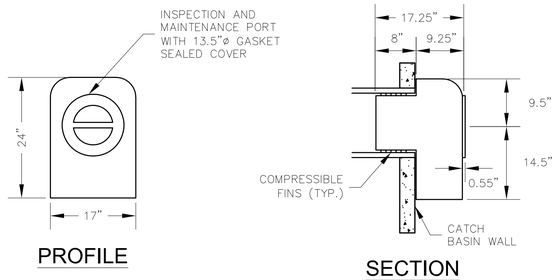
CRUSHED STONE PAD DETAIL

SCALE: N.T.S.

GENERAL NOTES:
1. TEST WELL SHALL BE ANCHORED WITH REBAR.
2. SEE SHEET C-5 FOR STORMWATER DRY WELL LOCATIONS.
3. STONE FILL SHALL BE 1.5"-3.0" IN DIAMETER.

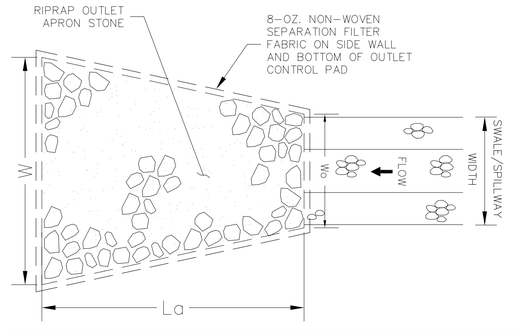
STORMWATER DRY WELL

SCALE: N.T.S.



HDPE CATCHBASIN HOOD

SCALE: N.T.S.



DISCHARGE POINT	La	Wo	W	RIPRAP STONE	LAYER THICKNESS
BASIN EMERGENCY SPILLWAY	6.5'	5.0'	6.5'	D50=4"	9"

RIPRAP OUTLET CONTROL PAD DETAIL

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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS III

DRAWING NO.:
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SHEET NO. 18 OF 57

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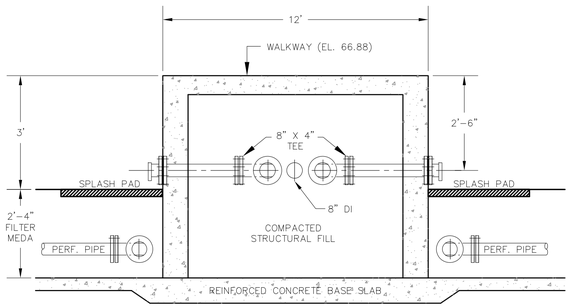
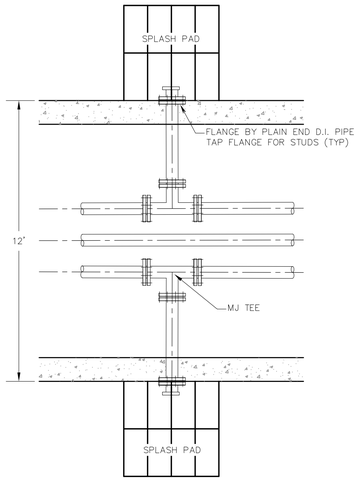
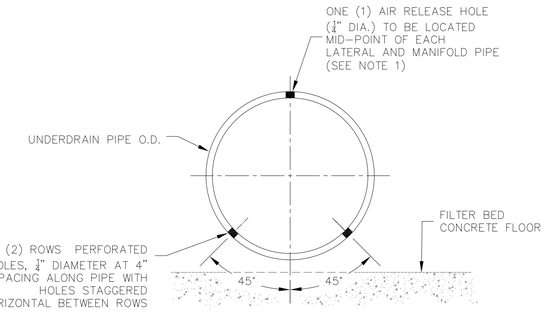


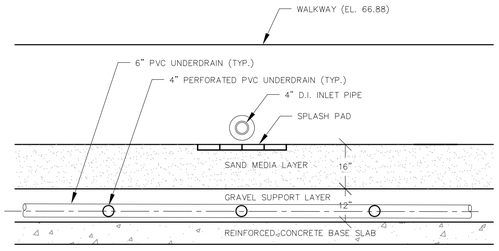
SECTION B - B
SCALE: NTS



PLAN VIEW - FILTER BED DISCHARGE PIPE
SCALE: NTS



PERFORATION HOLE PLACEMENT DETAIL FOR FILTER BED UNDERDRAIN
SCALE: N.T.S.



SECTION A - A
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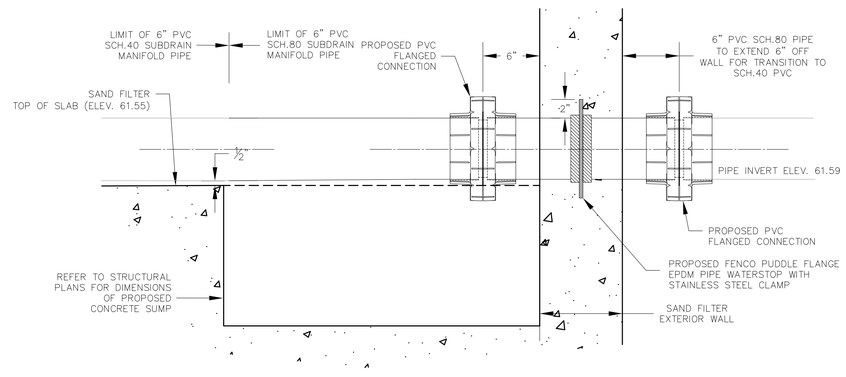
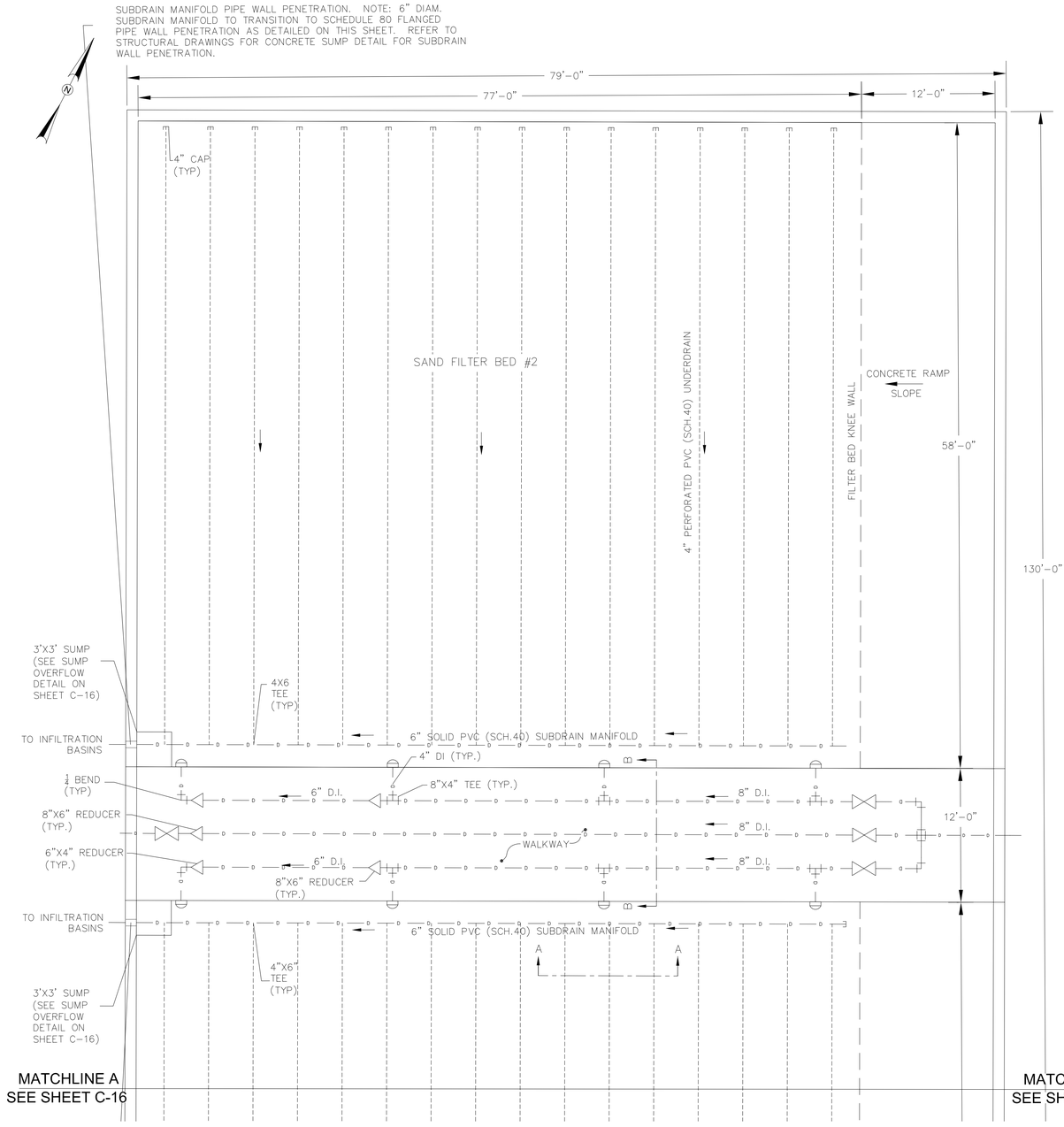


6-INCH SUBDRAIN MANIFOLD WALL PENETRATION DETAIL
SCALE: N.T.S.



FILTER BED PLAN VIEW
SCALE: NTS

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS IV

DRAWING NO.:
C-15
SHEET NO. 19 OF 57

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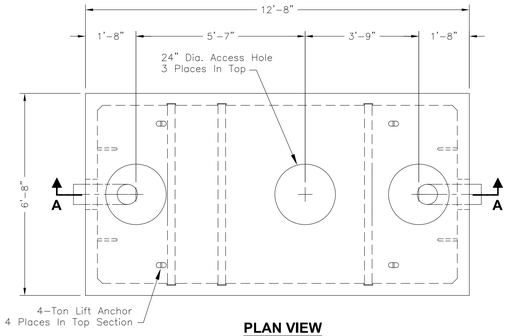
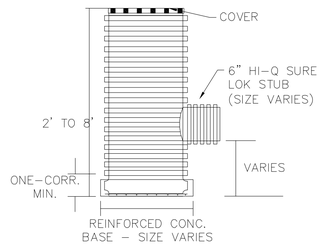
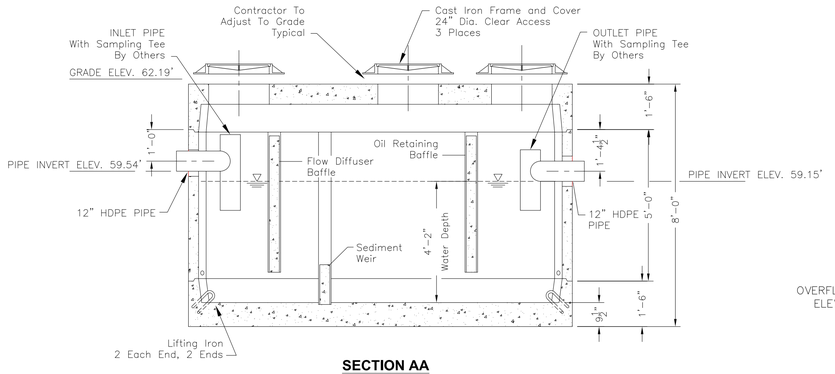


PLAN VIEW
Castings Not Shown



ROOF DRAIN ACCESS CLANOUT
SCALE: N.T.S.

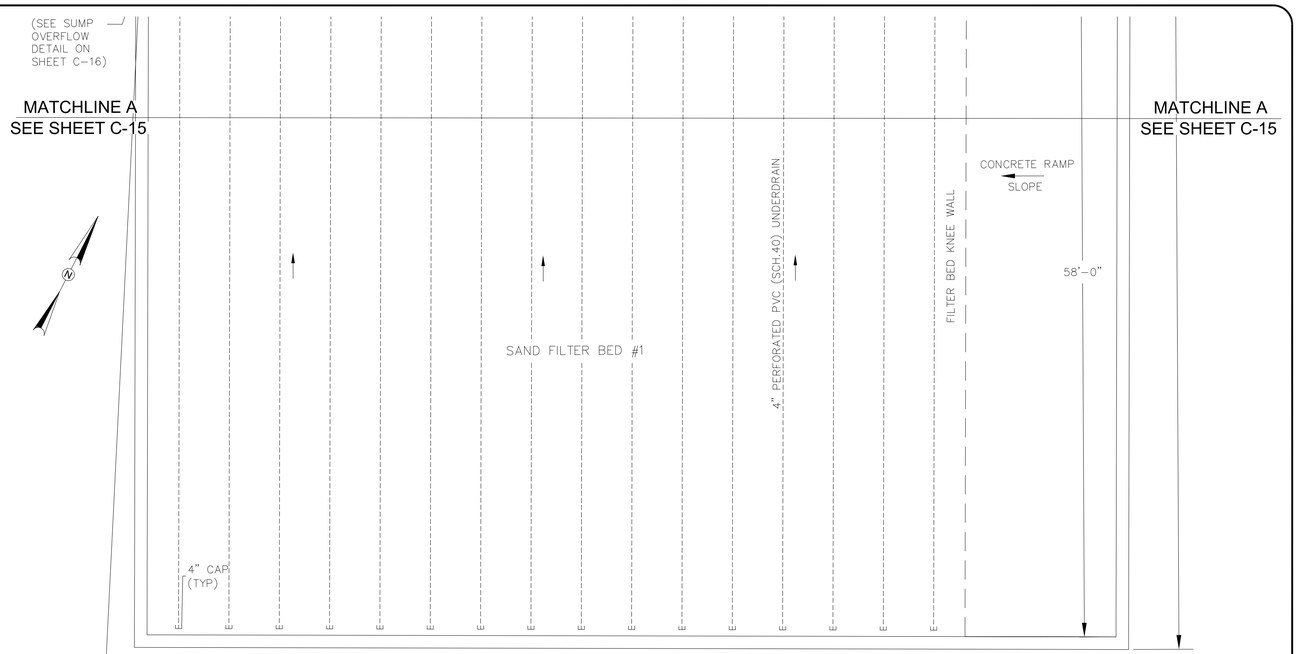


SECTION AA

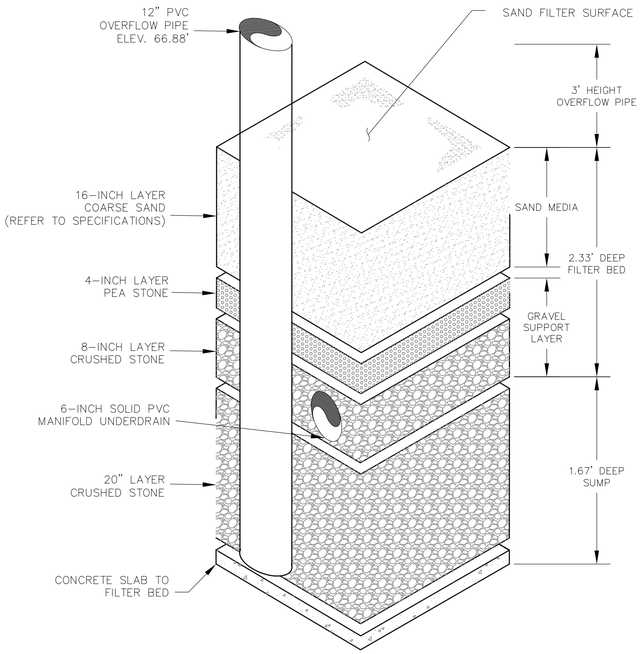
GENERAL NOTES:

1. CONCRETE: 28 DAY COMPRESSIVE STRENGTH f'c = 7,000 PSI
2. STEEL REINFORCEMENT: ATSMA-615 GRADE 60
3. MESH: ATSM A-185 GRADE 65
4. DESIGN: ACL-318-05 BUILDING CODE
   ATSM C-890 MINIMUM STRUCTURAL DESIGN
5. LOADS: HS-20 TRUCK WHEEL W/ 30% IMPACT PER AASHTO
6. OIL/GRIT SEPARATOR CAPACITY = 2,200 GALLONS
7. OIL/GRIT SEPARATOR UNIT SHALL BE OLDCASTLE PRECAST MODEL 612SA OR EQUAL.

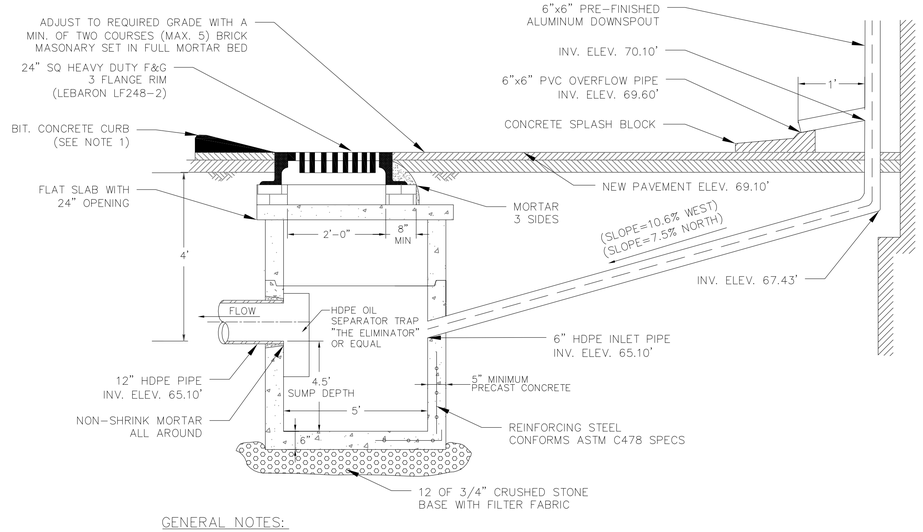
OIL / GRIT SEPARATOR
SCALE: 1" = 30'



FILTER BED PLAN VIEW
SCALE: 3/16" = 1'



SUMP OVERFLOW
SCALE: N.T.S.



GENERAL NOTES:

1. MANHOLE DESIGN TO CONFORM TO LASTEST ASTM C478 SPEC. FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".

PRECAST CONCRETE CATCH BAISN
SCALE: N.T.S.

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS V

DRAWING NO.:
C-16
SHEET NO. 20 OF 57

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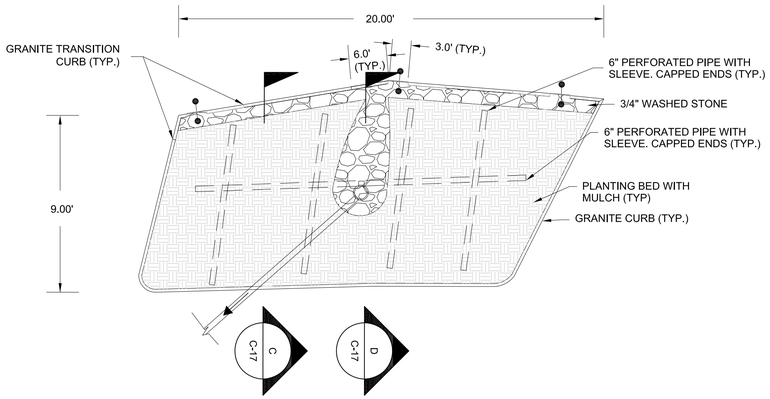
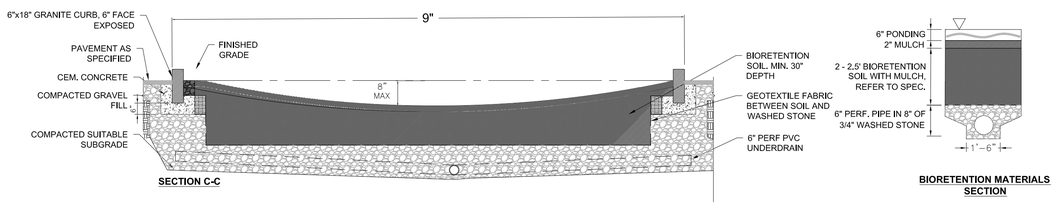
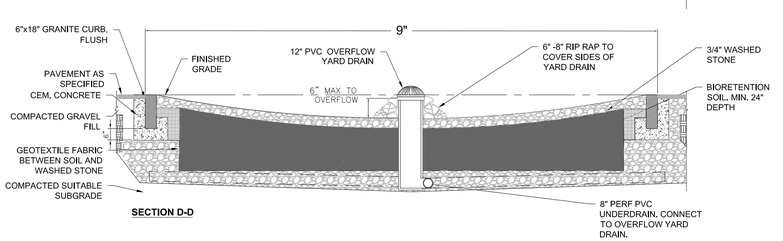


LAYOUT PLAN

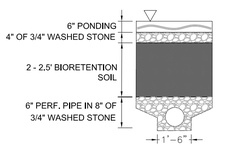


SECTION C-C

BIORETENTION MATERIALS SECTION



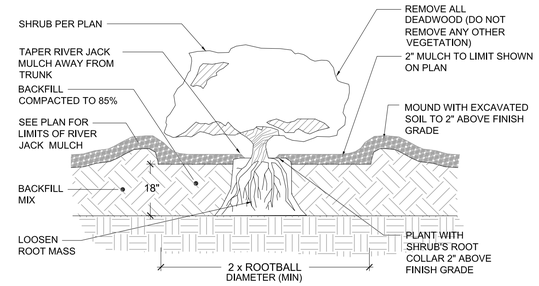
SECTION D-D



BIORETENTION MATERIALS SECTION

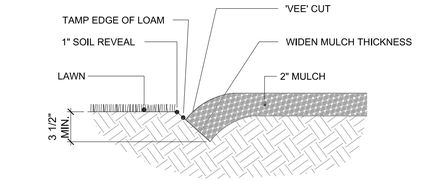
FILTERING RAIN GARDEN

SCALE: N.T.S.



CONTAINER GROWN TREE & SHRUB PLANTING

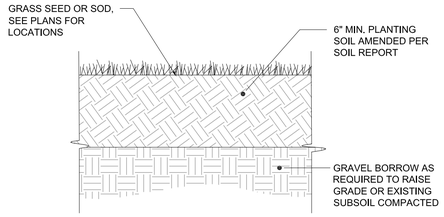
SCALE: N.T.S.



NOTE; LOCATE BEDLINE AS SHOWN ON PLAN.

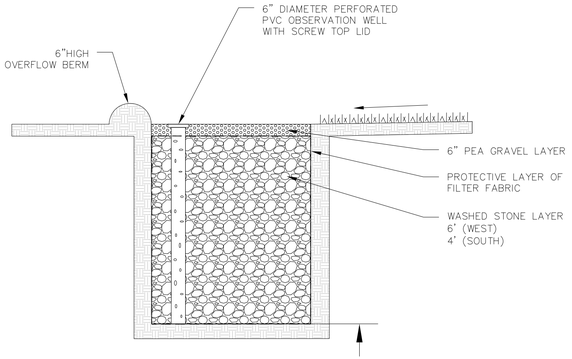
BEDLINE EDGE

SCALE: N.T.S.



LOAM AND SEED OR SOD

SCALE: N.T.S.

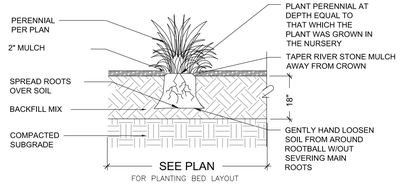


GENERAL NOTES:

1. STONE FILL SHALL BE 2"–5" IN DIAMETER.

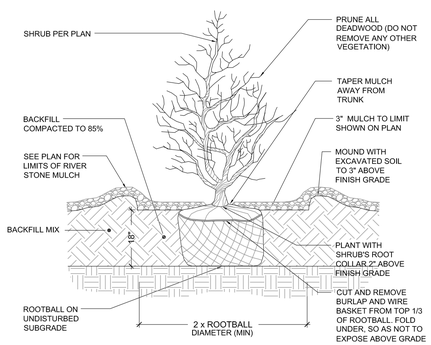
INFILTRATION TRENCH

SCALE: N.T.S.



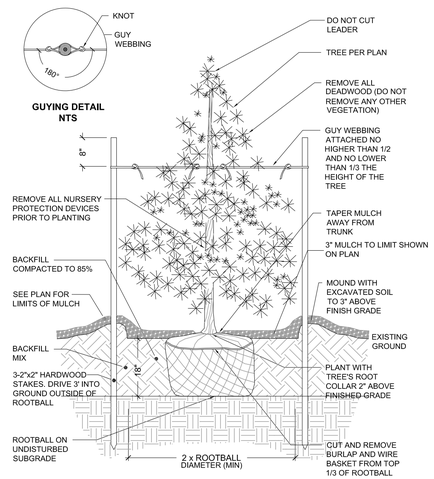
PERENNIAL AND GROUND COVER PLANTING

SCALE: N.T.S.



SHRUB PLANTING

SCALE: N.T.S.



NOTE:
AFTER THE GUARANTEE PERIOD THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REMOVAL OF STAKES AND GUY WEBBING.

EVERGREEN TREE STAKING & PLANTING

SCALE: N.T.S.

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS

NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 36,116
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS VI

DRAWING NO.:
C-17

SHEET NO. 21 OF 57

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CODE REVIEW

APPLICABLE BUILDING CODES / REGULATIONS

BUILDING	780 CMR: MASSACHUSETTS STATE BUILDING CODE, 10TH E. INTERNATIONAL BUILDING CODE (IBC) 2021 INTERNATIONAL EXISTING BUILDING CODE (IEBC) 2021 INTERNATIONAL FIRE CODE (IFC) 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC) 2021	PLUMBING	248 CMR: MASSACHUSETTS PLUMBING CODE
		MECHANICAL	INTERNATIONAL MECHANICAL CODE (IMC) 2021
		ELECTRICAL	527 CMR 12.00: MASSACHUSETTS ELECTRICAL CODE NATIONAL ELECTRICAL CODE (NEC) 2018
ACCESSIBILITY	521 CMR MASSACHUSETTS ARCHITECTURAL ACCESS BOARD (MAAB) AMERICANS WITH DISABILITIES ACT GUIDELINES (ADAG)	GAS AND FOSSIL FUEL	248 CMR INTERNATIONAL FUEL GAS CODE (IFGC) 2015
FIRE PROTECTION	527 CMR: MASSACHUSETTS FIRE PREVENTION REGULATIONS NATIONAL FIRE PROTECTION ASSOCIATION (NFPA 1) 2015		

OCCUPANCY CLASSIFICATION AND SQUARE FOOTAGE

FLOOR LEVEL	OCCUPANCY	OCCUPANCY CLASS	SQ FT	CONSTRUCTION TYPE	NOTES	CODE SECTION
FIRST	HIGH HAZARD GROUP	H-4	4,026	2-B	PRE ENGINEERED METAL BUILDING, WITH STEEL FRAMING AND INSULATED METAL PANEL WALLS AND ROOF.	IBC SECTION 310

FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS

BUILDING ELEMENT	TYPE 2-B	NOTES	CODE SECTION
PRIMARY STRUCTURAL FRAME ()	0 HOUR	REFER TO SECTION 202 & FOOTNOTE "a"	IBC TABLE 601
BEARING WALL - EXTERIOR	0 HOUR	NOT LESS THAN FIRE-RESISTANCE RATING BASED ON DISTANCE SEPARATION (TABLE 602) & SECTION 704.10	IBC TABLE 601
BEARING WALL - INTERIOR	0 HOUR		IBC TABLE 601
NON-BEARING WALL & PARTITION - EXTERIOR	SEE TABLE 602		IBC TABLE 601
NON-BEARING WALL & PARTITION - INTERIOR	0 HOUR	NOT LESS THAN FIRE-RESISTANCE RATING REQUIRED BY OTHER SECTIONS OF THE IBC CODE	IBC TABLE 601
FLOOR CONSTRUCTION & ASSOCIATED SECONDARY MEMBERS	0 HOUR	REFER TO SECTION 202	IBC TABLE 601
ROOF CONSTRUCTION & ASSOCIATED SECONDARY MEMBERS	0 HOUR	REFER TO SECTION 202 & FOOTNOTE "b" & "c"	IBC TABLE 601
OCCUPANCY SEPARATION	1 HOUR	SEPARATION BETWEEN F-1 AND H-4 OCCUPANCIES.	IBC TABLE 508.4

ALLOWABLE BUILDING HEIGHT ABOVE GRADE PLANE

OCCUPANCY CLASSIFICATION	TYPE OF CONST.	ALLOWED BLDG. HEIGHT	REQS.	NOTES	CODE SECTION
H-4	TYPE 2-B	75 FEET	S	PROPOSED - 32' - 9"	IBC TABLE 504.3

NUMBER OF STORIES ABOVE GRADE PLANE

OCCUPANCY	TYPE OF CONSTRUCTION	ALLOWED STORIES	REQS.	NOTES	CODE SECTION
F-2	TYPE 2-B	4 STORIES	S	PROPOSED - 1 STORY	IBC TABLE 504.4

CODE REVIEW

OCCUPANT LOAD CALCULATIONS

LEVEL	FUNCTION OF SPACE	SQ FT	RATIO	OCCUPANTS	FUNCTION OF SPACE	NOTES	CODE SECTION
FIRST FLOOR	F-1	286	100 GROSS	3	INDUSTRIAL WATER TREATMENT PLANT		IBC TABLE 1004.1.2
FIRST FLOOR	H-4	3,740	100 GROSS	38	INDUSTRIAL WATER TREATMENT PLANT		
TOTAL OCCUPANT LOAD				41			

MEANS OF EGRESS

ELEMENT	FLOOR LEVEL	REQUIRED	PROVIDED	NOTES	CODE SECTION
MINIMUM AMOUNT OF EXITS	FIRST	2	4	FROM 1 TO 500 OCCUPANTS = 2 EXITS REQUIRED. TWO EXITS WHEN OCCUPANT LOAD OR THE COMMON PATH OF EGRESS TRAVEL DISTANCE EXCEEDS THE VALUES LISTED	IBC TABLE 1006.3.1 IBC TABLE 1006.2.1
MAXIMUM COMMON PATH OF EGRESS	FIRST	75 FT MAX.	47' - 0"	COMMON PATH EGRESS DISTANCE (H-4 OCCUPANCY)	IBC TABLE 1006.2(2)
MAX. EXIT ACCESS TRAVEL DISTANCE	FIRST	175 FT MAX.	66' - 0"	EGRESS TRAVEL DISTANCE (H-4 OCCUPANCY)	IBC TABLE 1017.2
EGRESS FROM CONTROL ROOM 102	ONE EGRESS FROM CONTROL ROOM 102 PERMITTED DUE TO ROOM BEING AT GRADE LEVEL AND DISCHARGING DIRECTLY TO EXTERIOR OF BUILDING. CONTROL ROOM CANNOT EGRESS THROUGH WATER TREATMENT FACILITY DUE TO BEING A HIGHER HAZARD SPACE.				IBC 1006.3.4 SINGLE EXITS

MINIMUM CLEAR WIDTH OF MEANS OF EGRESS COMPONENTS

EGRESS COMPONENT	REQUIRED	PROVIDED	NOTES	CODE SECTION
DOOR	32"	36" / 36" / 36" / 36"	SWINGING DOORS CLEAR OPENINGS SHALL BE MEASURED FROM THE DOOR FACE TO THE STOP, WHEN DOOR OPEN 90 DEGREES	IBC 1010.1.1

OPAQUE THERMAL ENVELOPE INSULATION COMPONENTS INSULATION MIN. REQS. (R-VALUE METHOD)

CLIMATE ZONE	5A	PROJECT SHALL COMPLY WITH 9TH EDITION OF THE MASSACHUSETTS STATE BUILDING CODE 780 AND THE 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC) AS AMENDED			
BUILDING ELEMENT		TYPE OF CONSTRUCTION	REQUIRED R-VALUE	NOTES	CODE SECTION
ROOF		METAL BUILDINGS	R-30		IECC TABLE C402.1.3
WALLS ABOVE GRADE		METAL BUILDINGS	R-27 CI	CI = CONTINUOUS INSULATION / WALLS TO BE R-30	IECC TABLE C402.1.3
WALLS BELOW GRADE			R-7.5		IECC TABLE C402.1.3
SLAB ON GRADE		UNHEATED SLAB	R-15		IECC TABLE C402.1.3

BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS (C402.4)

CLIMATE ZONE	5A	PROJECT SHALL COMPLY WITH 9TH EDITION OF THE MASSACHUSETTS STATE BUILDING CODE 780 AND THE 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC) AS AMENDED			
FENESTRATION VALUE		TYPE OF CONSTRUCTION	REQUIRED VALUE	NOTES	CODE SECTION
U VALUE FIXED FENESTRATION		VERTICAL FENESTRATION	U=0.36		IECC TABLE C402.4
SHGC FIXED FENESTRATION		FIXED PF<0.2	SHGC=0.38		IECC TABLE C402.4

CHEMICAL STORAGE

THE FOLLOWING CHEMICALS WILL BE STORED IN THE FACILITY. THESE CHEMICALS, IN EXCESS OF THE QUANTITY DEFINED IN TABLE 307.1(2), TRIGGERS THE REQUIREMENT OF H-4 OCCUPANCY, HIGH HAZARD GROUP FOR HEALTH HAZARDS:

- POTASSIUM HYDROXIDE (KOH) 45% - BULK STORAGE - 4,000 GALLONS, DAY TANK - 200 GALLONS CORROSIVE, NFPA RATINGS (HEALTH 3, FIRE 0, REACTIVITY 1)
- SODIUM HYPOCHLORITE (NaOCl) 12.5% - BULK STORAGE - 800 GALLONS, DAY TANK - 50 GALLONS NFPA RATINGS (HEALTH 2, FIRE 0, REACTIVITY 1)

FIRE PROTECTION REQUIREMENTS

BUILDING ELEMENT	REQUIRED	PROVIDED	NOTES	CODE SECTION
SPRINKLER SYSTEM	YES	YES	FULLY SPRINKLERED, SEE MEP DRAWINGS	
PORTABLE FIRE EXTINGUISHERS	YES	YES	PROVIDED 1 PORTABLE FIRE EXTINGUISHER WITHIN EACH KITCHEN.	IBC 906
FIRE ALARM & DETECTION	YES	YES	PROVIDED, SEE MEP DRAWINGS	IBC 907

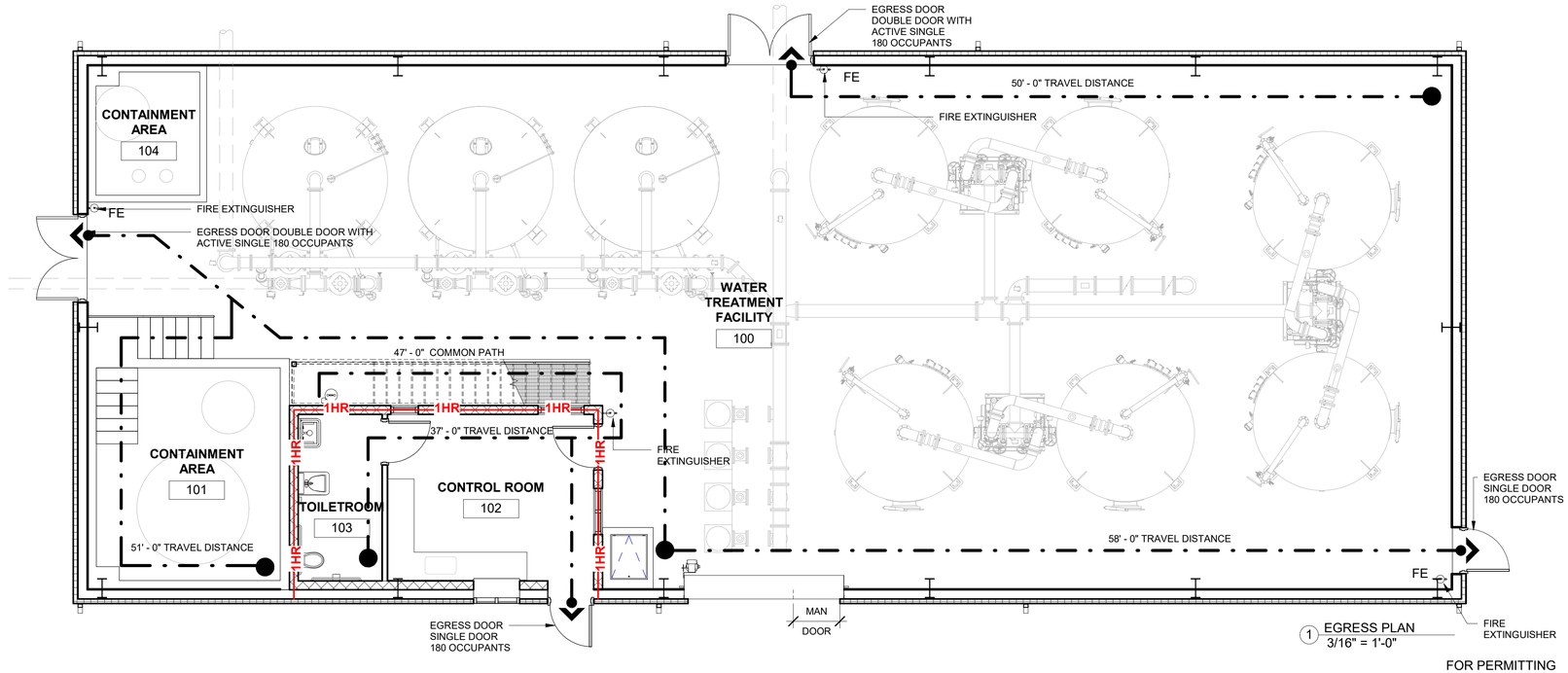
GENERAL NOTES

1. ALL MATERIALS AND WORK FOR THIS PROJECT SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE CONTRACT DOCUMENTS.
2. ALL MATERIALS AND WORK IN THIS PROJECT SHALL BE IN STRICT ACCORDANCE WITH MASSACHUSETTS BUILDING CODE AND MASSACHUSETTS ARCHITECTURAL ACCESS BOARD.
3. CONTRACTOR AND SUBCONTRACTORS SHALL INSPECT PROJECT'S SITE AND BUILDING'S PREMISES TO BE AWARE OF ALL EXISTING CONDITIONS BEFORE SUBMITTING THE BID PROPOSAL FOR THIS PROJECT. REFER TO CODE REVIEW MEMORANDUM.
4. CONTRACTOR COORDINATION OF ALL TRADES SHALL BE DONE IN A WAY TO AVOID CONFLICTS BETWEEN EACH OTHER AND TO A SMOOTH AND CONTINUOUS DELIVERY.
5. CONTRACTOR IS RESPONSIBLE FOR QUALITY CONTROL ASSURANCE.
6. THE WORK SHALL BE DONE IN SUCH A MANNER AS TO MAINTAIN AREAS CLEAN AND REDUCE FIRE HAZARDS, POLLUTION, ACCIDENTS AND STRUCTURAL LOAD INCREASE TO A MINIMUM. CONTRACTOR SHALL REMOVE ANY CONSTRUCTION DEBRIS, DUST AND ANY OTHER GARBAGE FROM THE PROJECT SITE AND DISPOSE IT PROPERLY, IN A LEGAL WAY. NO ACCUMULATION OF DEBRIS OR GARBAGE WILL BE ALLOWED AT THE PROJECT PREMISES AT ANY TIME.
7. ALL DIMENSIONS SHOWN IN CONTRACT DRAWINGS ARE TO BE FIELD VERIFIED, DO NOT SCALE DIMENSIONS FROM DRAWINGS. IF ANY REQUIRED DIMENSIONS ARE MISSING, GC SHALL ASK ARCHITECT FOR CLARIFICATION.
8. NOTIFY IMMEDIATELY TO THE CONSTRUCTION MANAGER / RESIDENT INSPECTOR AND THE ARCHITECT IF ANY DISCREPANCY WITH THE CONSTRUCTION DOCUMENTS IS ENCOUNTERED.
9. SHOWN ELEVATIONS ARE GIVEN IN LOCAL SYSTEM, FROM GROUND FLOOR LEVEL. REFER TO CIVIL DRAWINGS FOR FINISH FLOOR ELEVATIONS.
10. GENERAL CONTRACTOR IS RESPONSIBLE TO DELIVER THE PROJECT IN A OPERATIONAL STATE. WORKS SPECIFIED UNDER ANY OF THE TRADES, INCLUDED IN CONTRACT DOCUMENTS, IS THE RESPONSIBILITY OF THE CONTRACTOR IN THE SAME WAY AS IT'S OWN TRADE.
11. ALL ITEMS, MATERIALS, BUILDING COMPONENTS AND SYSTEMS SHOWN IN THE CONTRACT DOCUMENTS ARE NEW, UNLESS OTHERWISE NOTED AS EXISTING.
12. IN THE EVENT OF ANY DISCREPANCY BETWEEN THE CONSTRUCTION DOCUMENTS, THE PROJECT SPECIFICATIONS WILL TAKE PRECEDENT.
13. PRE ENGINEERED METAL BUILDING (PEMB) SHOWN FOR GENERAL REQUIREMENTS ONLY. PEMB MANUFACTURER TO DESIGN ALL FINAL CONNECTIONS, STRUCTURE, AND ELEMENTS TO GUARANTEE ALL APPLICABLE CODES ARE MET. SEE STRUCTURAL DRAWINGS FOR STRUCTURAL REQUIREMENTS OF THE PEMB.
14. ALL ENVELOPE METAL FABRICATIONS OF THE PEMB TO BE BY PEMB MANUFACTURER, AND PAINTED TO MATCH.

SCOPE OF WORK

WELL 3 & 4 WATER TREATMENT FACILITY IS A 4,026 S.F. STRUCTURE SUPPORTING THE BARNSTABLE FIRE DISTRICT WATER DEPARTMENT, LOCATED IN BARNSTABLE, MASSACHUSETTS.

THE BUILDING WILL BE BUILT ON A CONCRETE SLAB WITH CONCRETE FOOTINGS WITH EXTERIOR WALLS CONSISTING OF A STEEL FRAMED INSULATED METAL PANEL PRE ENGINEERED METAL BUILDING. THE ROOF CONSISTS OF INSULATED METAL PANELS WITH STANDING SEAM JOINTS OVER STEEL FRAMING. THE BUILDING INCLUDES INSULATED HOLLOW METAL DOORS, AND REMOVABLE WALL PANELS INSULATED TRANSLUCENT PANEL TO BRING NATURAL LIGHT INTO THE SPACE, FOR ANY REQUIRED EQUIPMENT MAINTENANCE OR REMOVAL.



1 EGRESS PLAN
3/16" = 1'-0"

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

studio umbra architecture

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS

NO.	DATE	DESCRIPTION

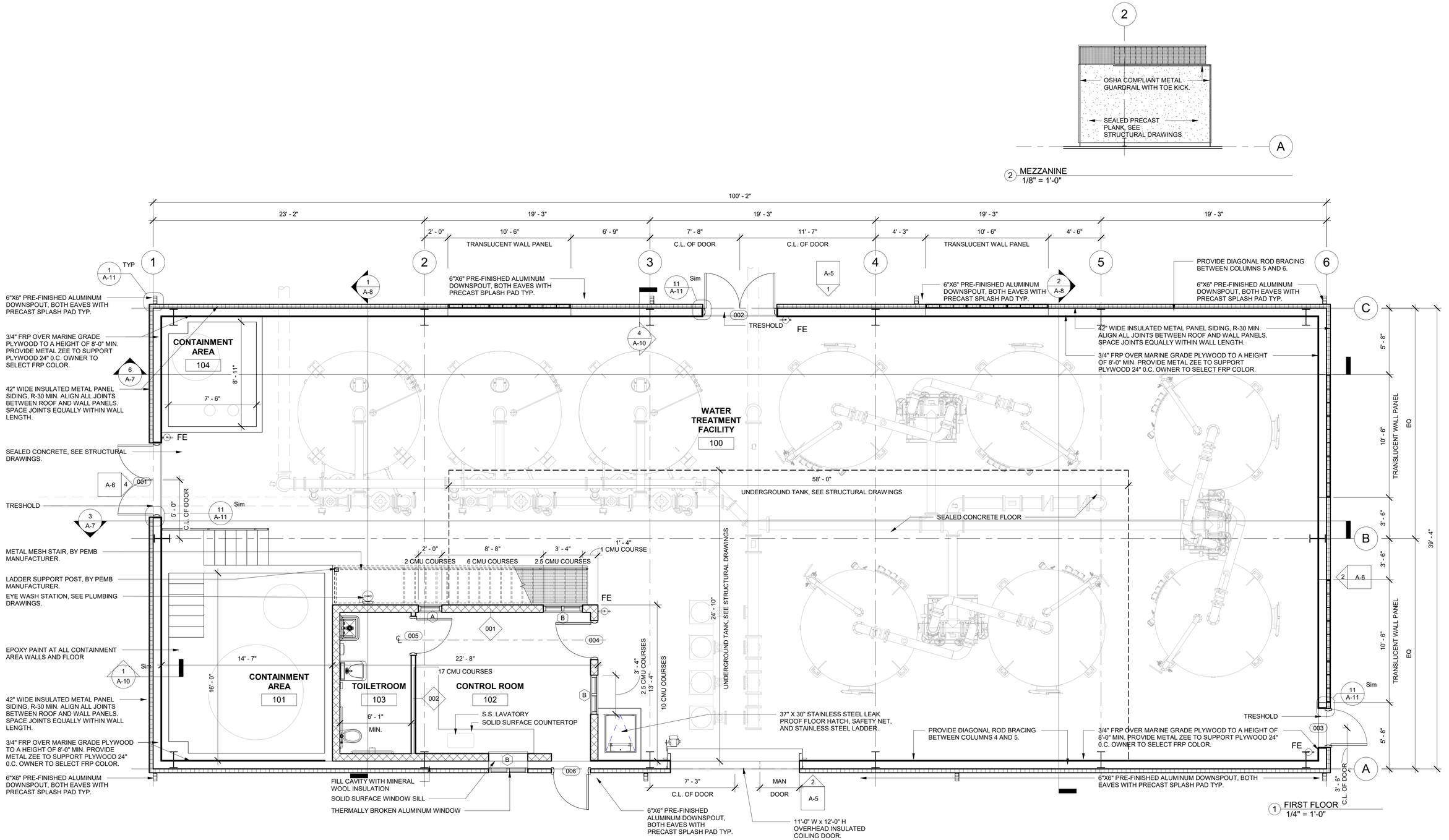
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	As indicated
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
CODE REVIEW

DRAWING NO.:
A-1

SHEET NO. 22 OF 57



FOR PERMITTING

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DRINKING WATER PROFESSIONALS

studio umbra architecture

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

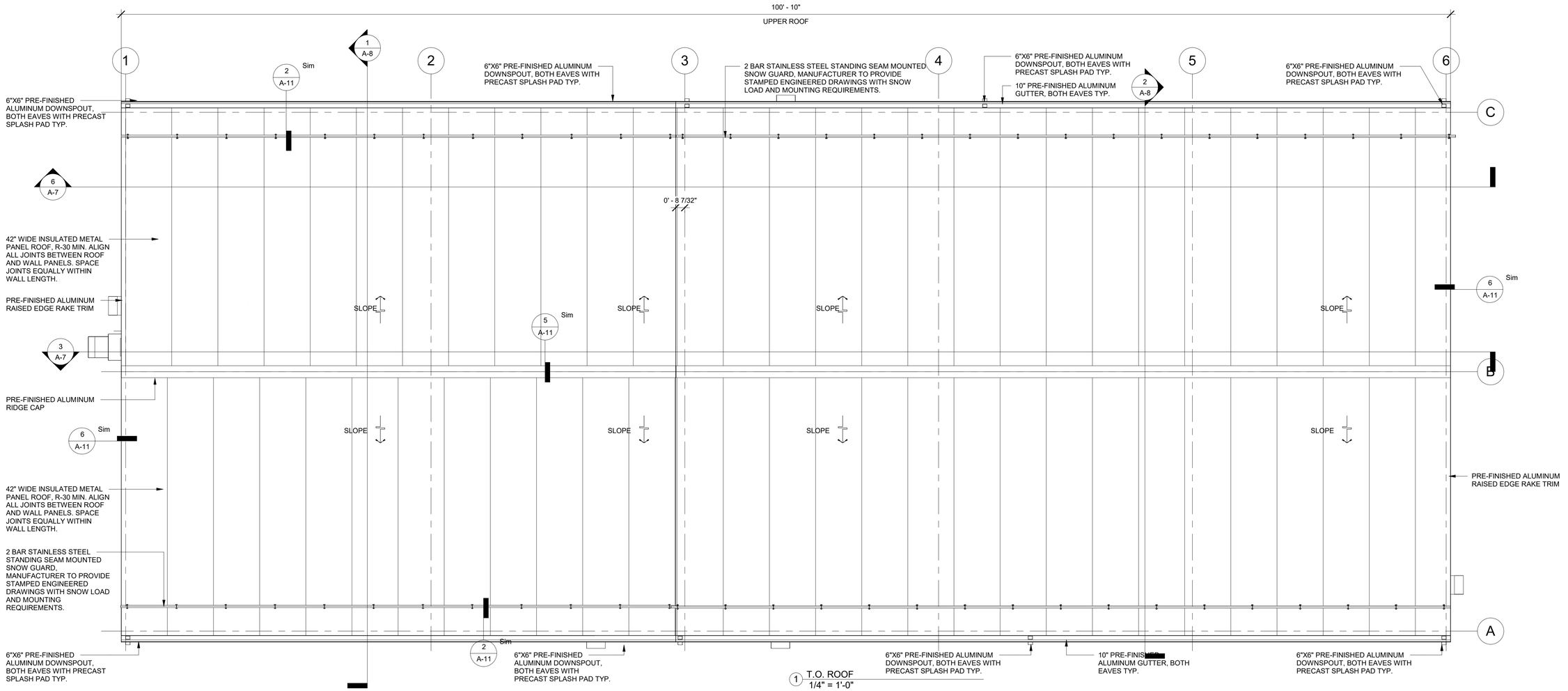
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	As indicated
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
FLOOR PLAN

DRAWING NO.:
A-2

SHEET NO. 23 OF 57



FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

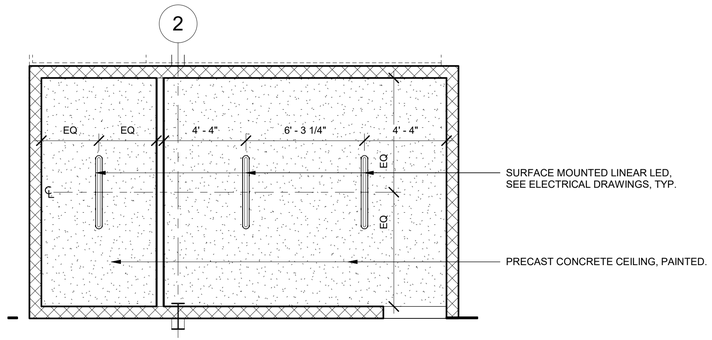
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

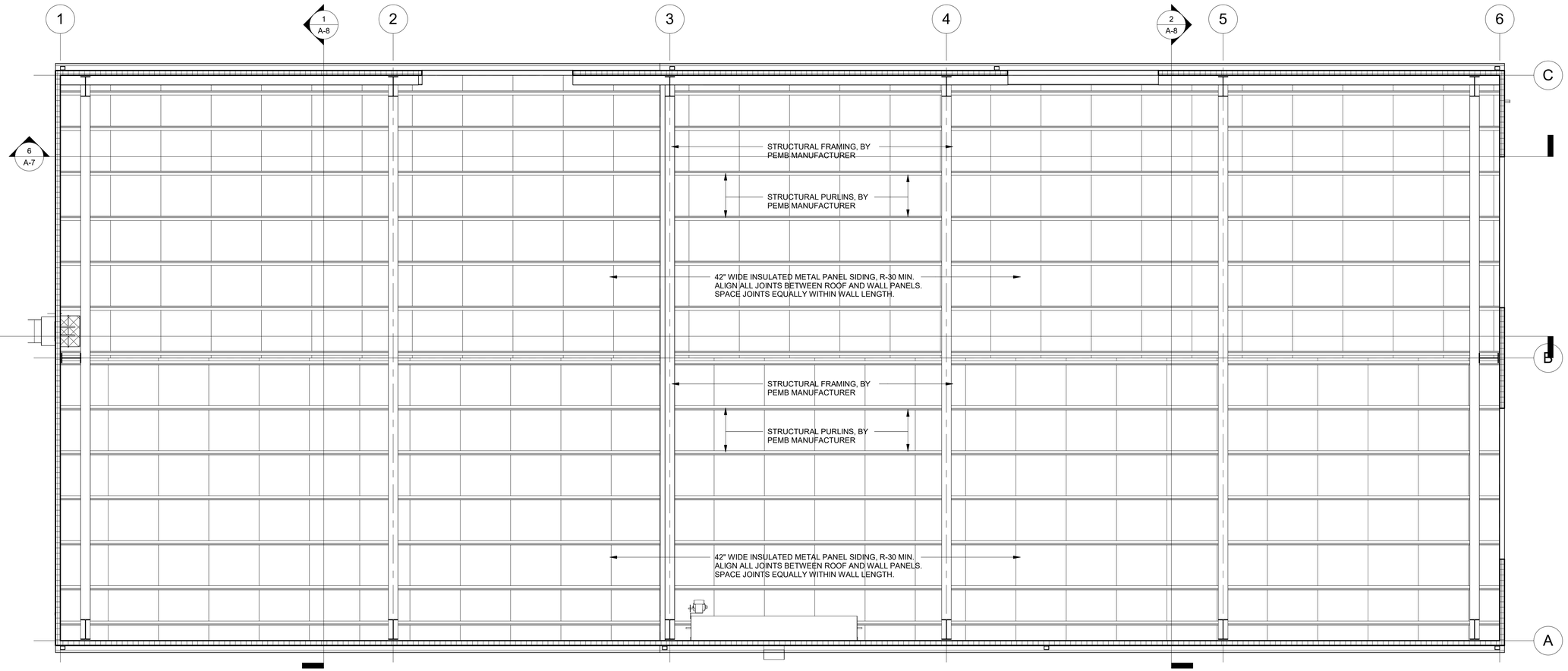
DRAWING TITLE:
ROOF PLAN

DRAWING NO.:
A-3

SHEET NO. 24 OF 57



2 CONTROL / TOILETROOM REFLECTED CEILING PLAN
1/4" = 1'-0"



1 FIRST FLOOR REFLECTED CEILING PLAN
1/4" = 1'-0"

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SCALE ADJUSTMENT GUIDE
0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. ALLEN
REGISTERED PROFESSIONAL ENGINEER
6/19/26

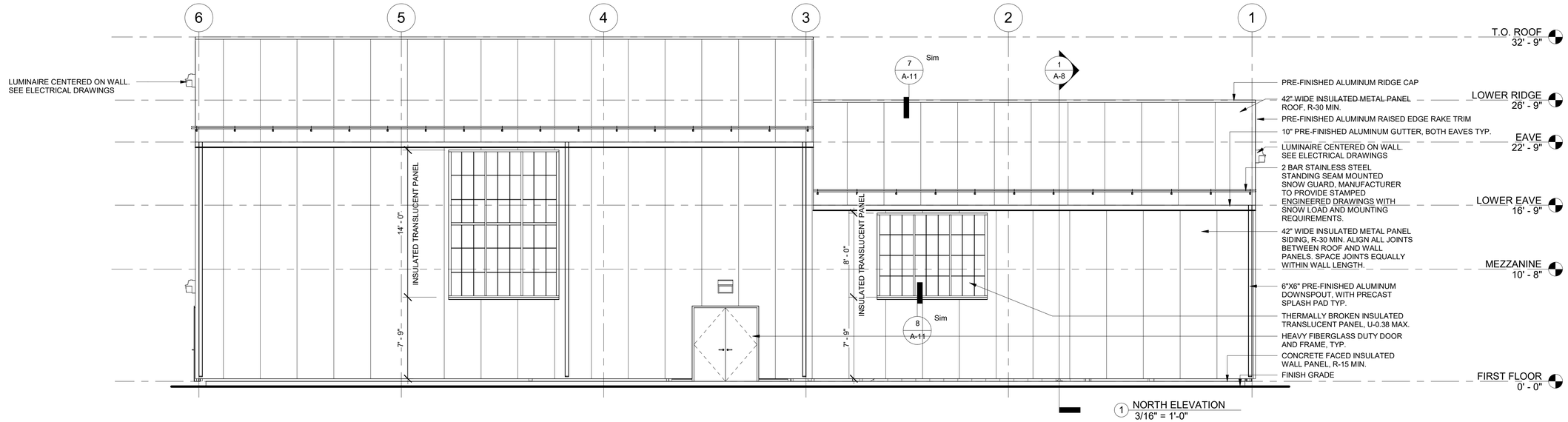
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

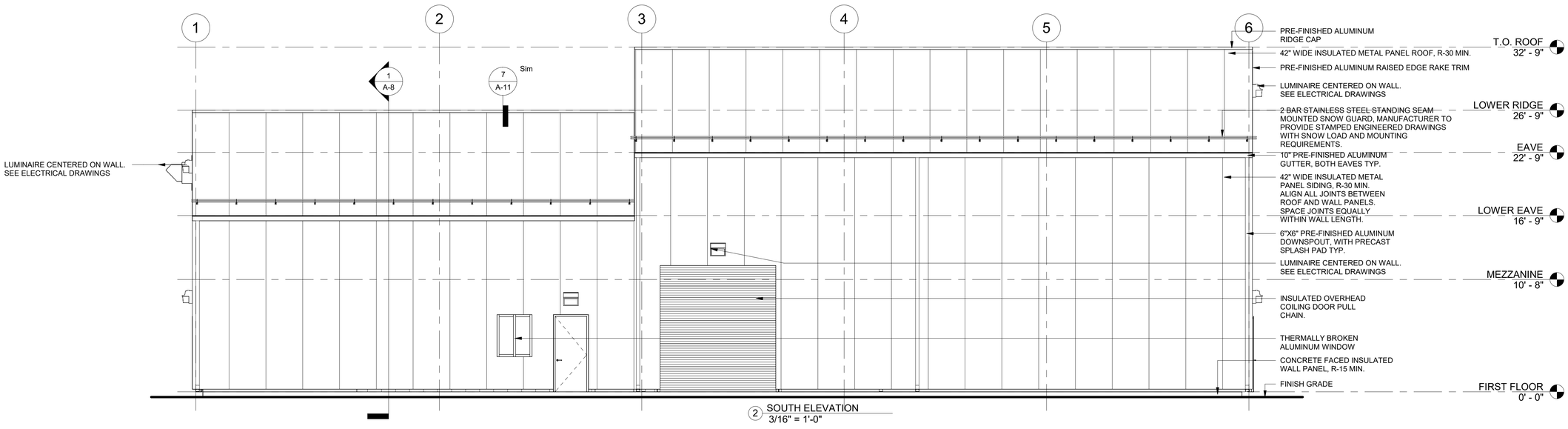
DRAWING TITLE:
REFLECTED CEILING PLANS

DRAWING NO.:
A-4

SHEET NO. 25 OF 57



1 NORTH ELEVATION
3/16" = 1'-0"



2 SOUTH ELEVATION
3/16" = 1'-0"

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DRINKING WATER PROFESSIONALS

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SCALE ADJUSTMENT GUIDE
0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

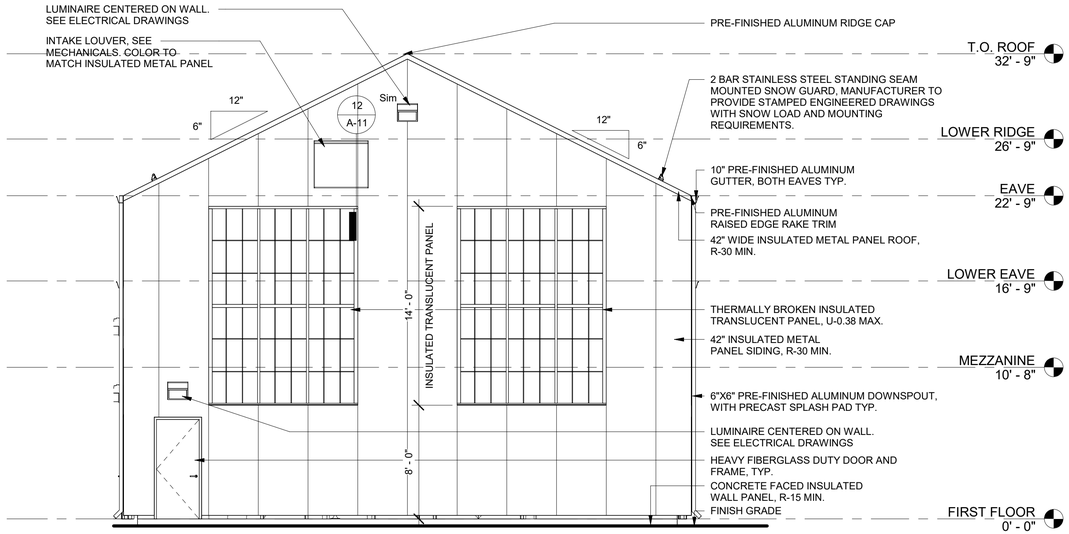
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

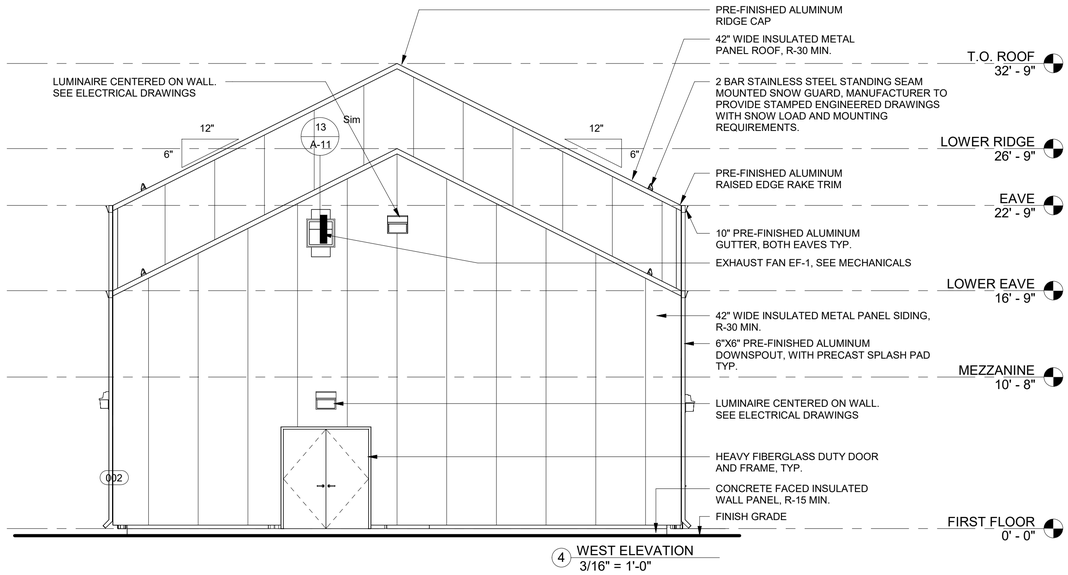
DRAWING TITLE:
EXTERIOR ELEVATIONS

DRAWING NO.:
A-5

SHEET NO. 26 OF 57



2 EAST ELEVATION
3/16" = 1'-0"



4 WEST ELEVATION
3/16" = 1'-0"

FOR PERMITTING

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DRINKING WATER PROFESSIONALS

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEVEN F. C.
REGISTERED PROFESSIONAL ENGINEER
6/19/26

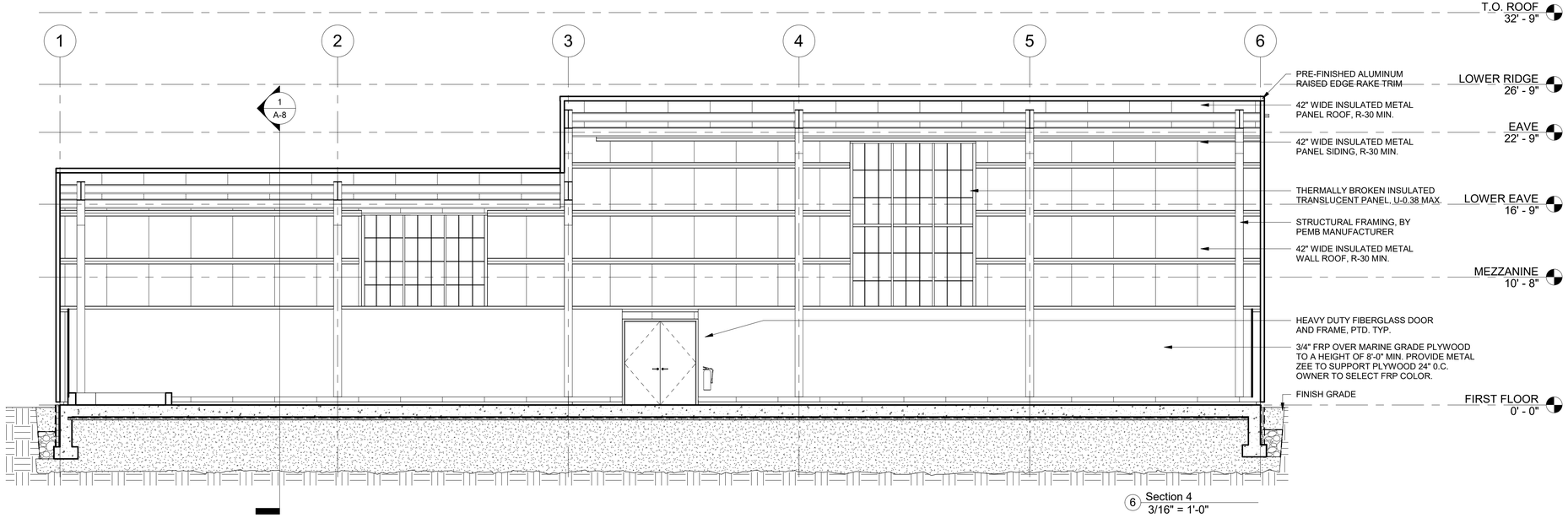
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

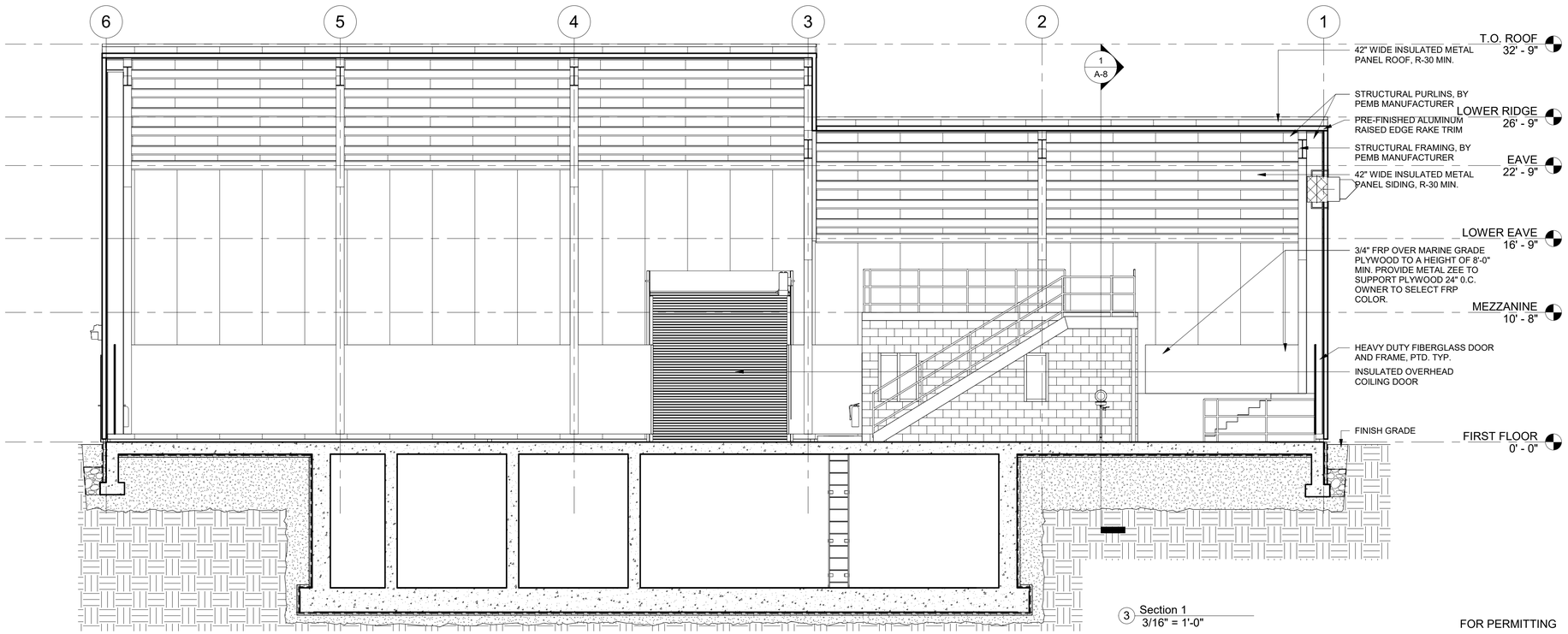
DRAWING TITLE:
EXTERIOR ELEVATIONS

DRAWING NO.:
A-6

SHEET NO. 27 OF 57



6 Section 4
3/16" = 1'-0"



3 Section 1
3/16" = 1'-0"

FOR PERMITTING

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DRINKING WATER PROFESSIONALS

studio umbra
architecture

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

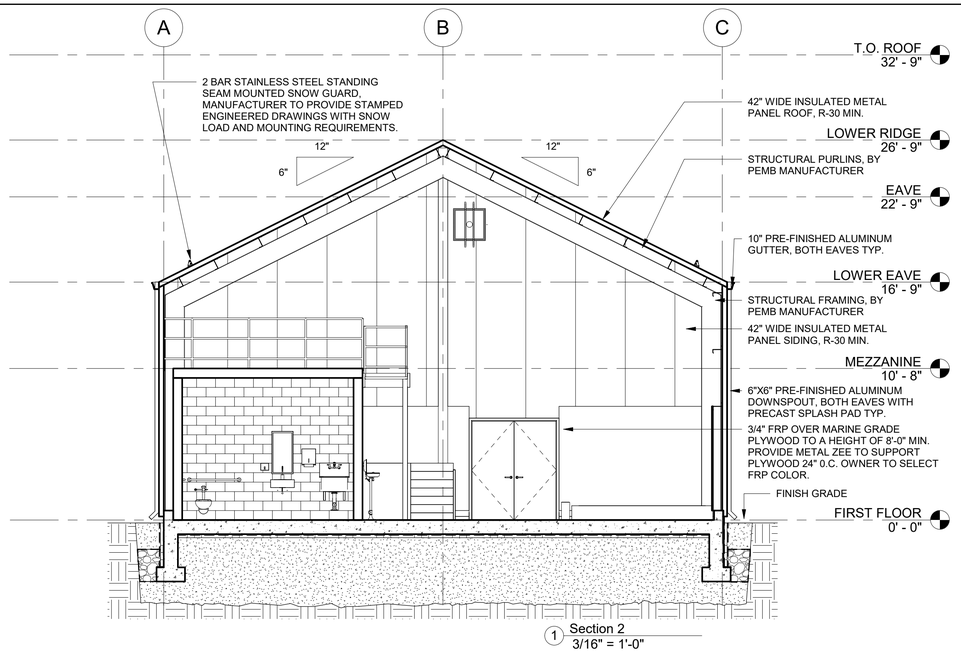
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

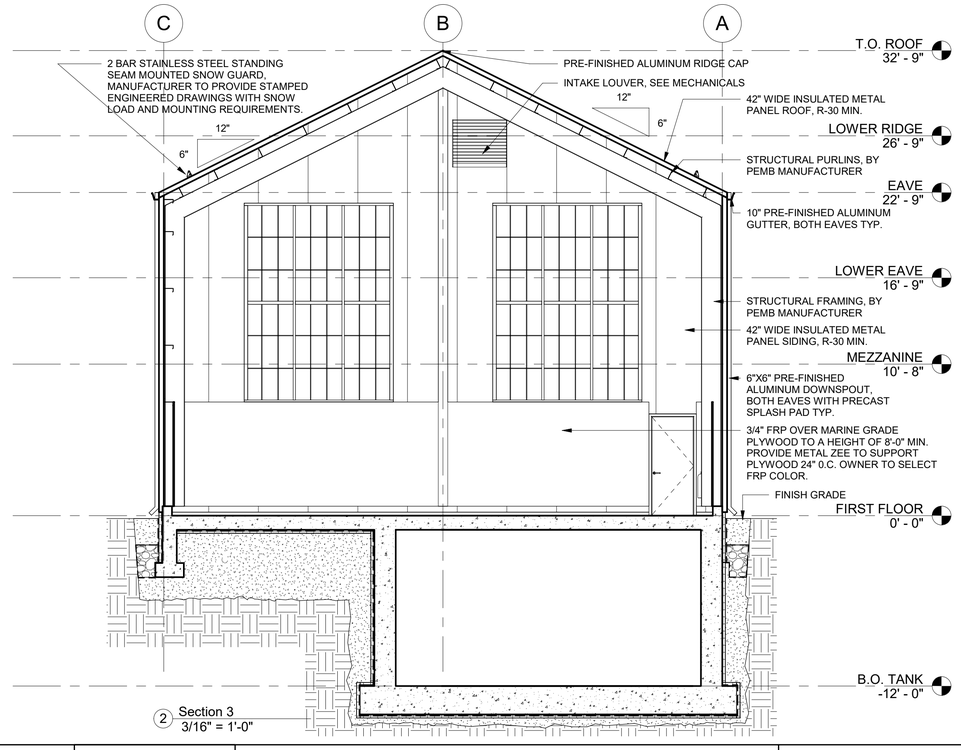
DRAWING TITLE:
BUILDING SECTIONS

DRAWING NO.:
A-7

SHEET NO. 28 OF 57



1 Section 2
3/16" = 1'-0"



2 Section 3
3/16" = 1'-0"

FOR PERMITTING

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studio umbra architecture

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

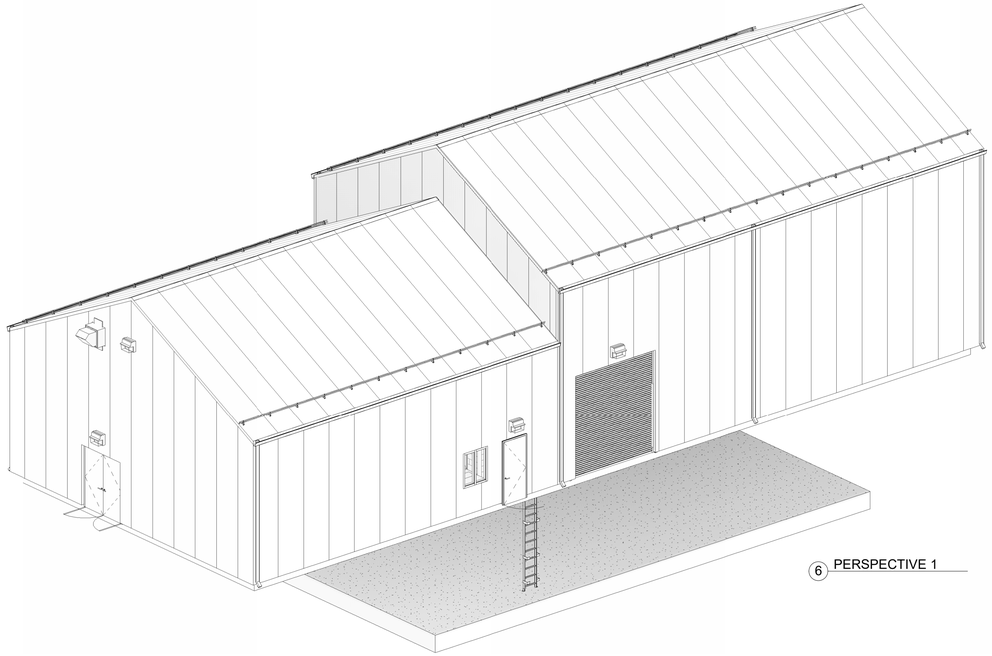
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

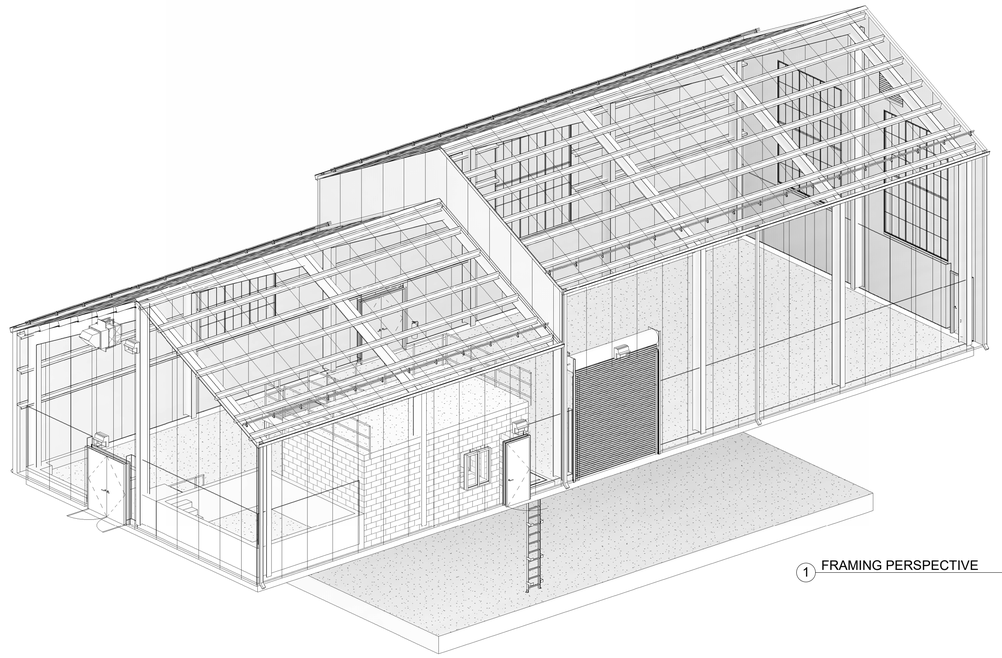
DRAWING TITLE:
BUILDING SECTIONS

DRAWING NO.:
A-8

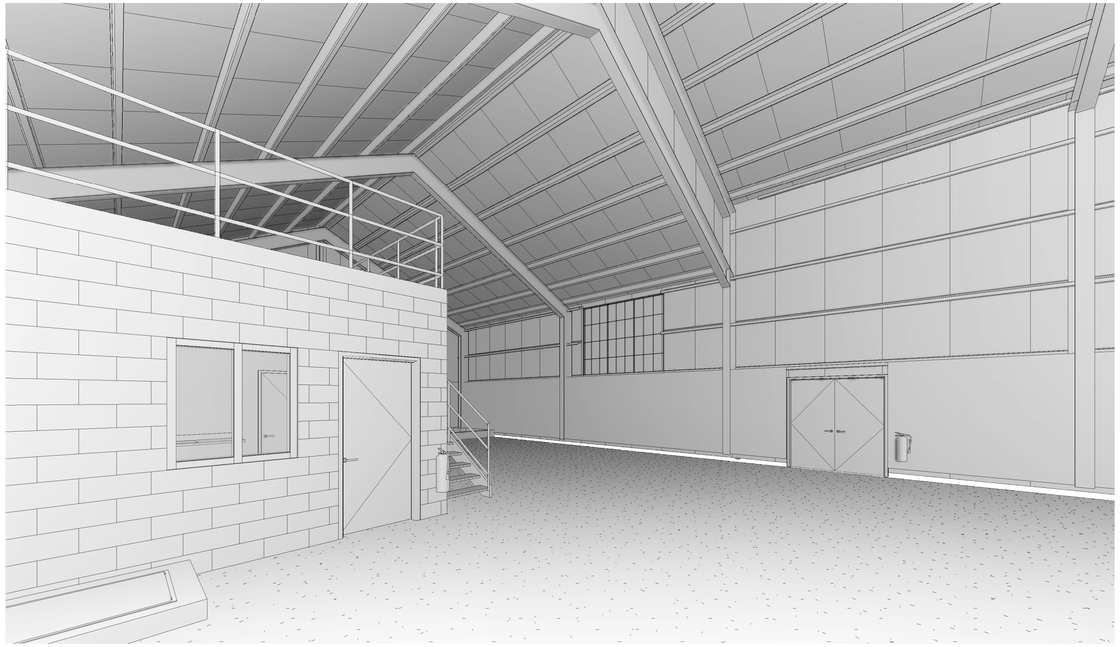
SHEET NO. 29 OF 57



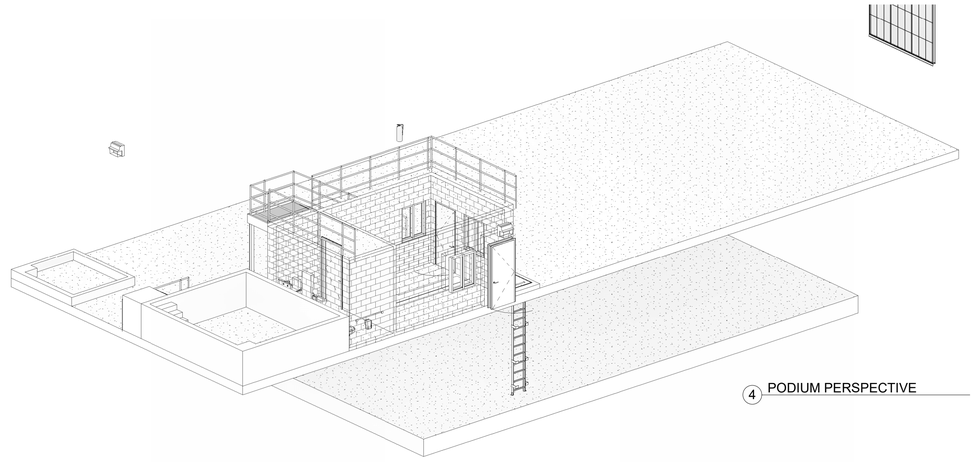
6 PERSPECTIVE 1



1 FRAMING PERSPECTIVE



2 3D View 2



4 PODIUM PERSPECTIVE

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN E. OLSON
No. 49,363
REGISTERED PROFESSIONAL ENGINEER
6/4/26

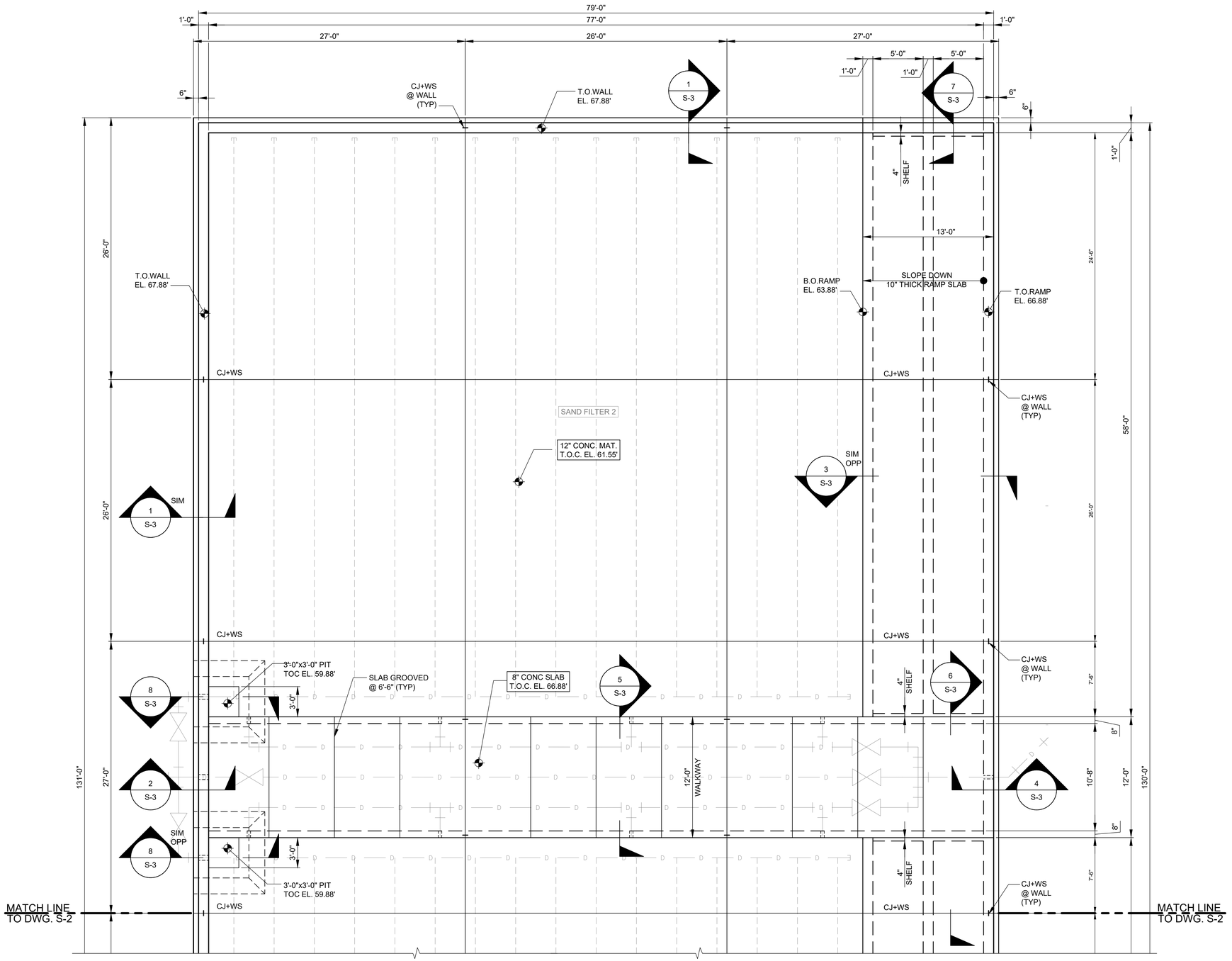
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
PERSPECTIVES

DRAWING NO.:
A-9

SHEET NO. 30 OF 57



FOR PERMITTING

H2Olson Engineering, Inc.
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www.h2olsonengineering.com
(508) 375-7007

LIN ASSOCIATES, INC.
CONSULTING ENGINEERS
(617)566-4216 FAX: (617)566-6038
BROCKTON MASSACHUSETTS

SCALE ADJUSTMENT GUIDE
0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
GREGORY KOLOJESKI
No. 52135
REGISTERED PROFESSIONAL ENGINEER
6/19/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

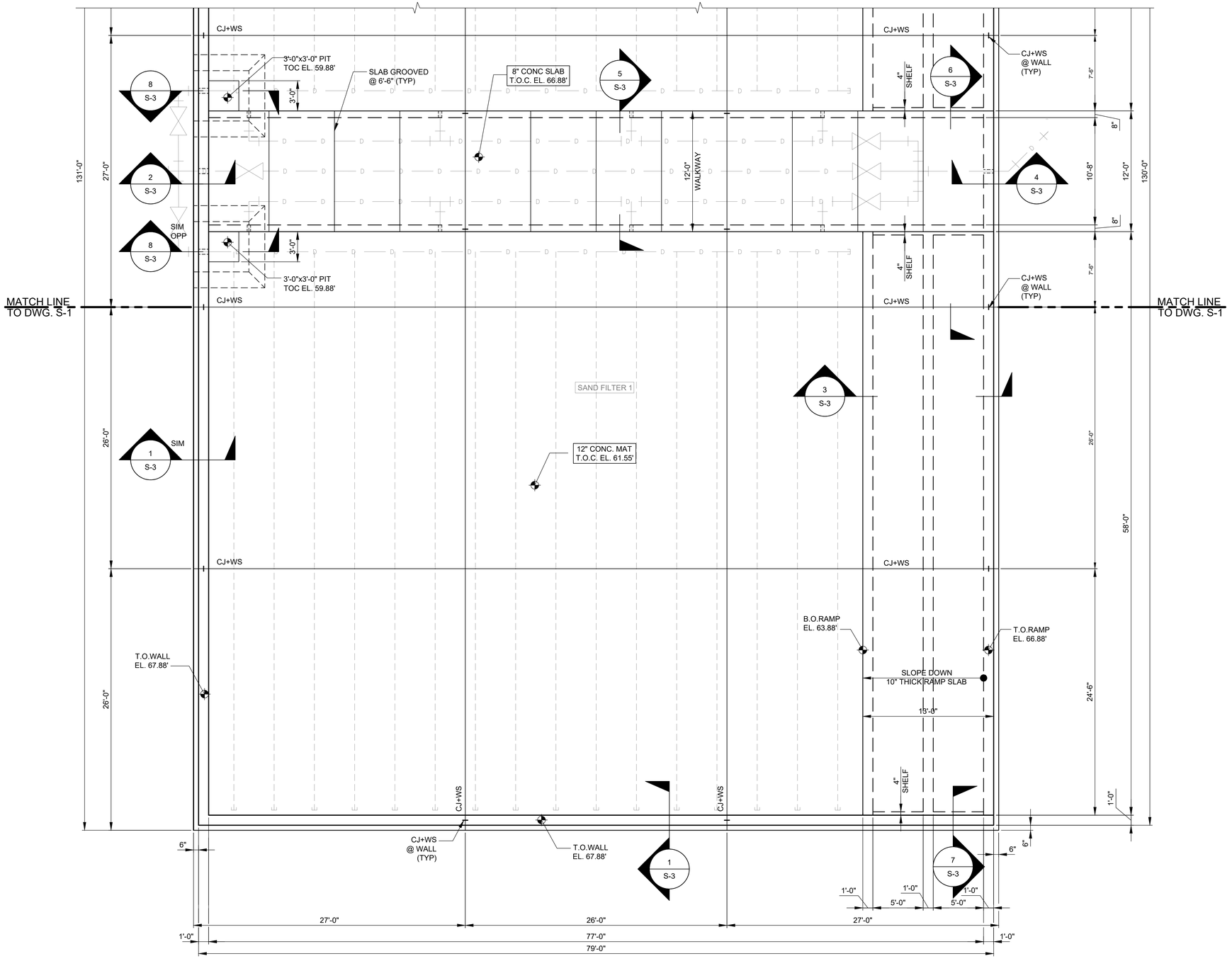
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SAND FILTERS
FOUNDATION PLAN (1)

DRAWING NO.:
S-1

SHEET NO. 31 OF 57

E:\2025.030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUB\FD WTP_S-1 and S-2 Sand Filters Foundation Plan.dwg



E:\2025.030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUB\FD WTP_S-1 and S-2 Sand Filters Foundation Plan.dwg

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BRIGHTON MASSACHUSETTS

SCALE ADJUSTMENT GUIDE
0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

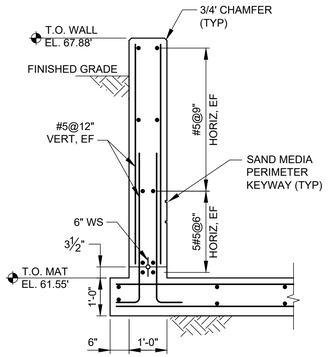
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

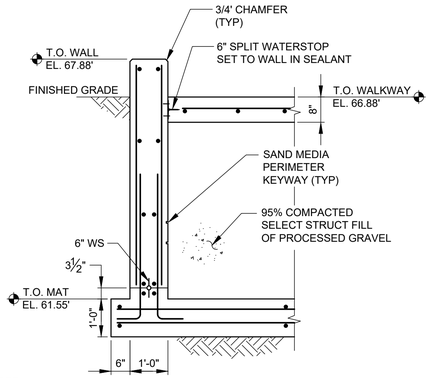
DRAWING TITLE:
SAND FILTERS
FOUNDATION PLAN (2)

DRAWING NO.:
S-2

SHEET NO. 32 OF 57

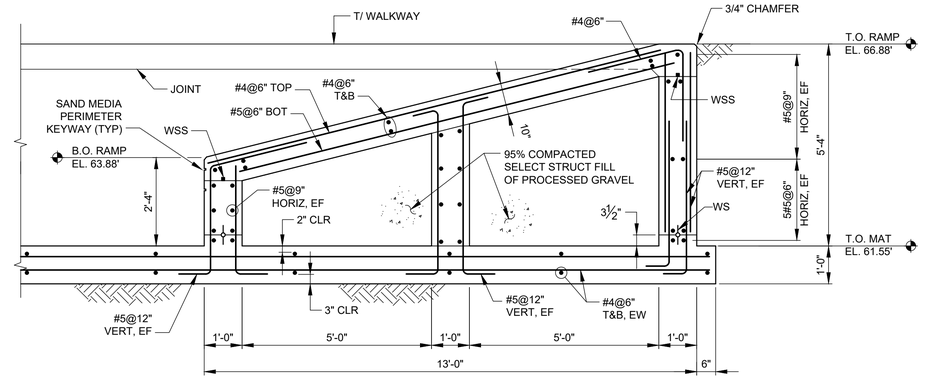


SECTION 1 / S-1
SCALE: 1/2"=1'-0"

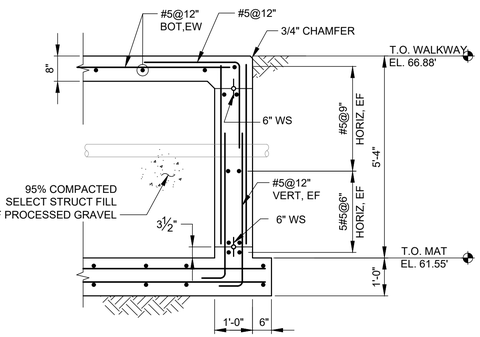


NOTE:
1. FOR WALL AND MAT REINF. SEE SECTION 1 ON THIS SHEET.

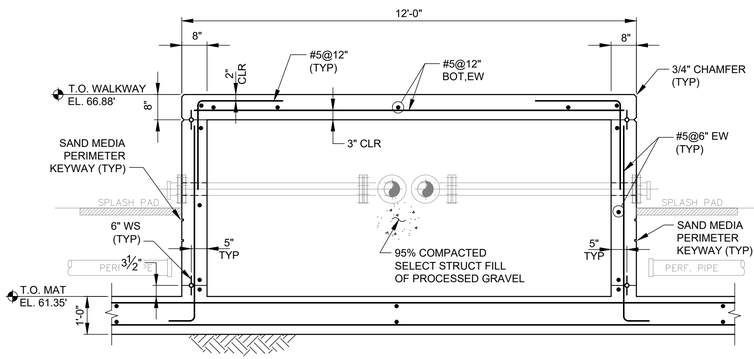
SECTION 2 / S-1
SCALE: 1/2"=1'-0"



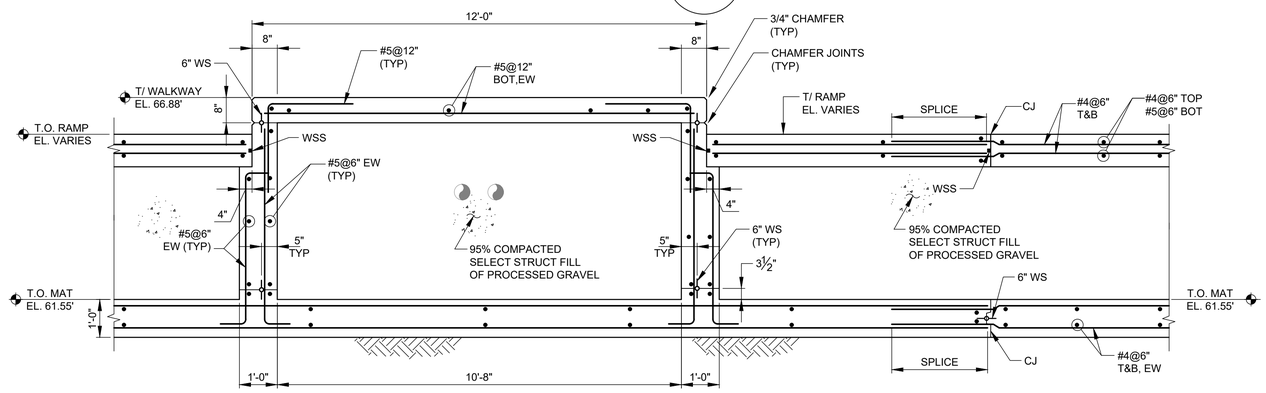
SECTION 3 / S-1
SCALE: 1/2"=1'-0"



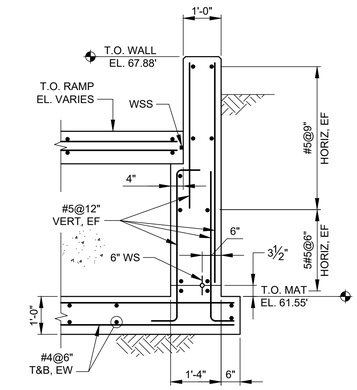
SECTION 4 / S-1
SCALE: 1/2"=1'-0"



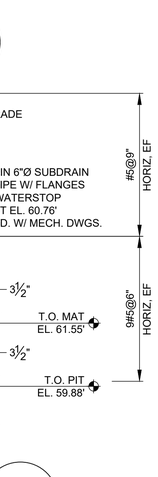
SECTION 5 / S-1
SCALE: 1/2"=1'-0"



SECTION 6 / S-1
SCALE: 1/2"=1'-0"



SECTION 7 / S-1
SCALE: 1/2"=1'-0"



SECTION 8 / S-1
SCALE: 1/2"=1'-0"

FOR PERMITTING

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LIN ASSOCIATES, INC.
CONSULTING ENGINEERS
(617)566-4216 FAX: (617)566-8038
BRIGHTON MASSACHUSETTS

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	AS SHOWN
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

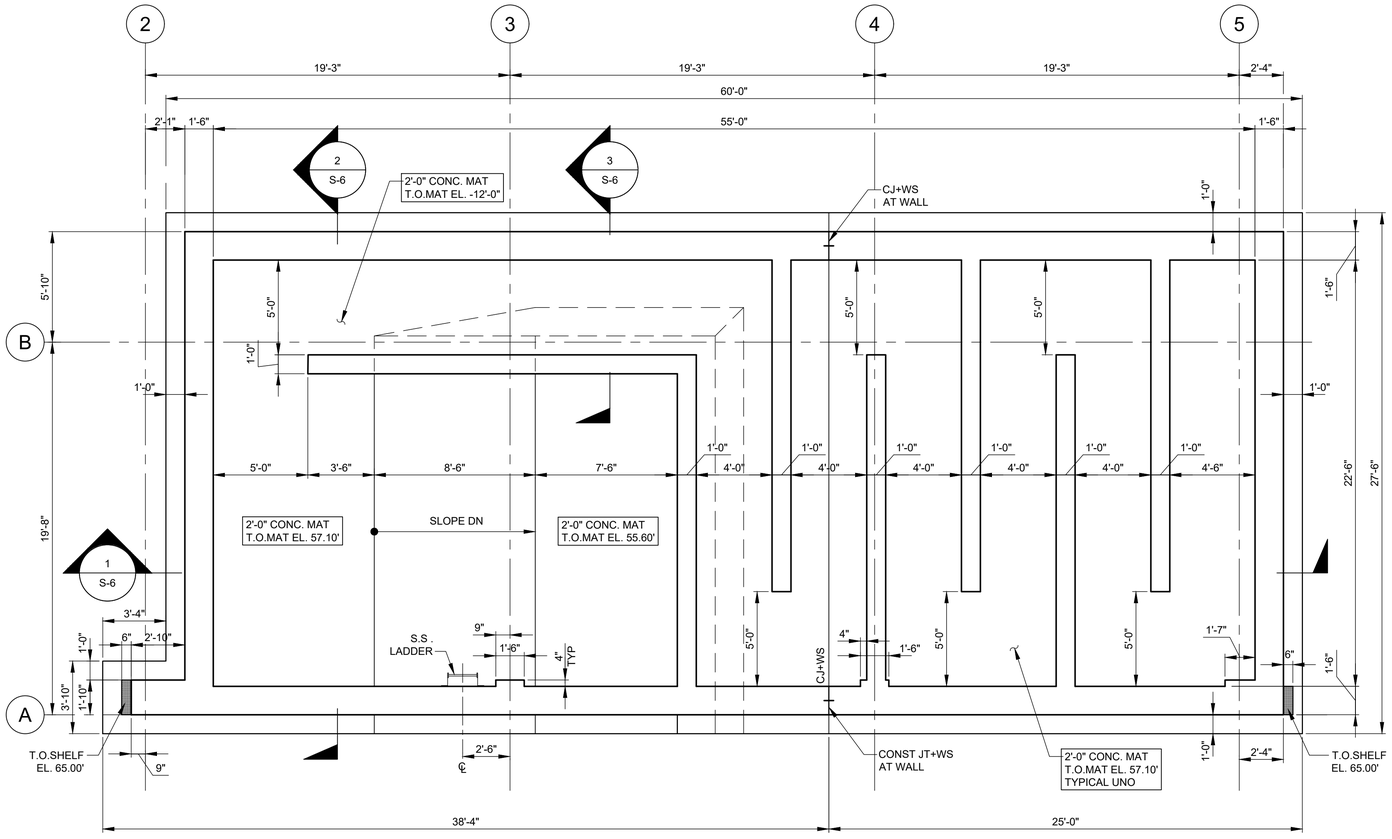
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SAND FILTERS
SECTIONS AND DETAILS

DRAWING NO.:
S-3

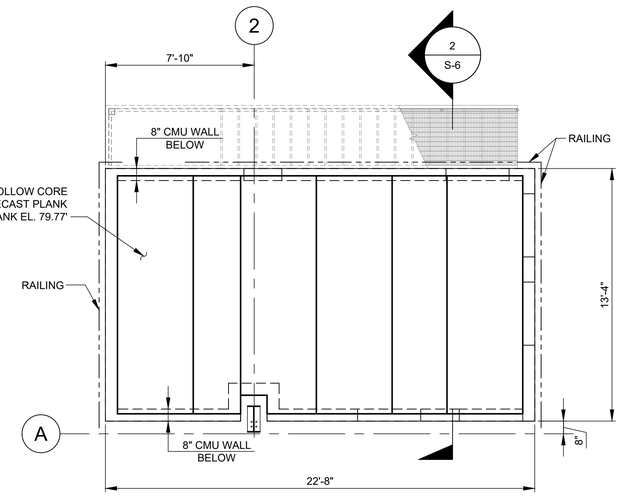
SHEET NO. 33 OF 57

E:\2025.030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUB\FD WTP_S-3 Sand Filters Sections and Details.dwg



LOWER LEVEL PLAN

SCALE: 1/4" = 1'-0"



NOTES:
1. FOR PRECAST PLANK SUPPORT DETAILS SEE TYPICAL DETAIL ON DRAWING S-12.

UPPER LEVEL PLAN

SCALE: 1/4" = 1'-0"

E:\2025\030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUBFD WTP_S-4 Building Lower Level and Upper Level Plans.dwg

FOR PERMITTING

H2Olson Engineering, Inc.
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(617)566-4216 FAX: (617)566-8038
BRIGHTON MASSACHUSETTS

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
GREGORY KLIMA
No. 49033
REGISTERED PROFESSIONAL ENGINEER
6/19/26

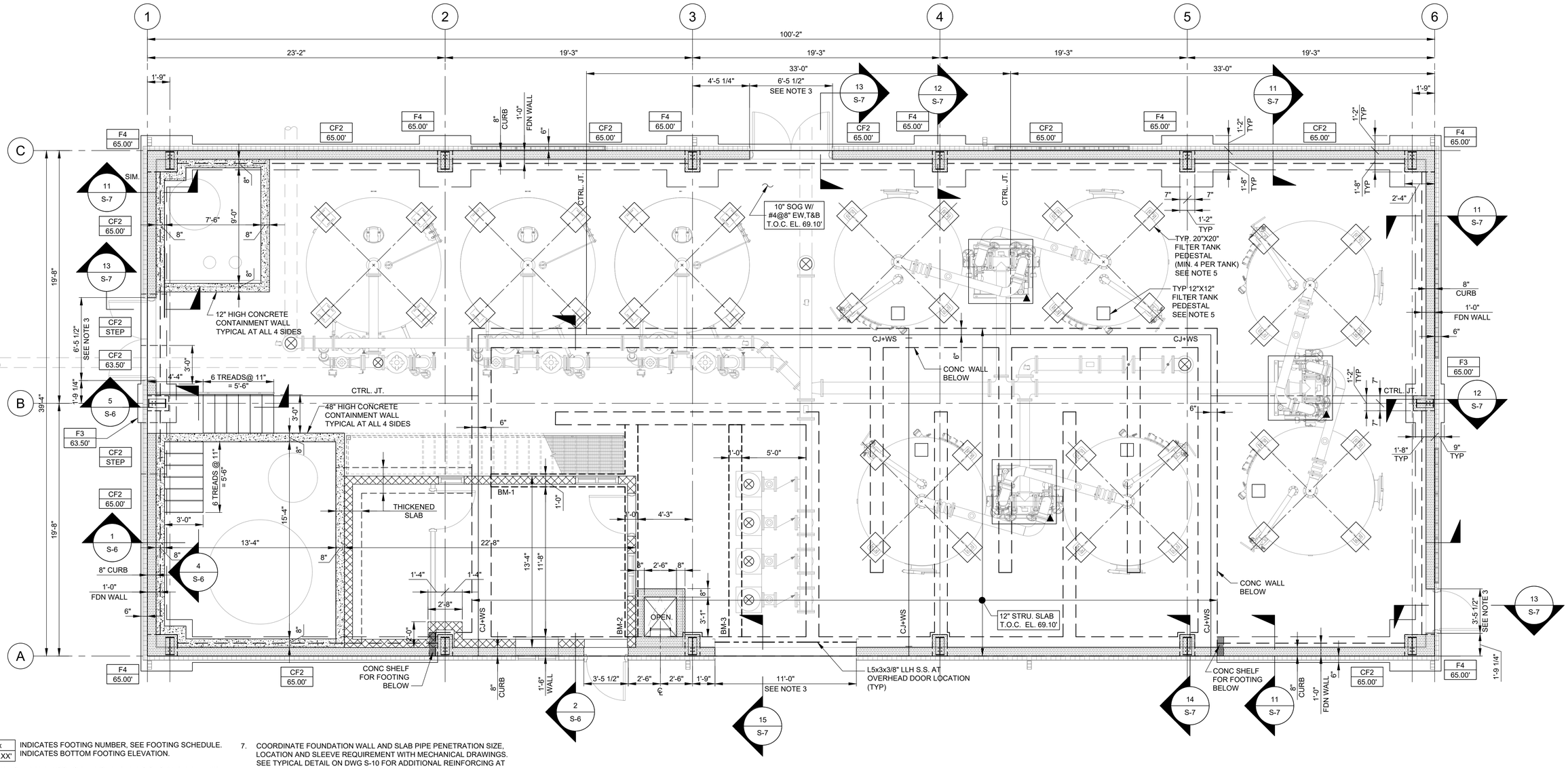
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
BUILDING LOWER LEVEL AND UPPER LEVEL PLANS

DRAWING NO.:
S-4

SHEET NO. 34 OF 57



NOTES:

1. Fx / XXX.XX' INDICATES FOOTING NUMBER, SEE FOOTING SCHEDULE. INDICATES BOTTOM FOOTING ELEVATION.
2. REFER TO A-DRAWINGS FOR LAYOUT, DIMENSIONS AND WALL TYPE. ARCHITECTURAL AND MECHANICAL LAYOUT SHOWN SCREENED IN BACKGROUND FOR REFERENCE ONLY.
3. INDICATES 8" HIGH CONCRETE CURB. COORDINATE WITH A-DRAWINGS FOR CURB LAYOUT AND DOOR OPENING WIDTH AND LOCATION. SEE CURB TYPICAL DETAILS ON DWG. S-10.
4. INDICATES CONCRETE PAD. SIZE AND LOCATION TO SUIT EQUIPMENT. SEE APPLICABLE CONC. EQUIPMENT PAD DETAILS ON DWG. S-10.
5. FOR FILTER TANK PEDESTAL SEE DETAIL ON DWG S-10, SIZE AND LOCATION TO SUIT MANUFACTURER REQUIREMENTS.
6. FOR CONCRETE PIER SIZES AND DETAILS SEE DWG. S-8.
7. COORDINATE FOUNDATION WALL AND SLAB PIPE PENETRATION SIZE, LOCATION AND SLEEVE REQUIREMENT WITH MECHANICAL DRAWINGS. SEE TYPICAL DETAIL ON DWG S-10 FOR ADDITIONAL REINFORCING AT OPENING.
8. Fx / STEP INDICATES FOOTING NUMBER, SEE FOOTING SCHEDULE. INDICATES STEPPED FOOTING ELEVATION. SEE TYP DET ON DWG. S-10.
9. FOR THE FINISH GRADE ELEVATION COORDINATE WITH CIVIL DRAWINGS.

FOOTING SCHEDULE		
TYPE	SIZE	REINFORCING
F3	3'-0" X 3'-0" X 1'-0" DEEP	#5 @ 6" E.W. BOTTOM
F4	4'-0" X 4'-0" X 1'-0" DEEP	#5 @ 6" E.W. BOTTOM
CF2	2'-0" X 1'-0" DEEP X CONT.	3-#5 LONG. & #5@12" TRANS. BOTT.

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BRIGHTON MASSACHUSETTS

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. GLEASON
No. 37,999
REGISTERED PROFESSIONAL ENGINEER
6/1/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

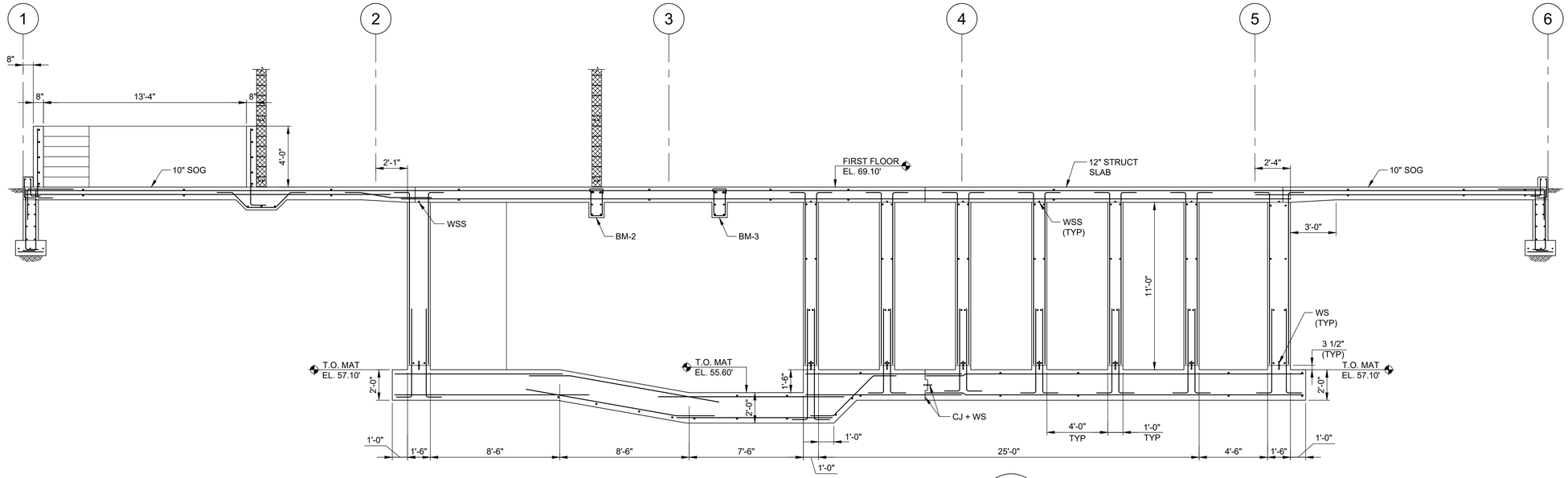
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
BUILDING FIRST FLOOR PLAN

DRAWING NO.:
S-5

SHEET NO. 35 OF 57

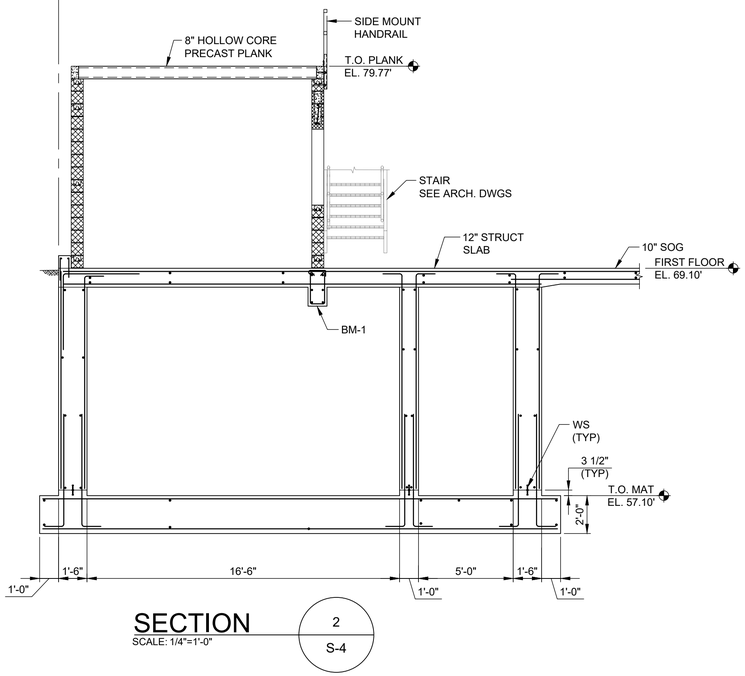
E:\2025.030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUBFD WTP_S-5 Building First Floor Plan.dwg



SECTION

SCALE: 1/4"=1'-0"

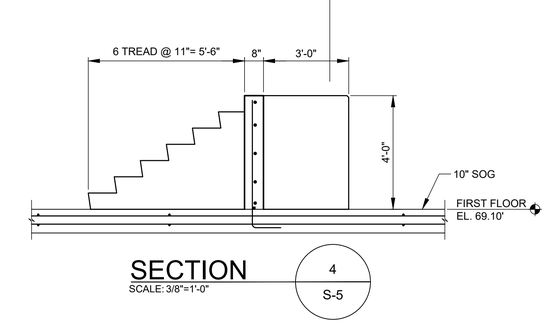
1
S-4



SECTION

SCALE: 1/4"=1'-0"

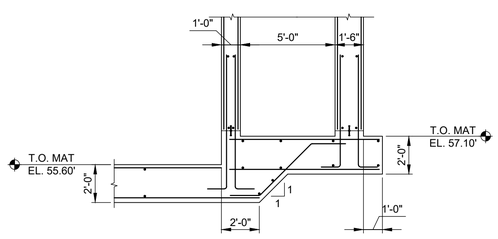
2
S-4



SECTION

SCALE: 3/8"=1'-0"

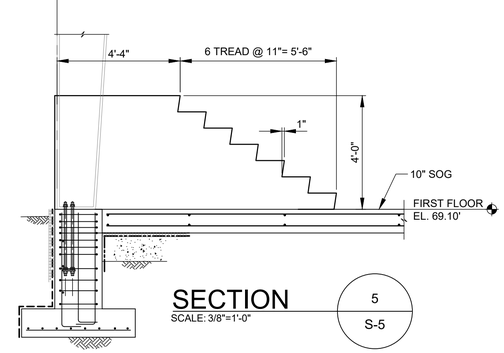
4
S-5



SECTION

SCALE: 1/4"=1'-0"

3
S-4



SECTION

SCALE: 3/8"=1'-0"

5
S-5

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REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	AS SHOWN
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

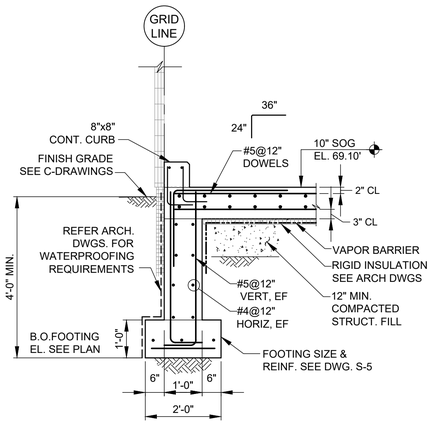
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
BUILDING
SECTIONS AND DETAIL (1)

DRAWING NO.:
S-6

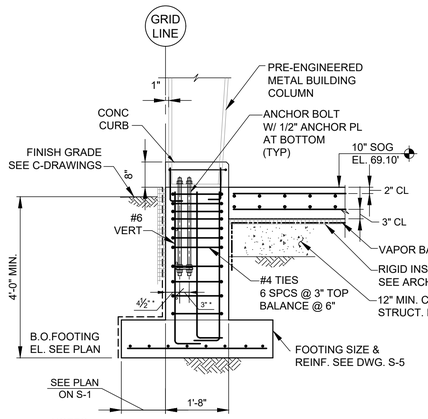
SHEET NO. 36 OF 57

E:\2025.000 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUB\PD WTP_S-6 Building Sections and Details.dwg



SECTION 11 / S-5

SCALE: 1/2"=1'-0"

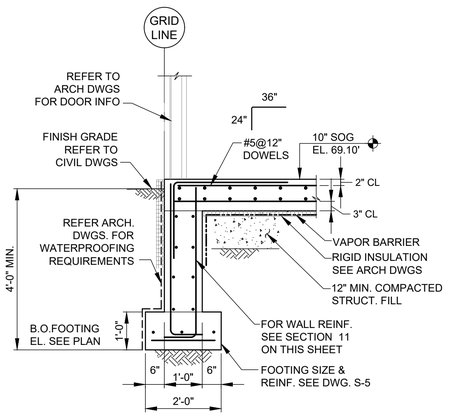


NOTES:

1. (*) ASTERISKS INDICATES ANCHOR BOLTS AND PIERS DIMENSIONS TO BE COORDINATED WITH METAL BUILDING REQUIREMENTS.
2. ANCHOR BOLTS DESIGNED AND FURNISHED BY METAL BUILDING SUPPLIER.

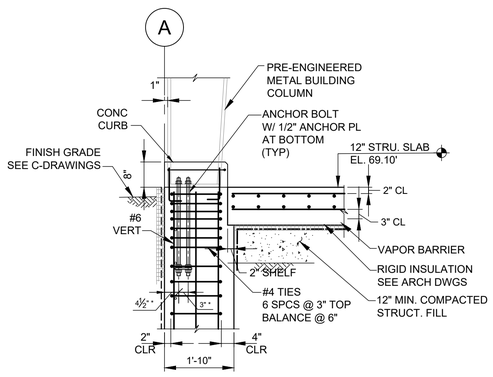
SECTION 12 / S-5

SCALE: 1/2"=1'-0"



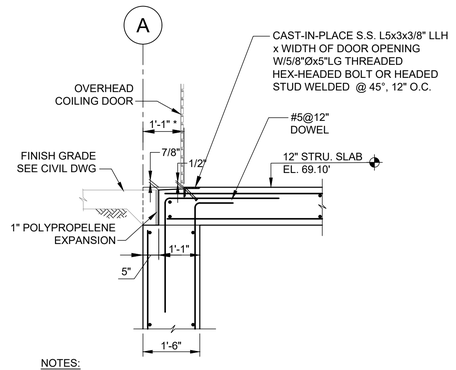
SECTION 13 / S-5

SCALE: 1/2"=1'-0"



SECTION 14 / S-5

SCALE: 1/2"=1'-0"



NOTES:

1. (*) ASTERISKS INDICATES DIMENSIONS FOR STAINLESS STEEL ANGLE TO BE COORDINATED WITH ARCHITECTURAL AND COILING DOOR MANUFACTURER.

SECTION 15 / S-5

SCALE: 1/2"=1'-0"

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. KLEIN — REGISTERED PROFESSIONAL ENGINEER — 6/19/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	AS SHOWN
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

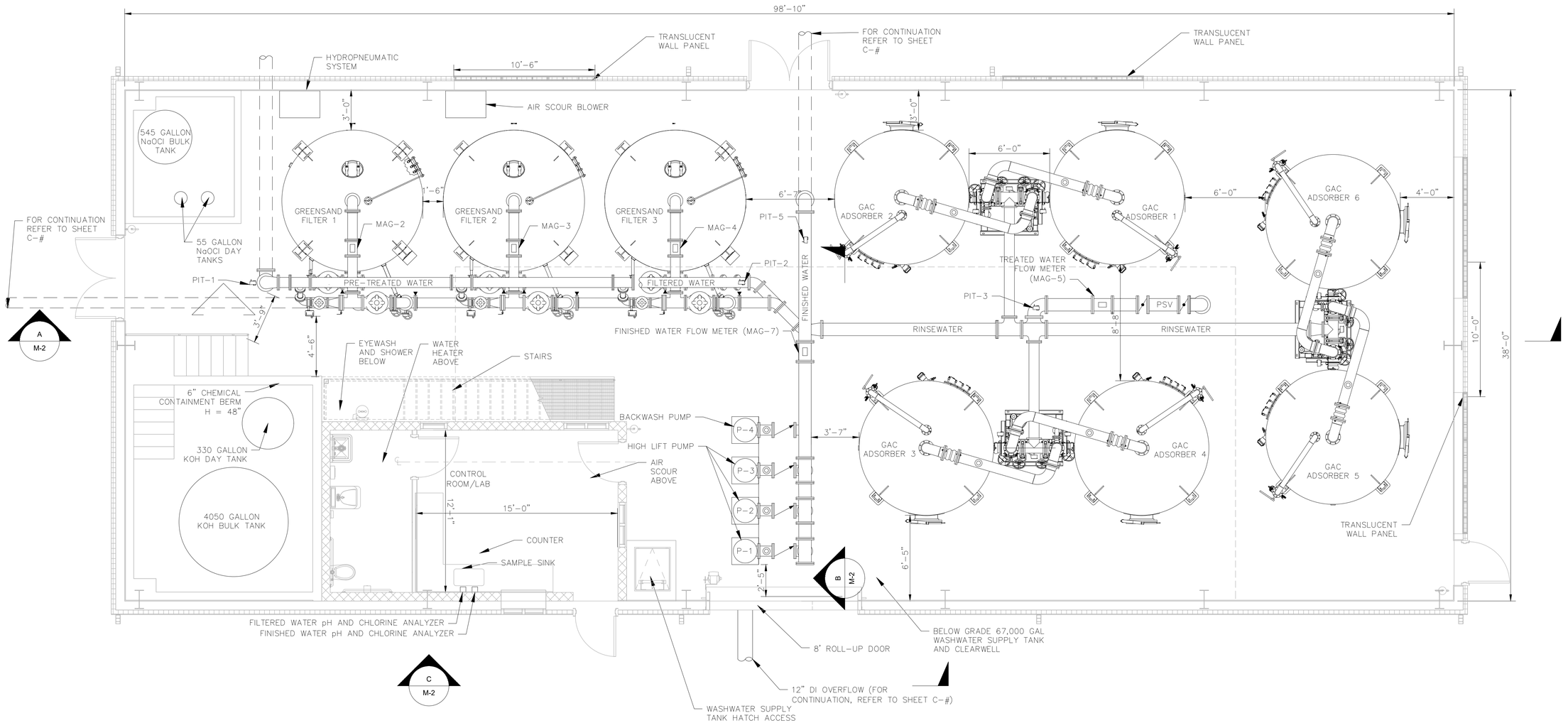
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
BUILDING SECTIONS AND DETAIL (2)

DRAWING NO.:
S-7

SHEET NO. 37 OF 57

E:\2025.030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUB\FD WTP_S-7 Building Sections and Details (2).dwg



PRELIMINARY FLOOR PLAN

SCALE: 1/4" = 1'

FOR PERMITTING

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REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: FLOOR PLAN

DRAWING NO.: M-1

SHEET NO. 38 OF 57

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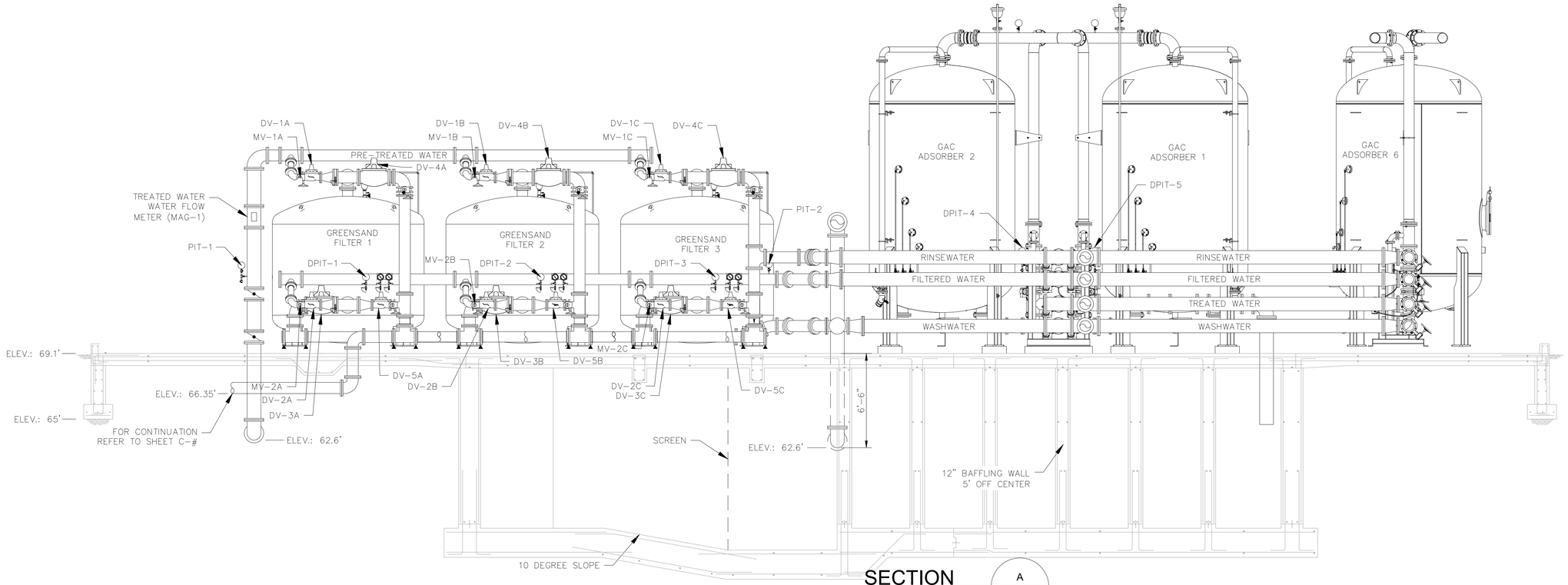
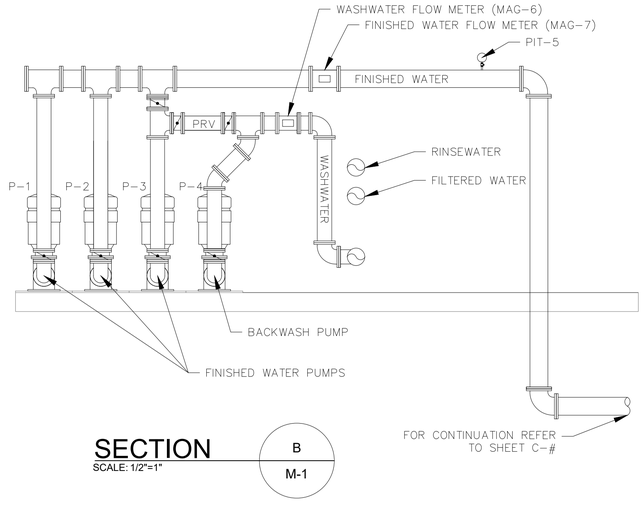
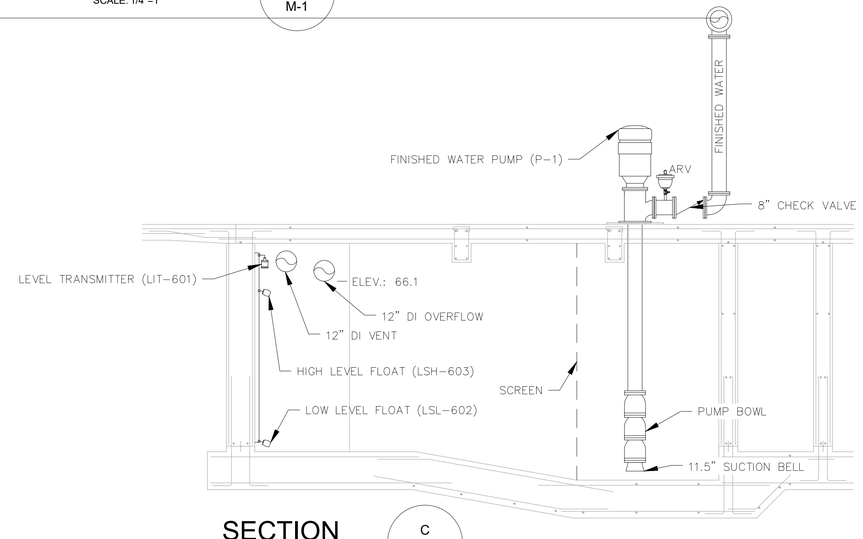


SECTION A
SCALE: 1/4"=1"
M-1



SECTION B
SCALE: 1/2"=1"
M-1



SECTION C
SCALE: 1/2"=1"
M-1

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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. OLSON — REGISTERED PROFESSIONAL ENGINEER — 6/19/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SECTION VIEW
NO. 1

DRAWING NO.:
M-2

SHEET NO. 39 OF 57

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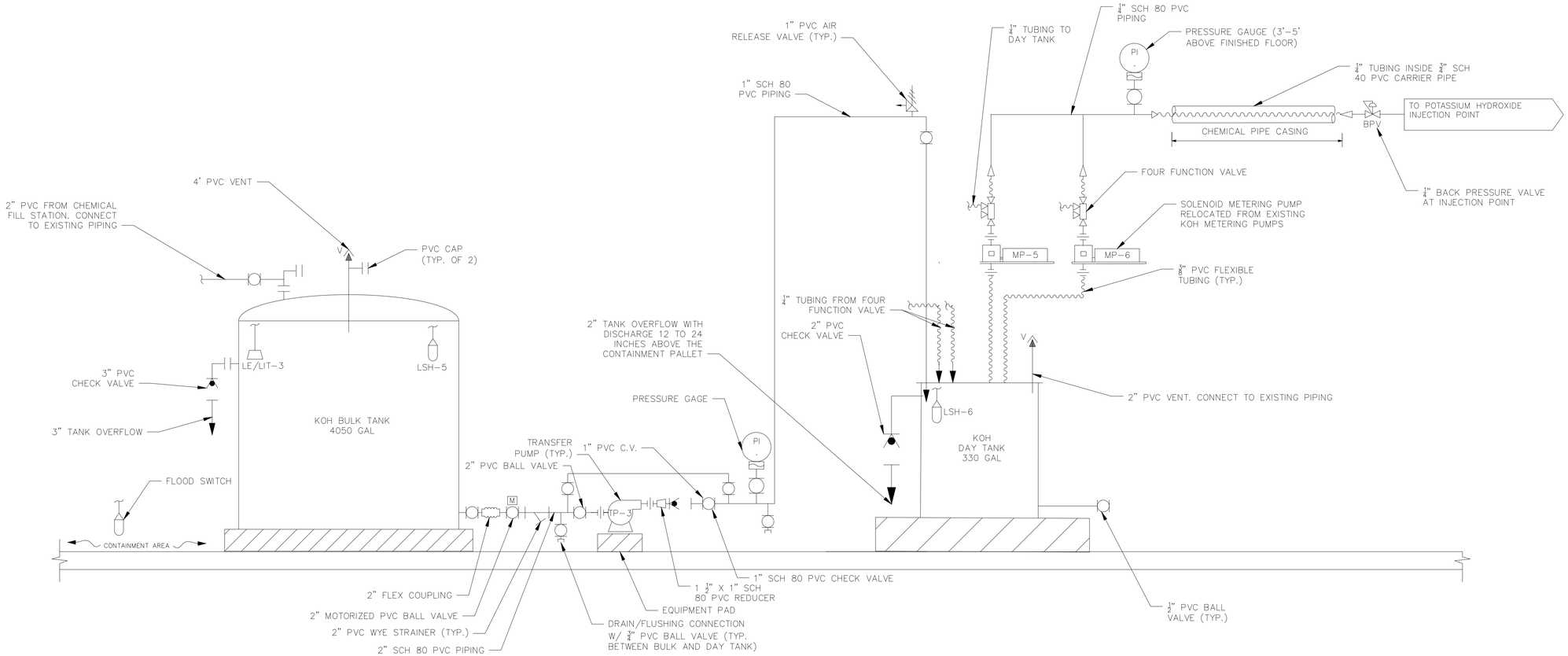

POTASSIUM HYDROXIDE (KOH) CHEMICAL FEED PIPING SCHEMATIC

SCALE: N.T.S.

CHEMICAL FEED PROCESS MECHANICAL NOTES:

1. ALL CHEMICAL FEED LINES, VENT LINES, AND PLANT WATER LINES SHALL BE SUPPORTED AS REQUIRED.
2. PIPING AND EQUIPMENT SUPPORTS SHALL BE INSTALLED AS DETERMINED BY THE CONTRACTOR FOLLOWING MANUFACTURER'S RECOMMENDATIONS FOR THE INTENDED SERVICE.
3. PROVIDE M.S.D.S. SHEETS, AND ALL OTHER ACCESSORIES TO MEET OSHA STANDARDS.
4. CONTRACTOR SHALL PROVIDE A VENT FOR EACH CHEMICAL STORAGE TANK. VENT SHALL BE FITTED WITH A GOOSE NECK AND 24-MESH (STAINLESS STEEL-NaOH AND PVC-CI AND CORROSION CONTROL) INSECT SCREEN. VENT SHALL SLOPE BACK TOWARD TANK. REFER TO INDIVIDUAL PIPING SCHEMATICS FOR SIZING.
5. ALL EQUIPMENT REQUIRING VENTING TO ATMOSPHERE SHALL HAVE VENTS LOCATED AWAY FROM ANY BUILDING OPENINGS.
6. ALL BULK TANKS AND DAY TANKS TO BE PROVIDED WITH EMERGENCY OVERFLOW LINES TO SECONDARY CONTAINMENT AREA. REFER TO INDIVIDUAL PIPING SCHEMATICS FOR SIZING. OVERFLOW CHECK VALVES SHALL BE SPRING LOADED AND MOUNTED IN HORIZONTAL POSITION.
7. INSTALL AIR RELEASE VALVE AT HIGH POINT BETWEEN TRANSFER PUMP AND DAY STORAGE TANK. AIR RELEASE SHALL BE PIPED BACK INTO DAY TANK.
8. PIPE ROUTING IS TO BE DETERMINED BY THE CONTRACTOR EXCEPT AS SHOWN ON PIPING SCHEMATICS. PIPE ROUTING SHALL BE ACCEPTED BY OWNER BEFORE INSTALLATION. PIPE ROUTING MUST NOT INTERFERE WITH ACCESS TO OPERATION OF ANY OTHER PIPE, VALVE, OR EQUIPMENT. PIPING SHALL NOT BE INSTALLED ABOVE ELECTRICAL EQUIPMENT AND CONTROL PANELS.
9. PIPING SHALL BE INSTALLED TO ALLOW FOR EXPANSION AND CONTRACTION WITHOUT APPLYING STRESS TO THE EQUIPMENT OR PIPING.
10. PVC WYE STRAINERS SHALL BE INSTALLED AT A MINIMUM OF 1'-0" OFF THE FINISHED FLOOR. REFER TO INDIVIDUAL CHEMICAL FEED PIPING SCHEMATICS FOR SIZES.
11. BULK TANK FILL LINE SHALL SLOPE TOWARD BULK TANK AFTER FILL PIPE GETS TO HEIGHT ABOVE TANK.
12. SUCTION AND INLET REDUCERS/INCREASERS SHALL BE PROVIDED, AS REQUIRED, AT TRANSFER PUMP CONNECTIONS TO PROPOSED CHEMICAL PIPING SYSTEMS.
13. PIPE UNIONS SHALL BE INSTALLED AT ALL PIPING CONNECTIONS TO AND FROM EQUIPMENT AND AS SHOWN ON PIPING SCHEMATIC.
14. BULK CHEMICAL STORAGE TANK PAD SHALL BE SUPPLIED BY TANK MANUFACTURER. PAD SHALL BE CUSTOM FIT TO MATCH THE TANK DIAMETER AND PAD MATERIAL SHALL BE COMPATIBLE WITH THE CHEMICAL BEING STORED.
15. METERING PUMP BRACKETS AND SHELVES SHALL BE INSTALLED 3' ABOVE FINISHED FLOOR.
17. TUBING CARRIER CONTAINMENT PIPE SHALL BE SCH. 80 PVC SOLVENT WELD JOINTS. CONTRACTOR SHALL MAKE ALL CHANGES IN DIRECTION OF THE CARRIER PIPE BY BENDING THE PIPE (MIN. 18" RADIUS) AND INSTALL "PULL BOXES" AT 15' INTERVALS ALONG THE ENTIRE LENGTH OF CONTAINMENT PIPING. PULL BOX SHALL INCLUDE TEE WITH THREADED CAP FOR ACCESS TO TUBING.
18. ALL CALIBRATION COLUMNS SHALL BE INSTALLED FOR GRAVITY FILL BY DAY TANK.

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SCALE ADJUSTMENT GUIDE
0" 1"
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REVISIONS

NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	NTS
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
POTASSIUM HYDROXIDE SCHEMATIC

DRAWING NO.:
M-3

SHEET NO. 40 OF 57

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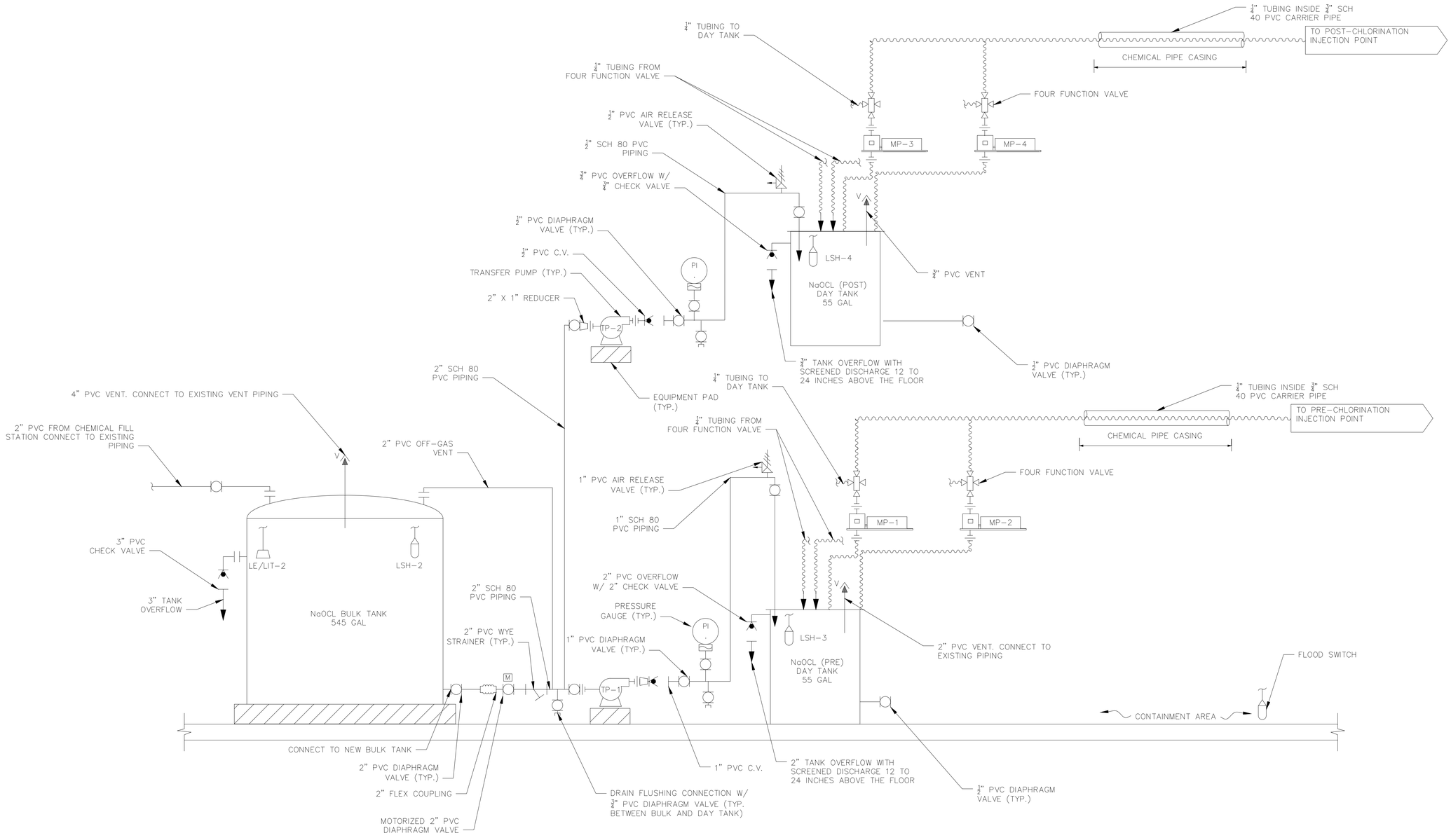

SODIUM HYPOCHLORITE PIPING SCHEMATIC

SCALE: N.T.S.

FOR PERMITTING

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REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	NTS
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SODIUM HYPOCHLORITE SCHEMATIC

DRAWING NO.:
M-4

SHEET NO. 41 OF 57

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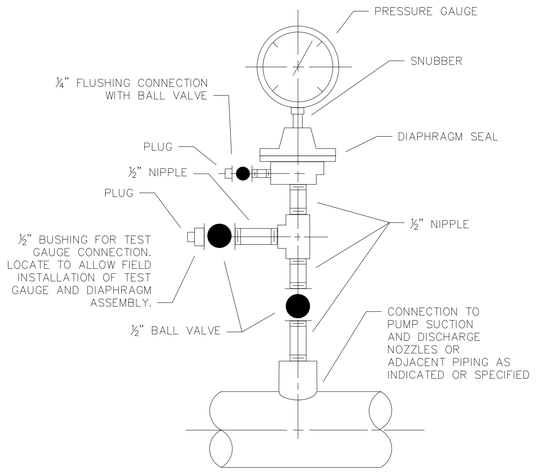
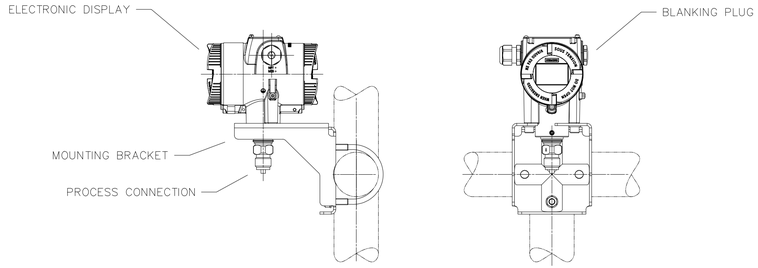


PRESSURE GAUGE MOUNTING DETAIL

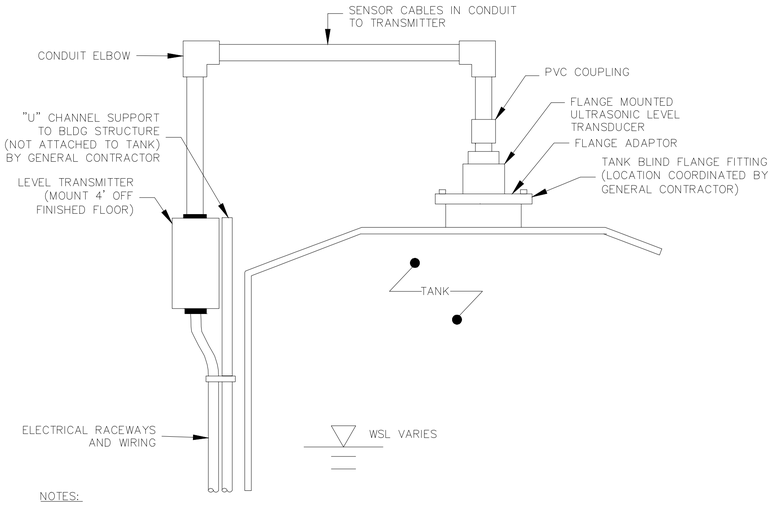
SCALE: N.T.S.



1. SEE NOTE 1 ON SHEET M-3

PRESSURE TRANSMITTER MOUNTING DETAIL

SCALE: N.T.S.

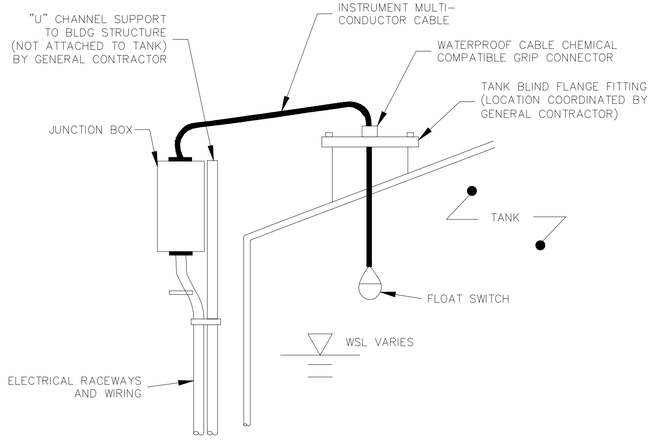


NOTES:

1. ELECTRICAL CONTRACTOR TO SUPPLY AND INSTALL ALL DIVISION 16 DEVICES, EQUIPMENT, COMPONENTS, AND ANCILLARY ITEMS ASSOCIATED WITH POWER AND SIGNAL WIRING FOR I&C DEVICES.
2. THE MOUNTING DETAILS PROVIDED ARE GENERIC FOR ULTRASONIC DEVICES OF VARIOUS MANUFACTURERS. THE INSTALLING CONTRACTOR MUST STRICTLY COMPLY WITH MANUFACTURER'S INSTRUCTION IN THE INSTALLATION OF THESE DEVICES. IF THERE ARE ANY ENGINEERING ISSUES THEY MUST BE REFERRED TO THE ENGINEER PRIOR TO INSTALLATION.

CHEMICAL TANK ULTRASONIC LEVEL DETAIL

SCALE: N.T.S.

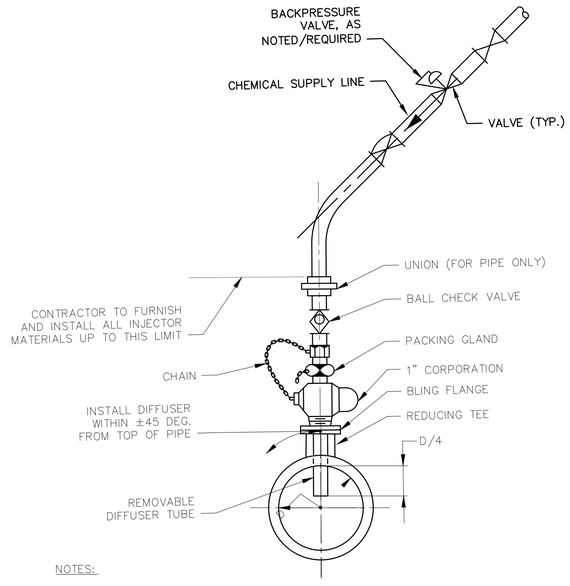


NOTES:

1. ELECTRICAL CONTRACTOR TO SUPPLY AND INSTALL ALL DIVISION 16 DEVICES, EQUIPMENT, COMPONENTS, AND ANCILLARY ITEMS ASSOCIATED WITH POWER AND SIGNAL WIRING FOR I&C DEVICES.
2. THE MOUNTING DETAILS PROVIDED ARE GENERIC FOR LEVEL SWITCH DEVICES OF VARIOUS MANUFACTURERS. THE INSTALLING CONTRACTOR MUST STRICTLY COMPLY WITH MANUFACTURER'S INSTRUCTION IN THE INSTALLATION OF THESE DEVICES. IF THERE ARE ANY ENGINEERING ISSUES THEY MUST BE REFERRED TO THE ENGINEER PRIOR TO INSTALLATION.

CHEMICAL TANK FLOAT SWITCH DETAIL

SCALE: N.T.S.

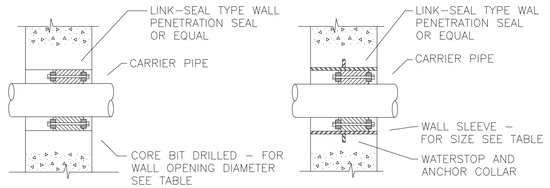


NOTES:

1. CHEMICAL INJECTORS INSTALLED IN 6-INCH PIPE OR SMALLER SHALL USE REDUCER TEE FOR INSTALLATION OF DIFFUSER.

CHEMICAL INJECTOR DETAILS

SCALE: N.T.S.



EXISTING CONCRETE WALL
SCALE: NTS

NEW CONCRETE WALL
SCALE: NTS

CARRIER PIPE NOMINAL SIZE	CARRIER PIPE O.D.	WALL SLEEVE SIZE	CORE DRILLED I.D.
2"	2.50"	4"	4"
4"	4.80"	8"	8"
6"	6.90"	10"	10"
8"	9.05"	12"	12"
16"	17.40"	20"	20"
18"	19.50"	24"	24"
24"	25.80"	30"	29"

NOTES:

1. SIZES SHOWN ARE FOR DUCTILE IRON PIPE, FOR OTHER MATERIALS AND PIPE SIZES CONSULT MANUFACTURER'S SPECIFICATIONS.
2. SOME APPLICATIONS MAY REQUIRE STANDARD WALL CASTINGS.
3. FOR WATER-TIGHT APPLICATIONS, PROVIDE NON-SHRINK GROUT ON EXTERIOR (NON-WATER SIDE) OF LINK-SEAL TYPE WALL PENETRATION.

TYPICAL WALL PENETRATION DETAIL

SCALE: N.T.S.

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 49,xxx
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	NTS
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
DETAILS

DRAWING NO.:
M-5

SHEET NO. 42 OF 57

C:\Users\Ryan\H2Olson Engineering, Inc\H2O - Documents\03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\M-Sheets\M Sheets.dwg

GENERAL NOTES

1. PROJECT SCOPE: PROVIDE COMPLETE AND OPERATIONAL SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS INCLUDING ALL NECESSARY MATERIAL, LABOR, AND EQUIPMENT.
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   E. THE TERM "EXTERIOR" IS ALL LOCATIONS, WHICH ARE NOT INTERIOR, OR UNDERGROUND.
   F. THE TERM "INTERIOR FINISHED SPACE" IS INTERIOR SPACES, WHICH ARE USED FOR OFFICES, CORRIDORS, LOBBIES, TOILETS, STORAGE AND FILING ROOMS, LOUNGES, MECHANICAL ROOMS, ELECTRICAL ROOMS, ETC.
13. DEMOLITION: DEMOLITION OF INDICATED ITEMS INCLUDES THE REMOVAL AND PROPER DISPOSAL OF THOSE ITEMS AND ALL ASSOCIATED PIPING, DUCTWORK, WIRING AND HANGERS. ELECTRICAL BRANCH, CONTROL, TELEPHONE, AND ALARM WIRING SHALL BE REMOVED BACK TO PANELBOARDS OR RELATED SYSTEM PANELS OR BACKBOARDS.
14. EQUIPMENT AND MATERIAL INSTALLATIONS:
   A. ALL EQUIPMENT AND MATERIALS SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING AND MANUFACTURER'S REQUIREMENTS.
   B. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
   C. IF AN EQUIPMENT MANUFACTURER REQUIRES LARGER CAPACITY, CIRCUITRY AND/OR EQUIPMENT, THE CONTRACTOR SHALL PROVIDE SUCH CAPACITY AND/OR EQUIPMENT UNDER HIS CONTRACT AT NO ADDITIONAL COST TO THE OWNER.
   D. LOCATE ALL EQUIPMENT, WHICH REQUIRES SERVICING IN FULLY ACCESSIBLE POSITIONS. IF REQUIRED FOR BETTER ACCESSIBILITY, FURNISH ACCESS DOORS FOR THAT PURPOSE.
   E. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR BETTER ACCESSIBILITY.
   F. ALL WORK IN INTERIOR FINISHED SPACES SHALL BE CONCEALED BEHIND WALLS, ABOVE CEILINGS OR HUNG CEILINGS, OR UNDER THE FLOOR. PROVIDE ALL NECESSARY CUTTING, PATCHING, REPAINTING AND/OR REPLACEMENT OF CEILING TILES AS REQUIRED TO PERFORM WORK.
   G. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO CONFORM WITH APPROVED SUBMITTAL DATA, INCLUDING COORDINATION DRAWINGS (IF REQUIRED), TO GREATEST EXTENT POSSIBLE. CONFORM TO ARRANGEMENTS INDICATED BY THE CONTRACT DOCUMENTS, RECOGNIZING THAT PORTIONS OF THE WORK ARE SHOWN ONLY IN DIAGRAMMATIC FORM. WHERE COORDINATION REQUIREMENTS CONFLICT WITH INDIVIDUAL SYSTEM REQUIREMENTS, REFER CONFLICT TO THE ARCHITECT/ENGINEER.
   H. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT LEVEL AND PLUMB, PARALLEL AND PERPENDICULAR TO OTHER BUILDING SYSTEMS AND COMPONENTS, WHERE INSTALLED EXPOSED IN FINISHED SPACES
   I. INSTALL EQUIPMENT TO FACILITATE SERVICING, MAINTENANCE, AND REPAIR OR REPLACEMENT OF EQUIPMENT COMPONENTS. AS MUCH AS PRACTICAL, CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM OF INTERFERENCE WITH OTHER INSTALLATIONS.
   J. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT GIVING RIGHT OF WAY PRIORITY TO SYSTEMS REQUIRED TO BE INSTALLED AT A SPECIFIED SLOPE.
   K. K) WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE.
   L. ASCERTAIN FROM EXAMINATION OF THE DRAWINGS, ANY SPECIAL TEMPORARY OPENINGS IN THE BUILDING REQUIRED FOR THE ADMISSION OF APPARATUS PROVIDED UNDER THIS DIVISION. NOTIFY THE CONTRACTOR WITH SUFFICIENT NOTICE TO PROVIDE THESE OPENINGS. IN THE EVENT OF FAILURE TO GIVE SUFFICIENT NOTICE, THE CONTRACTOR SHALL ASSUME ALL COSTS OF PROVIDING SUCH OPENINGS THEREAFTER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DISASSEMBLY AND ASSEMBLY OF EQUIPMENT AS REQUIRED TO PLACE EQUIPMENT IN THEIR FINAL LOCATIONS.
   M. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UNDERGROUND UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
15. FIRE RATINGS: THE CONTRACTOR SHALL REVIEW ALL CONTRACT DOCUMENTS FOR FIRE SEPARATION AND FIRE RATED ASSEMBLIES. ALL PIPING, DUCTWORK AND CONDUITS PASSING THROUGH OR PENETRATING WALLS, CEILINGS AND FLOORS SHALL BE PROVIDED WITH A UL LISTED FIRE STOPPING ASSEMBLIES. UL LISTED FIRE STOPPING ASSEMBLIES SHALL BE SUITABLE FOR THE CONDITIONS ENCOUNTERED AND SHALL BE RATED EQUAL TO THE RATING OF THE WALL, CEILING OR FLOOR. REVIEW FIRE RATED ASSEMBLIES THAT ALLOW PENETRATIONS OF ITEMS SUCH AS OUTLET BOXES AND CONDUITS THAT DO NOT REQUIRE FIRE STOPPING. SPACE AND POSITION THESE DEVICES AS ALLOWED PER THE ASSEMBLY'S UL RATING.
16. SERVICE LABELING: LABEL EQUIPMENT, PIPING, CONDUITS, INCLUDING FANS, AIR HANDLERS, TERMINAL UNITS, PANELBOARDS, ETC. WITH LABELS MADE OF SELF-STICKING, PLASTIC FILM DESIGNED FOR PERMANENT INSTALLATION. LABELS SHALL MATCH DESIGNATIONS AS INDICATED ON CONTRACT DRAWINGS. IDENTIFY PIPING AND CONDUITS IN ACCORDANCE WITH OSHA 29 CFR 1910.144, EXCEPT THAT LABELS OR TAPES MAY BE USED IN LIEU OF PAINTING OR STENCILING. SPACING OF IDENTIFICATION MARKING ON RUNS SHALL NOT EXCEED 50 FEET. MATERIALS FOR LABELS AND TAPES SHALL CONFORM TO CID A-A-1689, AND SHALL BE GENERAL PURPOSE TYPE AND COLOR CLASS.
   A. IN ADDITION IDENTIFY SERVICES AS INDICATED BELOW:
   B. EACH POINT OF ENTRY AND EXIT OF PIPE OR CONDUITS PASSING THROUGH WALLS.
   C. EACH CHANGE IN DIRECTION, I.E., ELBOWS, TEES.
   D. IN CONGESTED OR HIDDEN AREAS AND AT ALL ACCESS PANELS AT EACH POINT REQUIRED TO CLARIFY SERVICE OR INDICATED HAZARD.
   E. IN LONG STRAIGHT RUNS, LOCATE LABELS AT DISTANCES WITHIN EYESIGHT OF EACH OTHER NOT TO EXCEED 50 FEET. ALL LABELS SHALL BE VISIBLE AND LEGIBLE FROM THE PRIMARY SERVICE AND OPERATING AREA.
17. MANUFACTURER'S NAMEPLATES: EACH ITEM OF EQUIPMENT SHALL HAVE A NAMEPLATE BEARING THE MANUFACTURER'S NAME, ADDRESS, MODEL NUMBER, AND SERIAL NUMBER SECURELY AFFIXED IN A CONSPICUOUS PLACE; THE NAMEPLATE OF THE DISTRIBUTING AGENT WILL NOT BE ACCEPTABLE.
18. POSTED OPERATING INSTRUCTIONS: PROVIDE FOR EACH SYSTEM AND PRINCIPAL ITEM OF EQUIPMENT AS SPECIFIED FOR USE BY OPERATION AND MAINTENANCE PERSONNEL. PRINT OR ENGRAVE OPERATING INSTRUCTIONS AND FRAME UNDER GLASS OR IN APPROVED LAMINATED PLASTIC. POST INSTRUCTIONS WHERE DIRECTED. FOR OPERATING INSTRUCTIONS EXPOSED TO THE WEATHER, PROVIDE WEATHER-RESISTANT MATERIALS OR WEATHERPROOF ENCLOSURES. OPERATING INSTRUCTIONS SHALL NOT FADE WHEN EXPOSED TO SUNLIGHT AND SHALL BE SECURED TO PREVENT EASY REMOVAL OR PEELING. THE OPERATING INSTRUCTIONS SHALL INCLUDE THE FOLLOWING.
   A. WIRING DIAGRAMS, CONTROL DIAGRAMS, AND CONTROL SEQUENCE FOR EACH PRINCIPAL SYSTEM AND ITEM OF EQUIPMENT.
   B. START UP, PROPER ADJUSTMENT, OPERATING, LUBRICATION, AND SHUTDOWN PROCEDURES.
   C. SAFETY PRECAUTIONS.
   D. THE PROCEDURE IN THE EVENT OF EQUIPMENT FAILURE.
   E. OTHER ITEMS OF INSTRUCTION AS RECOMMENDED BY THE MANUFACTURER OF EACH SYSTEM OR ITEM OF EQUIPMENT.
19. WARNING SIGNS: PROVIDE WARNING SIGNS FOR THE ENCLOSURES OF ELECTRICAL EQUIPMENT INCLUDING SUBSTATIONS, PAD-MOUNTED TRANSFORMERS, PAD-MOUNTED SWITCHES, GENERATORS, AND SWITCHGEAR HAVING A NOMINAL RATING EXCEEDING 600 VOLTS.
20. EXTERIOR FERROUS MATERIALS: ALL EXTERIOR FERROUS MATERIALS SHALL BE PROTECTED FROM CORROSION BY ONE OF THE FOLLOWING METHODS:
   A. COVERED WITH A NON-FERROUS OR NON-CORRODING MATERIAL.
   B. MATERIALS THAT ARE INSULATED ON THE EXTERIOR.
   C. MATERIALS THAT ARE GALVANIZED.
   D. MATERIALS THAT ARE PAINTED. EXTERIOR PAINTING SHALL CONSIST OF A BASE COAT OF AN APPROPRIATE PRIMER AND TWO COATS OF FINAL PAINT. FINAL PAINT COLOR SHALL BE SELECTED BY THE OWNER'S REPRESENTATIVE.

GENERAL SYMBOLS

PLAN TITLES

A / A8

SCALE: 1/8" = 1'-0" 0 4' 8' 16'

A / A8 — SECTION MARKERS

NORTH ARROW

ITEMS TO BE DEMOLISHED

CODE REQUIREMENTS

ALL CONSTRUCTION SHALL FOLLOW THE 10TH ADDITION OF THE MASSACHUSETTS STATE BUILDING CODE AS FOLLOWS:
MASSACHUSETTS STATE BUILDING CODE (780 CMR),
MASSACHUSETTS ELECTRICAL CODE (527 CMR 12.00),
UNIFORM STATE PLUMBING CODE (248 CMR 10.00),
MASSACHUSETTS FUEL GAS CODE (248 CMR 4.00)
MASSACHUSETTS COMPREHENSIVE FIRE SAFETY CODE (527 CMR 1.00),
MASSACHUSETTS SANITARY CODE (105 CMR 410),
ARCHITECTURAL ACCESS BOARD (521 CMR),
MASSACHUSETTS STRETCH ENERGY CODE.

THE MASSACHUSETTS CODE AMENDS AND REFERENCES THE FOLLOWING CODES:
2021 INTERNATIONAL BUILDING CODE
2021 INTERNATIONAL RESIDENTIAL CODE (IRC):
2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
2021INTERNATIONAL EXISTING BUILDING CODE (IEBC)
2021INTERNATIONAL MECHANICAL CODE (IMC):
2023 NFPA 70 (NATIONAL ELECTRICAL CODE)

PLUMBING PIPE SYMBOLS

4" DCW	DOMESTIC COLD WATER
4" DHW	DOMESTIC HOT WATER
4" SAN	SANITARY SEWER DRAIN
4" SAN	SANITARY SEWER DRAIN BELOW
4" V	VENT
4" STRM	STORM DRAIN
4" STRM	STORM DRAIN BELOW

PLUMBING SYMBOLS

	ELBOW UP
	ELBOW DOWN
	TEE
	TEE UP
	TEE DOWN
	HOSE BIBB
	CONCENTRIC TRANSITION
	ECCENTRIC TRANSITION
	END CAP
	UNION
	BALL VALVE
	BUTTERFLY VALVE
	CHECK VALVE
	GLOBE VALVE
	GATE VALVE NRS
	GATE VALVE OS&Y
	PLUG VALVE LEVER
	PRESSURE REGULATING VALVE
	PRESSURE RELIEF VALVE
	RELIEF VALVE
	END OF LINE CLEANOUT
	CLEANOUT TO GRADE

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. GLAZIER — REGISTERED PROFESSIONAL ENGINEER — 6/4/26

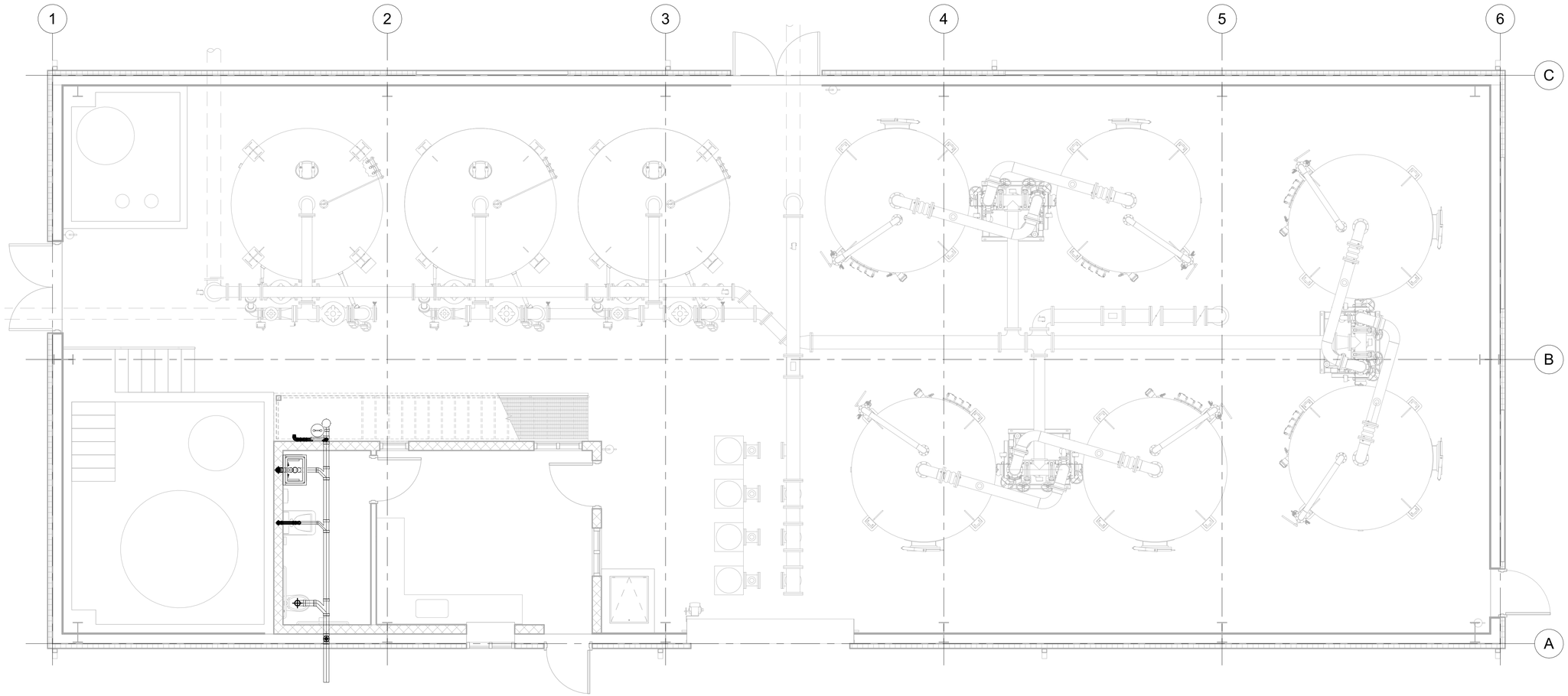
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	12" = 1'-0"
DESIGNED BY:	BAB
CHECKED BY:	BAB
DRAWN BY:	GJG
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
PLUMBING NOTES & SYMBOLS

DRAWING NO.:
P-1

SHEET NO. 43 OF 57



1
P-2

PLUMBING PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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0" 1"
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REVISIONS

NO.	DATE	DESCRIPTION

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DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	BAB
APPROVED BY:	KWK

WELL 3 & 4
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DRAWING TITLE:
PLUMBING PLANS

DRAWING NO.:
P-2

SHEET NO. 44 OF 57

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   E. THE TERM "EXTERIOR" IS ALL LOCATIONS, WHICH ARE NOT INTERIOR, OR UNDERGROUND.
   F. THE TERM "INTERIOR FINISHED SPACE" IS INTERIOR SPACES, WHICH ARE USED FOR OFFICES, CORRIDORS, LOBBIES, TOILETS, STORAGE AND FILING ROOMS, LOUNGES, MECHANICAL ROOMS, ELECTRICAL ROOMS, ETC.
13. DEMOLITION: DEMOLITION OF INDICATED ITEMS INCLUDES THE REMOVAL AND PROPER DISPOSAL OF THOSE ITEMS AND ALL ASSOCIATED PIPING, DUCTWORK, WIRING AND HANGERS. ELECTRICAL BRANCH, CONTROL, TELEPHONE, AND ALARM WIRING SHALL BE REMOVED BACK TO PANELBOARDS OR RELATED SYSTEM PANELS OR BACKBOARDS.
14. EQUIPMENT AND MATERIAL INSTALLATIONS:
   A. ALL EQUIPMENT AND MATERIALS SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING AND MANUFACTURER'S REQUIREMENTS.
   B. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
   C. IF AN EQUIPMENT MANUFACTURER REQUIRES LARGER CAPACITY, CIRCUITRY AND/OR EQUIPMENT, THE CONTRACTOR SHALL PROVIDE SUCH CAPACITY AND/OR EQUIPMENT UNDER HIS CONTRACT AT NO ADDITIONAL COST TO THE OWNER.
   D. LOCATE ALL EQUIPMENT, WHICH REQUIRES SERVICING IN FULLY ACCESSIBLE POSITIONS. IF REQUIRED FOR BETTER ACCESSIBILITY, FURNISH ACCESS DOORS FOR THAT PURPOSE.
   E. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR BETTER ACCESSIBILITY.
   F. ALL WORK IN INTERIOR FINISHED SPACES SHALL BE CONCEALED BEHIND WALLS, ABOVE CEILINGS OR HUNG CEILINGS, OR UNDER THE FLOOR. PROVIDE ALL NECESSARY CUTTING, PATCHING, REPAINTING AND/OR REPLACEMENT OF CEILING TILES AS REQUIRED TO PERFORM WORK.
   G. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO CONFORM WITH APPROVED SUBMITTAL DATA, INCLUDING COORDINATION DRAWINGS (IF REQUIRED), TO GREATEST EXTENT POSSIBLE. CONFORM TO ARRANGEMENTS INDICATED BY THE CONTRACT DOCUMENTS, RECOGNIZING THAT PORTIONS OF THE WORK ARE SHOWN ONLY IN DIAGRAMMATIC FORM. WHERE COORDINATION REQUIREMENTS CONFLICT WITH INDIVIDUAL SYSTEM REQUIREMENTS, REFER CONFLICT TO THE ARCHITECT/ENGINEER.
   H. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT LEVEL AND PLUMB, PARALLEL AND PERPENDICULAR TO OTHER BUILDING SYSTEMS AND COMPONENTS, WHERE INSTALLED EXPOSED IN FINISHED SPACES
   I. INSTALL EQUIPMENT TO FACILITATE SERVICING, MAINTENANCE, AND REPAIR OR REPLACEMENT OF EQUIPMENT COMPONENTS. AS MUCH AS PRACTICAL, CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM OF INTERFERENCE WITH OTHER INSTALLATIONS.
   J. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT GIVING RIGHT OF WAY PRIORITY TO SYSTEMS REQUIRED TO BE INSTALLED AT A SPECIFIED SLOPE.
   K. K) WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE.
   L. ASCERTAIN FROM EXAMINATION OF THE DRAWINGS, ANY SPECIAL TEMPORARY OPENINGS IN THE BUILDING REQUIRED FOR THE ADMISSION OF APPARATUS PROVIDED UNDER THIS DIVISION. NOTIFY THE CONTRACTOR WITH SUFFICIENT NOTICE TO PROVIDE THESE OPENINGS. IN THE EVENT OF FAILURE TO GIVE SUFFICIENT NOTICE, THE CONTRACTOR SHALL ASSUME ALL COSTS OF PROVIDING SUCH OPENINGS THEREAFTER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DISASSEMBLY AND ASSEMBLY OF EQUIPMENT AS REQUIRED TO PLACE EQUIPMENT IN THEIR FINAL LOCATIONS.
   M. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UNDERGROUND UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
15. FIRE RATINGS: THE CONTRACTOR SHALL REVIEW ALL CONTRACT DOCUMENTS FOR FIRE SEPARATION AND FIRE RATED ASSEMBLIES. ALL PIPING, DUCTWORK AND CONDUITS PASSING THROUGH FIRE RATED WALLS, CEILINGS AND FLOORS SHALL BE PROVIDED WITH A UL LISTED FIRE STOPPING ASSEMBLIES. UL LISTED FIRE STOPPING ASSEMBLIES SHALL BE SUITABLE FOR THE CONDITIONS ENCOUNTERED AND SHALL BE RATED EQUAL TO THE RATING OF THE WALL, CEILING OR FLOOR. REVIEW FIRE RATED ASSEMBLIES THAT ALLOW PENETRATIONS OF ITEMS SUCH AS OUTLET BOXES AND CONDUITS THAT DO NOT REQUIRE FIRE STOPPING. SPACE AND POSITION THESE DEVICES AS ALLOWED PER THE ASSEMBLY'S UL RATING.
16. SERVICE LABELING: LABEL EQUIPMENT, PIPING, CONDUITS, INCLUDING FANS, AIR HANDLERS, TERMINAL UNITS, PANELBOARDS, ETC. WITH LABELS MADE OF SELF-STICKING, PLASTIC FILM DESIGNED FOR PERMANENT INSTALLATION. LABELS SHALL MATCH DESIGNATIONS AS INDICATED ON CONTRACT DRAWINGS. IDENTIFY PIPING AND CONDUITS IN ACCORDANCE WITH OSHA 29 CFR 1910.144, EXCEPT THAT LABELS OR TAPES MAY BE USED IN LIEU OF PAINTING OR STENCILING. SPACING OF IDENTIFICATION MARKING ON RUNS SHALL NOT EXCEED 50 FEET. MATERIALS FOR LABELS AND TAPES SHALL CONFORM TO CID A-A-1689, AND SHALL BE GENERAL PURPOSE TYPE AND COLOR CLASS.
   A. IN ADDITION IDENTIFY SERVICES AS INDICATED BELOW:
   B. EACH POINT OF ENTRY AND EXIT OF PIPE OR CONDUITS PASSING THROUGH WALLS.
   C. EACH CHANGE IN DIRECTION, I.E., ELBOWS, TEES.
   D. IN CONGESTED OR HIDDEN AREAS AND AT ALL ACCESS PANELS AT EACH POINT REQUIRED TO CLARIFY SERVICE OR INDICATED HAZARD.
   E. IN LONG STRAIGHT RUNS, LOCATE LABELS AT DISTANCES WITHIN EYESIGHT OF EACH OTHER NOT TO EXCEED 50 FEET. ALL LABELS SHALL BE VISIBLE AND LEGIBLE FROM THE PRIMARY SERVICE AND OPERATING AREA.
17. MANUFACTURER'S NAMEPLATES: EACH ITEM OF EQUIPMENT SHALL HAVE A NAMEPLATE BEARING THE MANUFACTURER'S NAME, ADDRESS, MODEL NUMBER, AND SERIAL NUMBER SECURELY AFFIXED IN A CONSPICUOUS PLACE; THE NAMEPLATE OF THE DISTRIBUTING AGENT WILL NOT BE ACCEPTABLE.
18. POSTED OPERATING INSTRUCTIONS: PROVIDE FOR EACH SYSTEM AND PRINCIPAL ITEM OF EQUIPMENT AS SPECIFIED FOR USE BY OPERATION AND MAINTENANCE PERSONNEL. PRINT OR ENGRAVE OPERATING INSTRUCTIONS AND FRAME UNDER GLASS OR IN APPROVED LAMINATED PLASTIC. POST INSTRUCTIONS WHERE DIRECTED. FOR OPERATING INSTRUCTIONS EXPOSED TO THE WEATHER, PROVIDE WEATHER-RESISTANT MATERIALS OR WEATHERPROOF ENCLOSURES. OPERATING INSTRUCTIONS SHALL NOT FADE WHEN EXPOSED TO SUNLIGHT AND SHALL BE SECURED TO PREVENT EASY REMOVAL OR PEELING. THE OPERATING INSTRUCTIONS SHALL INCLUDE THE FOLLOWING:
   A. WIRING DIAGRAMS, CONTROL DIAGRAMS, AND CONTROL SEQUENCE FOR EACH PRINCIPAL SYSTEM AND ITEM OF EQUIPMENT.
   B. START UP, PROPER ADJUSTMENT, OPERATING, LUBRICATION, AND SHUTDOWN PROCEDURES.
   C. SAFETY PRECAUTIONS.
   D. THE PROCEDURE IN THE EVENT OF EQUIPMENT FAILURE.
   E. OTHER ITEMS OF INSTRUCTION AS RECOMMENDED BY THE MANUFACTURER OF EACH SYSTEM OR ITEM OF EQUIPMENT.
19. WARNING SIGNS: PROVIDE WARNING SIGNS FOR THE ENCLOSURES OF ELECTRICAL EQUIPMENT INCLUDING SUBSTATIONS, PAD-MOUNTED TRANSFORMERS, PAD-MOUNTED SWITCHES, GENERATORS, AND SWITCHGEAR HAVING A NOMINAL RATING EXCEEDING 600 VOLTS.
20. EXTERIOR FERROUS MATERIALS: ALL EXTERIOR FERROUS MATERIALS SHALL BE PROTECTED FROM CORROSION BY ONE OF THE FOLLOWING METHODS:
   A. COVERED WITH A NON-FERROUS OR NON-CORRODING MATERIAL.
   B. MATERIALS THAT ARE INSULATED ON THE EXTERIOR.
   C. MATERIALS THAT ARE GALVANIZED.
   D. MATERIALS THAT ARE PAINTED. EXTERIOR PAINTING SHALL CONSIST OF A BASE COAT OF AN APPROPRIATE PRIMER AND TWO COATS OF FINAL PAINT. FINAL PAINT COLOR SHALL BE SELECTED BY THE OWNER'S REPRESENTATIVE.

GENERAL SYMBOLS

PLAN TITLES

A / A8 — SCALE: 1/8" = 1'-0" (0, 4', 8', 16')

A / A8 — SECTION MARKERS

NORTH ARROW

ITEMS TO BE DEMOLISHED

CODE REQUIREMENTS

ALL CONSTRUCTION SHALL FOLLOW THE 10TH ADDITION OF THE MASSACHUSETTS STATE BUILDING CODE AS FOLLOWS:
MASSACHUSETTS STATE BUILDING CODE (780 CMR),
MASSACHUSETTS ELECTRICAL CODE (527 CMR 12.00),
UNIFORM STATE PLUMBING CODE (248 CMR 10.00),
MASSACHUSETTS FUEL GAS CODE (248 CMR 4.00)
MASSACHUSETTS COMPREHENSIVE FIRE SAFETY CODE (527 CMR 1.00),
MASSACHUSETTS SANITARY CODE (105 CMR 410),
ARCHITECTURAL ACCESS BOARD (521 CMR),
MASSACHUSETTS STRETCH ENERGY CODE.

THE MASSACHUSETTS CODE AMENDS AND REFERENCES THE FOLLOWING CODES:
2021 INTERNATIONAL BUILDING CODE
2021 INTERNATIONAL RESIDENTIAL CODE (IRC):
2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
2021INTERNATIONAL EXISTING BUILDING CODE (IEBC)
2021INTERNATIONAL MECHANICAL CODE (IMC):
2023 NFPA 70 (NATIONAL ELECTRICAL CODE)

FIRE PROT. SYMBOLS

- 4" WET — WET PIPE
- 4" DRY — DRY PIPE
- PENDENT HEAD
- PENDENT & UPRIGHT HEAD (ABOVE & BELOW CEILING)
- UPRIGHT HEAD
- UPRIGHT HEAD WITH GUARD
- SIDEWALL HEAD
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- GLOBE VALVE
- PRESSURE REGULATING VALVE

FIRE PROTECTION SPRINKLER SYSTEM GENERAL NOTES AND REQUIREMENTS

1. PROVIDE AN AUTOMATIC SPRINKLER SYSTEM.
2. THE SPRINKLER SYSTEM IS A DESIGN/BUILD PROJECT REQUIRING THE CONTRACTOR TO DESIGN & INSTALL THE SPRINKLER SYSTEM.
3. PLANS/DRAWINGS DO NOT SHOW ALL REQUIRED SYSTEM EQUIPMENT, DEVICES & PIPING. PROVIDE ALL REQUIRED ELEMENTS PER NFPA 13 FOR A COMPLETE AND OPERATIONAL SYSTEM.
4. SPRINKLER HEADS SHOWN ON DRAWINGS MAY NOT REFLECT ALL REQUIRED HEADS. PROVIDE ADDITIONAL HEADS AS REQUIRED BY NFPA 13.
5. PIPE SIZING SHOWN ON DRAWINGS ARE FOR GENERAL INFORMATION. SIZE ALL PIPE BASED ON HYDRAULIC CALCULATIONS PER NFPA 13.
6. THE DESIGN-BUILD AUTOMATIC FIRE SPRINKLER SYSTEM SHALL BE DESIGNED, FABRICATED, AND INSTALLED IN FULL COMPLIANCE WITH THE CURRENT EDITION OF THE MASSACHUSETTS STATE BUILDING CODE (780 CMR), INCLUDING ALL APPLICABLE AMENDMENTS; NFPA 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS, THE FIRE PROTECTION PROJECT SPECIFICATIONS, AND ALL LOCAL AUTHORITY HAVING JURISDICTION (AHJ) REQUIREMENTS.
7. ALL WORK SHALL CONFORM TO THE PROJECT SPECIFICATION PACKAGE, DIVISION 21 FIRE SUPPRESSION, WHICH GOVERNS SYSTEM DESIGN CRITERIA, MATERIALS, HYDRAULIC PERFORMANCE, OCCUPANCY/HAZARD CLASSIFICATION, REQUIREMENTS TO OBTAIN WATER SUPPLY DATA, AND ANY SPECIAL REQUIREMENTS INCLUDING ANTIFREEZE SYSTEMS, FREEZE PROTECTION OR SPECIAL PROTECTION FEATURES AND MONITORING REQUIREMENTS. COORDINATE WITH ARCHITECTURAL CODE SHEET AND PERFORM FLOW DOWN OF CODES AND REQUIREMENTS
8. SHOP DRAWINGS SHALL BE PREPARED UNDER DESIGN-BUILD RESPONSIBILITY AND ARE BASED ON THE CONSTRUCTION DOCUMENTS AND SPECIFICATIONS ANY DEVIATIONS FROM THE PROJECT SPECIFICATIONS MUST BE CLEARLY NOTED AND SUBMITTED FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
9. THE INSTALLING CONTRACTOR SHALL HOLDS A VALID MASSACHUSETTS FIRE PROTECTION SYSTEMS LICENSE. SHOP DRAWINGS INCLUDE THE NAME(S), LICENSE NUMBER(S), AND LICENSE EXPIRATION DATE(S) OF THE CONTRACTOR(S) DESIGNING AND INSTALLING THE FIRE PROTECTION SYSTEM
10. THE SHOP DRAWING SUBMITTAL SHALL INCLUDED TIER 1 AND TIER II SHOP DRAWINGS PER 780 CMR 901.2.2. INSTALLATION SHALL NOT COMMENCE UNTIL SHOP DRAWINGS ARE REVIEWED AND ACCEPTED BY THE OWNER AND OWNERS ' REPRESENTATIVE AND APPROVED BY THE LOCAL BUILDING OFFICIAL, AND FIRE MARSHALL
11. SYSTEM DESIGN SHALL INCLUDE HYDRAULIC CALCULATIONS, EQUIPMENT SPECIFICATIONS, DETAILED LAYOUT, HANGER DETAILS (WHERE APPLICABLE), AND SEQUENCE OF OPERATIONS. ALL COMPONENTS SHALL BE LISTED/APPROVED FOR THE INTENDED USE.
12. UPON COMPLETION, TIER III RECORD (AS-BUILT) DRAWINGS SHALL BE PREPARED, SEALED/REVIEWED BY THE DESIGNER OR LEGALLY RECOGNIZED PROFESSIONAL PERFORMING CONSTRUCTION CONTROL AND PROVIDED TO THE OWNER PER 780 CMR REQUIREMENTS.
13. THE CONTRACTOR SHALL PROVIDE ALL TESTING, FLUSHING, AND ACCEPTANCE SHALL FOLLOW NFPA 13 AND PROJECT SPECIFICATIONS, WITH WITNESSED INSPECTIONS BY THE AHJ, FIRE MARSHAL AND OWNER'S REPRESENTATIVE.
14. SHOP DRAWING SHALL INCLUDED SPRINKLER SHOP DRAWING SUBMITTAL PACKAGE WITH TITLES, DATES WITH THE ACTUAL PROJECT REFERENCES. THE SUBMITTAL SHALL BE IN COMPLIANCE WITH MASSACHUSETTS THREE-TIER SUBMITTAL PROCESS AND LICENSING NOTATION MANDATE.

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS

NO.	DATE	DESCRIPTION

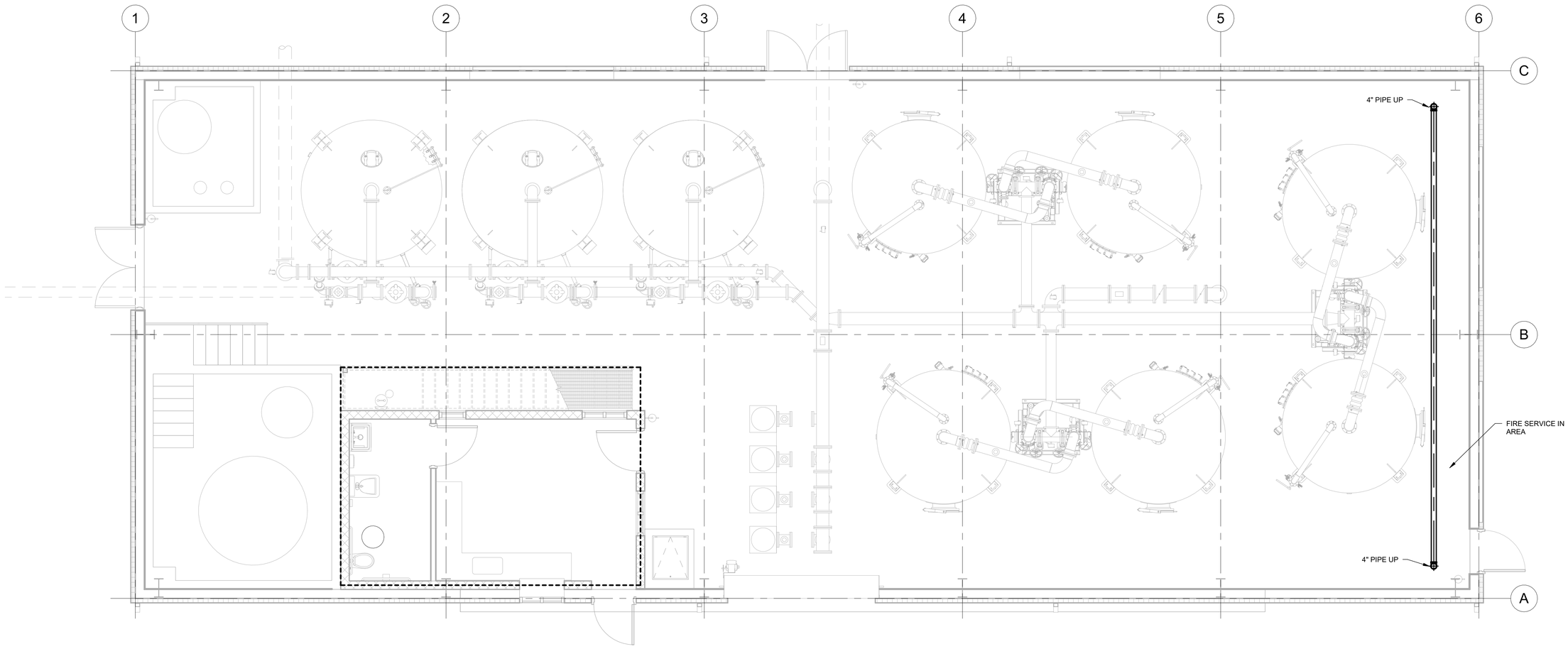
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	12" = 1'-0"
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	JPD
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
FIRE PROTECTION NOTES & SYMBOLS

DRAWING NO.:
FP-1

SHEET NO. 45 OF 57



1
FP-2

FIRST FLOOR FIRE PROTECTION PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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0" 1"
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PROJECT NO.:	127.25.01
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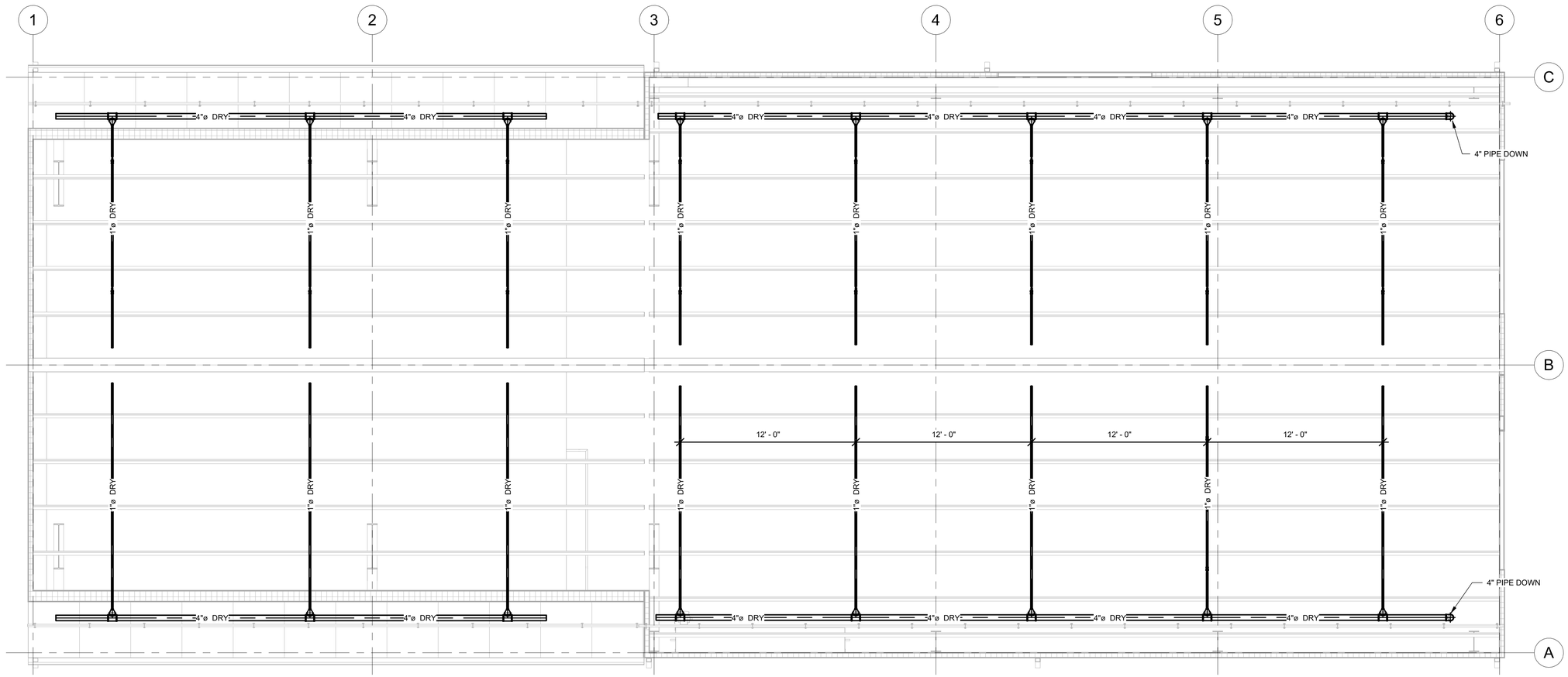
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	JPD
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
FIRE PROTECTION
FIRST FLOOR PLAN

DRAWING NO.:
FP-2

SHEET NO. 46 OF 57



MEZZANINE FIRE PROTECTION PLAN

1 / FP-3

Scale: 1/4" = 1'-0"

FOR PERMITTING

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DRINKING WATER PROFESSIONALS

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	JPD
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
FIRE PROTECTION
UPPER CEILING PLAN

DRAWING NO.:
FP-3

SHEET NO. 47 OF 57

GENERAL NOTES

1. PROJECT SCOPE: PROVIDE COMPLETE AND OPERATIONAL SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS INCLUDING ALL NECESSARY MATERIAL, LABOR, AND EQUIPMENT.
2. CONSTRUCTION\CONTRACT DOCUMENTS: CONTRACT DOCUMENTS INCLUDING PLANS, DETAILS, AND ONE-LINE DIAGRAMS SHOW THE GENERAL LOCATION AND ARRANGEMENT OF THE WORK. THESE DOCUMENTS ARE DIAGRAMMATIC AND DO NOT SHOW ALL CONNECTORS, FITTINGS, HANGERS, AND ADDITIONAL ELEMENTS WHICH THE CONTRACTOR MUST PROVIDE TO COMPLETE THE SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN, THAT MAY EXIST, THUS REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE PROJECT AREA BEFORE PERFORMING THE WORK. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BY FIELD MEASUREMENTS.
3. COORDINATION:
   A. THE CONTRACTOR SHALL COORDINATE THEIR WORK WITH ALL CONSTRUCTION DOCUMENTS AND OTHER TRADES ASSOCIATED WITH THE PROJECT.
   B. THE CONTRACTOR SHALL VISIT THE SITE OF WORK AND FAMILIARIZE HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE NATURE OF THE INSTALLATION AND CONDITIONS.
   C. BEFORE SELECTING MATERIAL, EQUIPMENT AND PROCEEDING WITH WORK, INSPECT AREAS WHERE MATERIAL AND EQUIPMENT ARE TO BE INSTALLED TO INSURE SUITABILITY, AND CHECK NEEDED SPACE FOR PLACEMENT, CLEARANCES AND INTERCONNECTIONS.
   D. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN THAT MAY EXIST; THUS, REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE SPACE BEFORE PERFORMING THE WORK.
   E. BEFORE CUTTING OR DRILLING INTO BUILDING ELEMENTS INSPECT AND LAYOUT WORK TO AVOID DAMAGING STRUCTURAL ELEMENTS AND BUILDING UTILITIES.
   F. ARRANGE FOR CHASES, SLOTS, AND OPENINGS IN OTHER BUILDING COMPONENTS DURING PROGRESS OF CONSTRUCTION, TO ALLOW FOR PROPER SYSTEM INSTALLATIONS.
   G. COORDINATE THE INSTALLATION OF REQUIRED SUPPORTING DEVICES AND SLEEVES TO BE SET IN POURED IN PLACE CONCRETE AND OTHER STRUCTURAL COMPONENTS, AS THEY ARE CONSTRUCTED.
   H. H) SEQUENCE, COORDINATE, AND INTEGRATE INSTALLATIONS OF MATERIALS AND EQUIPMENT FOR EFFICIENT FLOW OF THE WORK. GIVE PARTICULAR ATTENTION TO LARGE EQUIPMENT REQUIRING POSITIONING PRIOR TO CLOSING IN THE BUILDING.
   I. FAILURE OF THE CONTRACTOR TO ACQUAINT HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE ABOVE CONDITIONS AND NOT PERFORMING PROPER COORDINATION WILL NOT RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY FOR ESTIMATING THE DIFFICULTIES AND COSTS FOR SUCCESSFULLY PERFORMING THE COMPLETE WORK UNDER THIS PROJECT.
4. SHUTDOWNS: WRITTEN REQUESTS FOR APPROVAL FOR PLANNED SHUTDOWNS OR INTERRUPTION OF OWNER'S UTILITIES, SYSTEMS AND EQUIPMENT SHALL BE MADE 72 HOURS PRIOR TO THE START OF THE REQUESTED SHUTDOWN PERIODS.
5. CODES AND STANDARDS: THE CONTRACTOR SHALL FOLLOW ALL FEDERAL, STATE AND LOCAL CODES THAT HAVE JURISDICTION WHERE THE WORK IS BEING PERFORMED. THROUGHOUT THE CONTRACT DOCUMENTS CERTAIN CODES AND STANDARDS ARE REFERENCED. THE CONTRACTOR SHALL USE THE LATEST VERSIONS OF CODES AND STANDARDS REFERENCED UNLESS OTHERWISE NOTED. IF THE CONTRACTOR IS NOT FAMILIAR WITH THE REFERENCED STANDARD THEY SHALL CONTACT THE OWNER'S REPRESENTATIVE FOR DIRECTION.
6. PERMITS: THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED PERMITS AND ARRANGE FOR ALL REQUIRED INSPECTIONS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES.
7. WORKMAN: ALL WORK SHALL BE DONE WITH LICENSED WORKMEN IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES CODES AND REGULATIONS.
8. SUBMITTALS: THE CONTRACTOR SHALL PROVIDE SUBMITTALS FOR ALL EQUIPMENT AND MATERIALS BEING PROVIDED BEFORE SUCH EQUIPMENT AND MATERIALS ARE PURCHASED AND INSTALLED. THE SUBMITTALS SHALL BE REVIEWED AND RETURNED BY THE OWNER'S REPRESENTATIVE WITH APPROPRIATE COMMENTS. SUBMITTALS SHALL BE SUBMITTED ELECTRONICALLY IN PDF FORMAT AND WILL BE RETURNED WITH COMMENTS TO THE CONTRACTOR IN PDF FORMAT.
9. AS-BUILT DOCUMENTATION: THE CONTRACTOR SHALL PROVIDE ONE MARK-UP SET OF CONSTRUCTION DOCUMENTS SHOWING FINAL AS-BUILT CONDITIONS. DOCUMENTS SHALL CLEARLY SHOW THE CHANGES MADE TO THE INSTALLED SYSTEMS.
10. EQUIPMENT WARRANTIES, MAINTENANCE MANUALS AND INSTALLATION MANUALS: TURN OVER TO THE OWNER ALL MANUFACTURERS' WARRANTIES, MAINTENANCE MANUALS, AND INSTALLATION MANUALS FOR EQUIPMENT AND MATERIALS PROVIDED.
11. PHOTOGRAPHS: PHOTOGRAPHS ARE PROVIDED TO SHOW CURRENT CONDITION OF BUILDING SYSTEMS TO ASSIST THE CONTRACTOR. PHOTOGRAPHS DO NOT SHOW ALL AREAS OF THE BUILDING OR ALL SYSTEM CONDITIONS, THUS REQUIRING THE CONTRACTOR TO VISIT THE SITE BEFORE PERFORMING WORK. PHOTOGRAPHS ARE NOT INTENDED TO SHOW SCOPE OF WORK, PLANS, NOTES, SPECIFICATIONS AND OTHER BID DOCUMENTS INDICATE SCOPE OF WORK.
12. TERMINOLOGY:
   A. THE TERM "INDICATED" SHALL MEAN, "AS SHOWN ON CONTRACT DOCUMENTS (SPECIFICATIONS, DRAWINGS, AND RELATED ATTACHMENTS)".
   B. THE TERM "PROVIDE" SHALL MEAN, "TO FURNISH, INSTALL, AND CONNECT COMPLETELY".
   C. THE TERM "COORDINATE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "TO MANAGE, INTERFACE, COMMUNICATE, MAKE ARRANGEMENT, BRING INTO ORDER, ADMINISTER AND HANDLE COMPLETELY".
   D. THE TERM "INTERIOR" IS AN INTERIOR LOCATION WHERE ITS ENVIRONMENT IS HEATED AND/OR AIR CONDITIONED AND NOT SUBJECT TO OUTSIDE WEATHER CONDITIONS.
   E. THE TERM "EXTERIOR" IS ALL LOCATIONS, WHICH ARE NOT INTERIOR, OR UNDERGROUND.
   F. THE TERM "INTERIOR FINISHED SPACE" IS INTERIOR SPACES, WHICH ARE USED FOR OFFICES, CORRIDORS, LOBBIES, TOILETS, STORAGE AND FILING ROOMS, LOUNGES, MECHANICAL ROOMS, ELECTRICAL ROOMS, ETC.
13. DEMOLITION: DEMOLITION OF INDICATED ITEMS INCLUDES THE REMOVAL AND PROPER DISPOSAL OF THOSE ITEMS AND ALL ASSOCIATED PIPING, DUCTWORK, WIRING AND HANGERS. ELECTRICAL BRANCH, CONTROL, TELEPHONE, AND ALARM WIRING SHALL BE REMOVED BACK TO PANELBOARDS OR RELATED SYSTEM PANELS OR BACKBOARDS.
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   A. ALL EQUIPMENT AND MATERIALS SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING AND MANUFACTURER'S REQUIREMENTS.
   B. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
   C. IF AN EQUIPMENT MANUFACTURER REQUIRES LARGER CAPACITY, CIRCUITRY AND/OR EQUIPMENT, THE CONTRACTOR SHALL PROVIDE SUCH CAPACITY AND/OR EQUIPMENT UNDER HIS CONTRACT AT NO ADDITIONAL COST TO THE OWNER.
   D. LOCATE ALL EQUIPMENT, WHICH REQUIRES SERVICING IN FULLY ACCESSIBLE POSITIONS. IF REQUIRED FOR BETTER ACCESSIBILITY, FURNISH ACCESS DOORS FOR THAT PURPOSE.
   E. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR BETTER ACCESSIBILITY.
   F. ALL WORK IN INTERIOR FINISHED SPACES SHALL BE CONCEALED BEHIND WALLS, ABOVE CEILINGS OR HUNG CEILINGS, OR UNDER THE FLOOR. PROVIDE ALL NECESSARY CUTTING, PATCHING, REPAINTING AND/OR REPLACEMENT OF CEILING TILES AS REQUIRED TO PERFORM WORK.
   G. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO CONFORM WITH APPROVED SUBMITTAL DATA, INCLUDING COORDINATION DRAWINGS (IF REQUIRED), TO GREATEST EXTENT POSSIBLE. CONFORM TO ARRANGEMENTS INDICATED BY THE CONTRACT DOCUMENTS, RECOGNIZING THAT PORTIONS OF THE WORK ARE SHOWN ONLY IN DIAGRAMMATIC FORM. WHERE COORDINATION REQUIREMENTS CONFLICT WITH INDIVIDUAL SYSTEM REQUIREMENTS, REFER CONFLICT TO THE ARCHITECT/ENGINEER.
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   J. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT GIVING RIGHT OF WAY PRIORITY TO SYSTEMS REQUIRED TO BE INSTALLED AT A SPECIFIED SLOPE.
   K. K) WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE.
   L. ASCERTAIN FROM EXAMINATION OF THE DRAWINGS, ANY SPECIAL TEMPORARY OPENINGS IN THE BUILDING REQUIRED FOR THE ADMISSION OF APPARATUS PROVIDED UNDER THIS DIVISION. NOTIFY THE CONTRACTOR WITH SUFFICIENT NOTICE TO PROVIDE THESE OPENINGS. IN THE EVENT OF FAILURE TO GIVE SUFFICIENT NOTICE, THE CONTRACTOR SHALL ASSUME ALL COSTS OF PROVIDING SUCH OPENINGS THEREAFTER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DISASSEMBLY AND ASSEMBLY OF EQUIPMENT AS REQUIRED TO PLACE EQUIPMENT IN THEIR FINAL LOCATIONS.
   M. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
15. FIRE RATINGS: THE CONTRACTOR SHALL REVIEW ALL CONTRACT DOCUMENTS FOR FIRE SEPARATION AND FIRE RATED ASSEMBLIES. ALL PIPING, DUCTWORK AND CONDUITS PASSING THROUGH FIRE RATED WALLS, CEILINGS AND FLOORS SHALL BE PROVIDED WITH A UL LISTED FIRE STOPPING ASSEMBLIES. UL LISTED FIRE STOPPING ASSEMBLIES SHALL BE SUITABLE FOR THE CONDITIONS ENCOUNTERED AND SHALL BE RATED EQUAL TO THE RATING OF THE WALL, CEILING OR FLOOR. REVIEW FIRE RATED ASSEMBLIES THAT ALLOW PENETRATIONS OF ITEMS SUCH AS OUTLET BOXES AS CONDUITS THAT DO NOT REQUIRE FIRE STOPPING. SPACE AND POSITION THESE DEVICES AS ALLOWED PER THE ASSEMBLY'S UL RATING.
16. SERVICE LABELING: LABEL EQUIPMENT, PIPING, CONDUITS, INCLUDING FANS, AIR HANDLERS, TERMINAL UNITS, PANELBOARDS, ETC. WITH LABELS MADE OF SELF-STICKING, PLASTIC FILM DESIGNED FOR OUTDOOR USE. LABELS SHALL MATCH DESIGNATIONS AS INDICATED ON CONTRACT DRAWINGS. IDENTIFY PIPING AND CONDUITS IN ACCORDANCE WITH OSHA 29 CFR 1910.144, EXCEPT THAT LABELS OR TAPES MAY BE USED IN LIEU OF PAINTING OR STENCILING. SPACING OF IDENTIFICATION MARKING ON RUNS SHALL NOT EXCEED 50 FEET. MATERIALS FOR LABELS AND TAPES SHALL CONFORM TO CID A-A-1689, AND SHALL BE GENERAL PURPOSE TYPE AND COLOR CLASS.
   A. IN ADDITION IDENTIFY SERVICES AS INDICATED BELOW:
   B. EACH POINT OF ENTRY AND EXIT OF PIPE OR CONDUITS PASSING THROUGH WALLS.
   C. EACH CHANGE IN DIRECTION, I.E., ELBOWS, TEES.
   D. IN CONGESTED OR HIDDEN AREAS AND AT ALL ACCESS PANELS AT EACH POINT REQUIRED TO CLARIFY SERVICE OR INDICATED HAZARD.
   E. IN LONG STRAIGHT RUNS, LOCATE LABELS AT DISTANCES WITHIN EYESIGHT OF EACH OTHER NOT TO EXCEED 50 FEET. ALL LABELS SHALL BE VISIBLE AND LEGIBLE FROM THE PRIMARY SERVICE AND OPERATING AREA.
17. MANUFACTURER'S NAMEPLATES: EACH ITEM OF EQUIPMENT SHALL HAVE A NAMEPLATE BEARING THE MANUFACTURER'S NAME, ADDRESS, MODEL NUMBER, AND SERIAL NUMBER SECURELY AFFIXED IN A CONSPICUOUS PLACE; THE NAMEPLATE OF THE DISTRIBUTING AGENT WILL NOT BE ACCEPTABLE.
18. POSTED OPERATING INSTRUCTIONS: PROVIDE FOR EACH SYSTEM AND PRINCIPAL ITEM OF EQUIPMENT AS SPECIFIED FOR USE BY OPERATION AND MAINTENANCE PERSONNEL. PRINT OR ENGRAVE OPERATING INSTRUCTIONS AND FRAME UNDER GLASS OR IN APPROVED LAMINATED PLASTIC. POST INSTRUCTIONS WHERE DIRECTED. FOR OPERATING INSTRUCTIONS EXPOSED TO THE WEATHER, PROVIDE WEATHER-RESISTANT MATERIALS OR WEATHERPROOF ENCLOSURES. OPERATING INSTRUCTIONS SHALL NOT FADE WHEN EXPOSED TO SUNLIGHT AND SHALL BE SECURED TO PREVENT EASY REMOVAL OR PEELING. THE OPERATING INSTRUCTIONS SHALL INCLUDE THE FOLLOWING.
   A. WIRING DIAGRAMS, CONTROL DIAGRAMS, AND CONTROL SEQUENCE FOR EACH PRINCIPAL SYSTEM AND ITEM OF EQUIPMENT.
   B. START UP, PROPER ADJUSTMENT, OPERATING, LUBRICATION, AND SHUTDOWN PROCEDURES.
   C. SAFETY PRECAUTIONS.
   D. THE PROCEDURE IN THE EVENT OF EQUIPMENT FAILURE.
   E. OTHER ITEMS OF INSTRUCTION AS RECOMMENDED BY THE MANUFACTURER OF EACH SYSTEM OR ITEM OF EQUIPMENT.
19. WARNING SIGNS: PROVIDE WARNING SIGNS FOR THE ENCLOSURES OF ELECTRICAL EQUIPMENT INCLUDING SUBSTATIONS, PAD-MOUNTED TRANSFORMERS, PAD-MOUNTED SWITCHES, GENERATORS, AND SWITCHGEAR HAVING A NOMINAL RATING EXCEEDING 600 VOLTS.
20. EXTERIOR FERROUS MATERIALS: ALL EXTERIOR FERROUS MATERIALS SHALL BE PROTECTED FROM CORROSION BY ONE OF THE FOLLOWING METHODS:
   A. COVERED WITH A NON-FERROUS OR NON-CORRODING MATERIAL.
   B. MATERIALS THAT ARE INSULATED ON THE EXTERIOR.
   C. MATERIALS THAT ARE GALVANIZED.
   D. MATERIALS THAT ARE PAINTED. EXTERIOR PAINTING SHALL CONSIST OF A BASE COAT OF AN APPROPRIATE PRIMER AND TWO COATS OF FINAL PAINT. FINAL PAINT COLOR SHALL BE SELECTED BY THE OWNER'S REPRESENTATIVE.

DUCTWORK SPECIFICATION

PART 1 GENERAL

1.1 QUALITY ASSURANCE: EXCEPT AS OTHERWISE SPECIFIED, APPROVAL OF MATERIALS AND EQUIPMENT IS BASED ON MANUFACTURER'S PUBLISHED DATA.

A. WHERE MATERIALS AND EQUIPMENT ARE SPECIFIED TO CONFORM TO THE STANDARDS OF THE UNDERWRITERS LABORATORIES, THE LABEL OF OR LISTING WITH REEXAMINATION IN UL BLD MAT DIR. AND UL 6 IS ACCEPTABLE AS SUFFICIENT EVIDENCE THAT THE ITEMS CONFORM TO UNDERWRITERS LABORATORIES REQUIREMENTS. IN LIEU OF SUCH LABEL OR LISTING, SUBMIT A WRITTEN CERTIFICATE FROM ANY NATIONALLY RECOGNIZED TESTING AGENCY, ADEQUATELY EQUIPPED AND COMPETENT TO PERFORM SUCH SERVICES, STATING THAT THE ITEMS HAVE BEEN TESTED AND THAT THE UNITS CONFORM TO THE SPECIFIED REQUIREMENTS. OUTLINE METHODS OF TESTING USED BY THE SPECIFIED AGENCIES.

B. WHERE MATERIALS OR EQUIPMENT ARE SPECIFIED TO BE CONSTRUCTED OR TESTED, OR BOTH, IN ACCORDANCE WITH THE STANDARDS OF THE ASTM INTERNATIONAL (ASTM), THE ASME INTERNATIONAL (ASME), OR OTHER STANDARDS, A MANUFACTURER'S CERTIFICATE OF COMPLIANCE OF EACH ITEM IS ACCEPTABLE AS PROOF OF COMPLIANCE.

C. CONFORMANCE TO SUCH AGENCY REQUIREMENTS DOES NOT RELIEVE THE ITEM FROM COMPLIANCE WITH OTHER REQUIREMENTS OF THESE SPECIFICATIONS.

PART 2 PRODUCTS

2.1 DUCT SYSTEMS

2.1.1 METAL DUCTWORK: PROVIDE METAL DUCTWORK CONSTRUCTION, INCLUDING ALL FITTINGS AND COMPONENTS, THAT COMPLIES WITH SMACNA "HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE", AS SUPPLEMENTED AND MODIFIED BY THIS SPECIFICATION.

A. PROVIDE RADIUS TYPE ELBOWS WITH A CENTERLINE RADIUS OF 1.5 TIMES THE WIDTH OR DIAMETER OF THE DUCT WHERE SPACE PERMITS. OTHERWISE, ELBOWS HAVING A MINIMUM RADIUS EQUAL TO THE WIDTH OR DIAMETER OF THE DUCT OR SQUARE ELBOWS WITH FACTORY FABRICATED TURNING VANES ARE ALLOWED.

B. PROVIDE SEALANTS THAT ARE SUITABLE FOR THE RANGE OF AIR DISTRIBUTION AND AMBIENT TEMPERATURES TO WHICH IT IS EXPOSED. DO NOT USE PRESSURE SENSITIVE TAPE AS A SEALANT.

C. MAKE SPIRAL LOCK SEAM DUCT, AND FLAT OVAL WITH DUCT SEALANT AND LOCK WITH NOT LESS THAN 3 EQUALLY SPACED DRIVE SCREWS OR OTHER APPROVED METHODS INDICATED IN SMACNA "HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE". APPLY THE SEALANT TO THE EXPOSED MALE PART OF THE FITTING COLLAR SO THAT THE SEALER IS ON THE INSIDE OF THE JOINT AND FULLY PROTECTED BY THE METAL OF THE DUCT FITTING. APPLY ONE BRUSH COAT OF THE SEALANT OVER THE OUTSIDE OF THE JOINT TO AT LEAST 2 INCH BAND WIDTH COVERING ALL SCREW HEADS AND JOINT GAP. DENTS IN THE MALE PORTION OF THE SLIP FITTING COLLAR ARE NOT ACCEPTABLE. FABRICATE OUTDOOR AIR INTAKE DUCTS AND PLENUMS WITH WATERTIGHT SOLDERED OR BRAZED JOINTS AND SEAMS.

2.1.2 INSULATED NONMETALLIC FLEXIBLE DUCT RUNOUTS: USE FLEXIBLE DUCT RUNOUTS ONLY WHERE INDICATED. RUNOUT LENGTH IS INDICATED ON THE DRAWINGS, AND IS NOT TO EXCEED 5 FEET. PROVIDE RUNOUTS THAT ARE PREINSULATED, FACTORY FABRICATED, AND THAT COMPLY WITH NFPA 90A AND UL 181. PROVIDE EITHER FIELD OR FACTORY APPLIED VAPOR BARRIER. PROVIDE NOT LESS THAN 20 OUNCE GLASS FABRIC DUCT CONNECTORS COATED ON BOTH SIDES WITH NEOPRENE. WHERE COIL INDUCTION OR HIGH VELOCITY UNITS ARE SUPPLIED WITH VERTICAL AIR INLETS, USE A STREAMLINED, VANED AND MITERED ELBOW TRANSITION PIECE FOR CONNECTION TO THE FLEXIBLE DUCT OR HOSE. PROVIDE A DIE-STAMPED ELBOW AND NOT A FLEXIBLE CONNECTOR AS THE LAST ELBOW TO THESE UNITS OTHER THAN THE VERTICAL AIR INLET TYPE. INSULATED FLEXIBLE CONNECTORS ARE ALLOWED AS RUNOUTS. PROVIDE INSULATED MATERIAL AND VAPOR BARRIER THAT CONFORM TO THE REQUIREMENTS OF SECTION 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. DO NOT EXPOSE THE INSULATION MATERIAL SURFACE TO THE AIR STREAM.

2.1.3 GENERAL SERVICE DUCT CONNECTORS: PROVIDE A FLEXIBLE DUCT CONNECTOR APPROXIMATELY 6 INCHES IN WIDTH WHERE SHEET METAL CONNECTIONS ARE MADE TO FANS OR WHERE DUCTS OF DISSIMILAR METALS ARE CONNECTED. FOR ROUND/OVAL DUCTS, SECURE THE FLEXIBLE MATERIAL BY STAINLESS STEEL OR ZINC-COATED, IRON CLINCH-TYPE DRAW BANDS. FOR RECTANGULAR DUCTS, INSTALL THE FLEXIBLE MATERIAL LOCKED TO METAL COLLARS USING NORMAL DUCT CONSTRUCTION METHODS. PROVIDE A COMPOSITE CONNECTOR SYSTEM THAT COMPLIES WITH NFPA 701 AND IS CLASSIFIED AS "FLAME-RETARDED FABRICS" IN UL BLD MAT DIR.

PART 3 EXECUTION

3.1 GENERAL: SEE DUCTWORK SCHEDULE FOR SYSTEM MATERIALS, PRESSURE CLASSIFICATIONS AND SEALANT REQUIREMENTS.

3.2 INSTALLATION

A. INSTALL MATERIALS AND EQUIPMENT IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT DRAWINGS AND APPROVED MANUFACTURER'S INSTALLATION INSTRUCTIONS. ACCOMPLISH INSTALLATION BY WORKERS SKILLED IN THIS TYPE OF WORK. PERFORM INSTALLATION SO THAT THERE IS NO DEGRADATION OF THE DESIGNED FIRE RATINGS OF WALLS, PARTITIONS, CEILINGS, AND FLOORS.

B. NO INSTALLATION IS PERMITTED TO BLOCK OR OTHERWISE IMPEDE ACCESS TO ANY EXISTING MACHINE OR SYSTEM. INSTALL ALL HINGED DOORS TO SWING OPEN A MINIMUM OF 120 DEGREES. PROVIDE AN AREA IN FRONT OF ALL ACCESS DOORS THAT CLEARS A MINIMUM OF 3 FEET. IN FRONT OF ALL ACCESS DOORS TO ELECTRICAL CIRCUITS, CLEAR THE AREA THE MINIMUM DISTANCE TO ENERGIZED CIRCUITS AS SPECIFIED IN OSHA STANDARDS, PART 1910.333 (ELECTRICAL-SAFETY RELATED WORK PRACTICES)AND AN ADDITIONAL 3 FEET.

3.2.2 FLEXIBLE DUCT

INSTALL PRE-INSULATED FLEXIBLE DUCT IN ACCORDANCE WITH THE LATEST PRINTED INSTRUCTIONS OF THE MANUFACTURER TO ENSURE A VAPOR TIGHT JOINT. PROVIDE HANGERS, WHEN REQUIRED TO SUSPEND THE DUCT, OF THE TYPE RECOMMENDED BY THE DUCT MANUFACTURER AND SET AT THE INTERVALS RECOMMENDED.

3.2.3 METAL DUCTWORK: INSTALL ACCORDING TO SMACNA "HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE" UNLESS OTHERWISE INDICATED. INSTALL DUCT SUPPORTS FOR SHEET METAL DUCTWORK ACCORDING TO SMACNA "HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE", UNLESS OTHERWISE SPECIFIED. DO NOT USE FRICTION BEAM CLAMPS INDICATED IN SMACNA. ANCHOR RISERS ON HIGH VELOCITY DUCTS IN THE CENTER OF THE VERTICAL RUN TO ALLOW ENDS OF RISER TO MOVE DUE TO THERMAL EXPANSION. ERECT SUPPORTS ON THE RISERS THAT ALLOW FREE VERTICAL MOVEMENT OF THE DUCT. ATTACH SUPPORTS ONLY TO STRUCTURAL FRAMING MEMBERS AND CONCRETE SLABS. DO NOT ANCHOR SUPPORTS TO METAL DECKING UNLESS A MEANS IS PROVIDED AND APPROVED FOR PREVENTING THE ANCHOR FROM PUNCTURING THE METAL DECKING. WHERE SUPPORTS ARE REQUIRED BETWEEN STRUCTURAL FRAMING MEMBERS, PROVIDE SUITABLE INTERMEDIATE METAL FRAMING. WHERE C-CLAMPS ARE USED, PROVIDE RETAINER CLIPS.

3.6 TESTING, ADJUSTING, AND BALANCING: PERFORM TAB IN ACCORDANCE WITH THE REQUIREMENTS OF THE TAB PROCEDURAL STANDARD RECOMMENDED BY THE TAB TRADE ASSOCIATION THAT APPROVED THE TAB FIRMS QUALIFICATIONS. COMPLY WITH REQUIREMENTS OF AABC "NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE", NEBB "PROCEDURAL STANDARDS FOR TAB (TESTING, ADJUSTING AND BALANCING) ENVIRONMENTAL SYSTEMS", OR SMACNA "HVAC SYSTEMS - TESTING, ADJUSTING AND BALANCING". RECOMMENDATIONS AND SUGGESTED PRACTICES CONTAINED IN THE TAB PROCEDURAL STANDARDS ARE CONSIDERED MANDATORY. SUBMIT TAB REPORTS TO THE OWNER'S REPRESENTATIVE.

3.7 PERFORMANCE TESTS: AFTER TESTING, ADJUSTING, AND BALANCING IS COMPLETE AS SPECIFIED, TEST EACH SYSTEM AS A WHOLE TO SEE THAT ALL ITEMS PERFORM AS INTEGRAL PARTS OF THE SYSTEM AND TEMPERATURES AND CONDITIONS ARE EVENLY CONTROLLED THROUGHOUT THE BUILDING. RECORD THE TESTING DURING THE APPLICABLE SEASON. MAKE CORRECTIONS AND ADJUSTMENTS AS NECESSARY TO PRODUCE THE CONDITIONS INDICATED OR SPECIFIED. CONDUCT CAPACITY TESTS AND GENERAL OPERATING TESTS BY AN EXPERIENCED ENGINEER. PROVIDE TESTS THAT COVER A PERIOD OF NOT LESS THAN 3 DAYS FOR EACH SYSTEM AND DEMONSTRATE THAT THE ENTIRE SYSTEM IS FUNCTIONING ACCORDING TO THE SPECIFICATIONS.

3.9 INSULATION: SEE DUCT INSULATION SCHEDULES FOR INSULATION MATERIAL AND INSTALLATION REQUIREMENTS.

DUCTWORK SYMBOLS

- 12Ø — SINGLE LINE ROUND DUCT (DIMENSIONS IN INCHES)
- 24x12 — SINGLE LINE RECTANGULAR DUCT, FIRST NUMBER IS VIEW SIZE, SECOND NUMBER IS DEPTH SIZE (DIMENSIONS IN INCHES)
- 12Ø — DOUBLE LINE ROUND DUCT (DIMENSIONS IN INCHES)
- 24x12 — DOUBLE LINE RECTANGULAR DUCT, FIRST NUMBER IS VIEW SIZE, SECOND NUMBER IS DEPTH SIZE (DIMENSIONS IN INCHES)
- 24/12 — DOUBLE LINE OVAL DUCT, FIRST NUMBER IS VIEW SIZE, SECOND NUMBER IS DEPTH SIZE (DIMENSIONS IN INCHES)
- INTERNALLY LINED DUCTWORK
- 8Ø — FLEX DUCT WITH SIZE (DIMENSIONS IINCHES)
- 90 DEGREE ELBOW WITH TURNING VANES
- ELBOW WITH TURNING VANES
- SUPPLY UP OR DN
- RETURN DUCT UP OR DN
- EXHAUST DUCT UP OR DN
- MANUAL BALANCING DAMPER
- FD&AD — FIRE DAMPER AND ACCESS DOOR
- SFD&AD — COMBINATION FIRE / SMOKE DAMPER & ACCESS DOOR, SPRING CLOSED/POWER OPEN DAMPER ACTUATOR MOTOR
- SLF4P-6x6-200 — SUPPLY DIFFUSER WITH DESIGNATION, NECK SIZE & CFM
- RPF24T-6-200 — RETURN GRILLE WITH DESIGNATION, NECK SIZE & CFM
- SLF4P-6x6-200 OR RPF24T-6-200 — SUPPLY OR RETURN GRILLE WITH DESIGNATION, NECK SIZE & CFM
- EPF24T-6-75 — EXHAUST GRILLE WITH DESIGNATION, NECK SIZE & CFM
- SUPPLY AIR FLOW
- RETURN / EXHAUST AIR FLOW

CONTROL SYMBOLS

- T — THERMOSTAT

GENERAL SYMBOLS

PLAN TITLES

A / A8 — SCALE: 1/8" = 1'-0" (0, 4', 8', 16')

A / A8 — SECTION MARKERS

NORTH ARROW

ITEMS TO BE DEMOLISHED

CODE REQUIREMENTS

ALL CONSTRUCTION SHALL FOLLOW THE 10TH ADDITION OF THE MASSACHUSETTS STATE BUILDING CODE AS FOLLOWS:
MASSACHUSETTS STATE BUILDING CODE (780 CMR),
MASSACHUSETTS ELECTRICAL CODE (527 CMR 12.00),
UNIFORM STATE PLUMBING CODE (248 CMR 10.00),
MASSACHUSETTS FUEL GAS CODE (248 CMR 4.00)
MASSACHUSETTS COMPREHENSIVE FIRE SAFETY CODE (527 CMR 1.00),
MASSACHUSETTS SANITARY CODE (105 CMR 410),
ARCHITECTURAL ACCESS BOARD (521 CMR),
MASSACHUSETTS STRETCH ENERGY CODE.

THE MASSACHUSETTS CODE AMENDS AND REFERENCES THE FOLLOWING CODES:
2021 INTERNATIONAL BUILDING CODE
2021 INTERNATIONAL RESIDENTIAL CODE (IRC):
2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
2021INTERNATIONAL EXISTING BUILDING CODE (IEBC)
2021INTERNATIONAL MECHANICAL CODE (IMC):
2023 NFPA 70 (NATIONAL ELECTRICAL CODE)

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. SYLVIA — REGISTERED PROFESSIONAL ENGINEER — 6/4/26

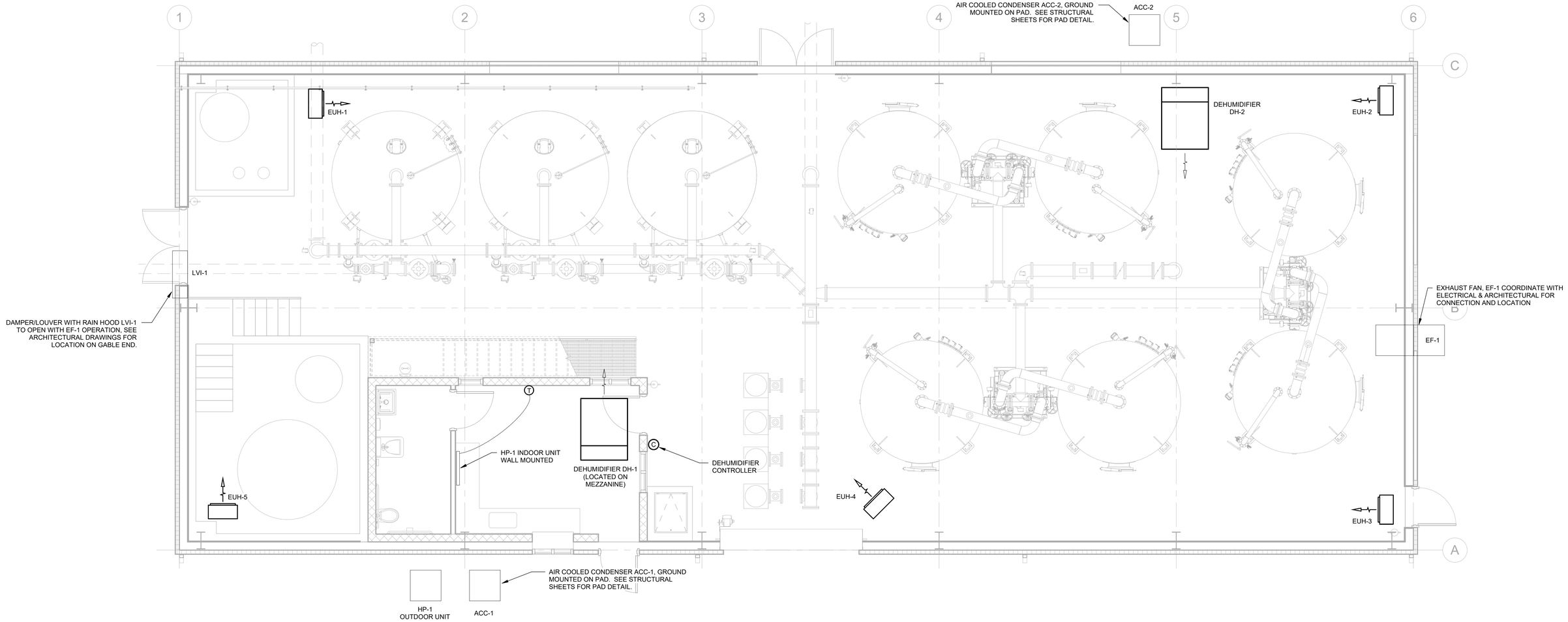
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	12" = 1'-0"
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	GJG
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
MECHANICAL NOTES & SYMBOLS

DRAWING NO.:
H-1

SHEET NO. 48 OF 57



1 / H-2

MECHANICAL PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
MECHANICAL PLANS

DRAWING NO.:
H-2

SHEET NO. 49 OF 57

MECHANICAL PIPING MATERIAL SCHEDULE						
PIPING SYSTEM	ABBREVIATION	OPERATING TEMPERATURE (°F) OR PRESSURE (PSI)	SERVICE PRESSURE (PSI)	PIPE DIAMETER, NPS (INCH)	PIPE MATERIAL \ SCHEDULE OR TYPE \ SPECIFICATION	JOINT MATERIAL \ TYPE \ SPECIFICATION
COOLING COIL CONDENSATE	C	55°F	N/A	0.5 - 4.0	CPR \ L \ ASTM B88 HARD DRAWN PVC \ 40 \ ASTM D 2665	WC \ SOLDER SOCKET \ ASME B16.22 CPR \ PRESS FITTING \ ASME 18.18 OR ASME B16.22 PVC \ SOCKET SOLVENT CEMENT \ ASTM F 891
REFRIGERANT	LL & VL	45°F - 150°F	150	0.5 - 2.0	CPR-ACR \ \ ASTM B280	WC \ SOCKET BRAZED \ ASME B16.22

NOTES
1. VALVE JOINT TYPE INCLUDES OTHER VALVES AND ITEMS NOT SHOWN IN SCHEDULE (I.E. STRAINERS, BALANCING VALVES)
2. DRAWINGS MAY INDICATE DIFFERENT VALVE TYPE. VALVE TYPE SHALL BE AS SHOWN ON DRAWINGS UNLESS OTHERWISE INDICATED.
3. MXIMUM WORKING PRESSURE OF 62 PSI AT 180°F.

PIPE MATERIAL ABBREVIATION SCHEDULE	
CPR	COPPER
CPR-ACR	COPPER AIR-CONDITIONING REFRIGERATION
PVC	POLYVINYLCHLORIDE

JOINT MATERIAL ABBREVIATION SCHEDULE	
CPR	COPPER
PVC	POLYVINYLCHLORIDE
WC	WROUGHT COPPER

MECHANICAL PIPE SUPPORT SCHEDULE, NOTE 1				
PIPE MATERIAL \ SCHEDULE OR TYPE \ SPECIFICATION	PIPE SIZE (IN)	MAX. HORIZONTAL SUPPORT SPACING (FT)	MIN. HORIZONTAL HANGER ROD SIZE DIAMETER (IN)	MAX. VERTICAL SUPPORT SPACING (FT)
CPR \ L \ ASTM B88 HARD DRAWN	0.50	4	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	0.75	5	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	1.00	6	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	1.25	6	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	1.50	9	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	2.00	10	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	2.50	10	1/2	10
CPR-ACR \ \ ASTM B280	<0.5	4	1/4	10
CPR-ACR \ \ ASTM B280	0.50	4	3/8	10
CPR-ACR \ \ ASTM B280	0.75	5	3/8	10
CPR-ACR \ \ ASTM B280	1.00	6	3/8	10
PVC\ 40 \ ASTM D 2665	0.50	3	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	0.75	3	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	1.00	3	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	1.25	4	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	1.50	4	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	2.00	4	3/8	10, NOTE 3

NOTES:
1. PIPE SUPPORTS BASED ON STRAIGHT RUNS WITH NO VALVES. PROVIDE ADDITIONAL SUPPORTS AS REQUIRED.
2. ROD MATERIAL BASED ON STEEL ROLLED THREADS, S=9.5 KSI.
3. MID STORY GUIDE REQUIRED.
4. AS RECOMMENDED BY PIPING MANUFACTURER.

MECHANICAL PIPING & EQUIPMENT INSULATION SCHEDULE														
PIPING SYSTEM, NOTE 1	LOCATION	PIPING TEMP. (°F)	INSULATION THICKNESS BASED ON PIPE DIAMETER (IN), NOTE 2						INSULATION MATERIAL, NOTE 3	K-FACTOR AT A 75°F MEAN TEMP.	JACKET TYPE, NOTE 3	FITTING COVER TYPE	PRODUCT, NOTE 4	MANUFACTURER, NOTE 4
			RUNOUTS <2	<=1	1.0 - 1.25	1.5 - 3.5	4 - 6	>=8						
COOLING COIL CONDENSATE	INTERIOR	55	0.5	0.5	0.5	0.5	0.5	0.5	GLASS MINERAL WOOL	0.23	ASJ+	PVC	EARTHWOOL 1000°	KNAUF
REFRIGERANT VAPOR	INTERIOR	45	0.5	0.5	1.0	1.0	1.0	1.0	CLOSED CELL ELASTOMERIC FOAM	0.25	N/A	N/A	AP ARMAFLEX	ARMACELL
REFRIGERANT VAPOR	EXTERIOR	45	1.0	1.0	1.5	1.5	1.5	1.5	CLOSED CELL ELASTOMERIC FOAM	0.25	N/A	N/A	AP ARMAFLEX	ARMACELL

NOTES:
1. SEE PIPING SCHEDULE FOR PIPING TYPES.
2. RUNOUTS ARE AREAS WERE PIPING IS RUN IN PARTITIONS WITHIN CONDITIONED SPACES.
3. INSULATION AND JACKET SHALL HAVE A MAXIMUM FLAME SPREAD OF 25 & SMOKE DEVELOPMENT OF 50 PER ASTM E 84.
4. OR EQUAL MANUFACTURERS ARE ACCEPTABLE.

ELECTRIC UNIT HEATER SCHEDULE					
DESIGNATION	EUH-1	EUH-2	EUH-3	EUH-4	EUH-4
DESCRIPTION	ELECTRIC UNIT HEATER	ELECTRIC UNIT HEATER	ELECTRIC UNIT HEATER	ELECTRIC UNIT HEATER	ELECTRIC UNIT HEATER
HEATER OUTPUT (KW)	20	20	20	20	20
AIR FLOW (CFM)	1000	1000	1000	1000	1000
FAN MOTOR HP	1/10	1/10	1/10	1/10	1/10
ACCESSORIES	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET
LOCAL ELECTRICAL DISCONNECT	PROVIDE	PROVIDE	PROVIDE	PROVIDE	PROVIDE
ELECTRICAL (V/PH/HZ)	480V/3/60	480V/3/60	480V/3/60	480V/3/60	480V/3/60
ELECTRICAL MCA (AMPS)	24.8	24.8	24.8	24.8	24.8
ELECTRICAL MOCP (AMPS)	35	35	35	35	35
WEIGHT (LBS)	78	78	78	78	78
MODEL	IUH-2048	IUH-2048	IUH-2048	IUH-2048	IUH-2048
MANUFACTURER	QMARK / MARLEY	QMARK / MARLEY	QMARK / MARLEY	QMARK / MARLEY	QMARK / MARLEY

DEHUMIDIFIER SCHEDULE		
DESIGNATION	DH-1	DH-2
DESCRIPTION	LOW TEMPERATURE DESIGN DEHUMIDIFIER UNIT OUTDOOR AIR COOLED CONDENSER	LOW TEMPERATURE DESIGN DEHUMIDIFIER UNIT OUTDOOR AIR COOLED CONDENSER
SUPPLY AIR FLOW (CFM)	2750.00	2750.00
COOLING COIL TYPE	DX	DX
COOLING COIL REFRIGERANT TYPE	R-407C	R-407C
COOLING LAT. CAPACITY (MBH)	10.00	10.00
COOLING SENS. CAPACITY (MBH)	50.00	50.00
COOLING TOTAL CAPACITY (MBH)	60.00	60.00
COOLING EAT DB/RH (F)	70 / 50%	70 / 50%
DEHUMIDIFICATION RATE (LBS/HR)	13.20	13.20
HOT GAS LINE SIZE (IN), NOTE 2	7/8	7/8
LIQUID LINE SIZE (IN), NOTE 2	1/2	1/2
FILTER TYPE	MERV 8	MERV 8
TEMPERATURE AND HUMIDITY CONTROLLER	PROVIDE CM3540-3-WALL WALL MOUNTED CONTROLLER WITH TEMP AND RH SENSORS	PROVIDE CM3540-3-WALL WALL MOUNTED CONTROLLER WITH TEMP AND RH SENSORS
TEMPERATURE AND HUMIDITY SENSOR	PROVIDE WALL MOUNT TYPE	PROVIDE WALL MOUNT TYPE
ACCESSORIES	SECONDARY DRAIN PAN UNDER UNIT, ELECTROFIN COATING ON COILS	SECONDARY DRAIN PAN UNDER UNIT, ELECTROFIN COATING ON COILS
LOCAL ELECTRICAL DISCONNECT	PROVIDE	PROVIDE
ELECTRICAL (V/PH/HZ)	480/3/60	480/3/60
ELECTRICAL MCA, ESTIMATED note 3	12	12
ELECTRICAL MOCP, ESTIMATED Note 3	15	15
AIR COOLED CONDENSER		
DESIGNATION	ACC-1	ACC-2
SERVICE	DH-1	DH-2
DESCRIPTION	AIR COOLED CONDENSER	AIR COOLED CONDENSER
AIR FLOW RATE (CFM)		
REFRIGERANT TYPE	R-407C	R-407C
CONDENSER EAT TEMP. (F)	95.00	95.00
HEAT OF REJECTION (MBH)	48.00	48.00
ACCESSORIES	ELECTROFIN COATING ON COILS	ELECTROFIN COATING ON COILS
LOCAL ELECTRICAL DISCONNECT	PROVIDE	PROVIDE
ELECTRICAL (V/PH/HZ)	480/3/60	480/3/60
ELECTRICAL MCA	2.50	2.50
ELECTRICAL MOCP	15.00	15.00
DH MODEL	LW05	LW05
ACC MODEL	NOTE 1	NOTE 1
MANUFACTURER	DESERT-AIRE	DESERT-AIRE

NOTES:
1. CONFIRM ACC UNIT MEETS THE REQUIREMENTS OF THE DH UNIT IT SERVES.
2. PROVIDE REFRIGERANT PIPING BETWEEN DH AND ACC UNIT. INSTALL PER DH MANUFACTURER'S REQUIREMENTS.
3. MECHANICAL CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR FOR SIZE OF CIRCUIT IF DIFFERENT FROM WHAT IS SHOWN.

EXHAUST FAN SCHEDULE	
DESIGNATION	EF-1
DESCRIPTION	SIDEWALL DIRECT DRIVE FAN
CONSTRUCTION	SEE STANDARD CONSTRUCTION FEATURES BELOW
AIR FLOW (CFM)	6,000
EXT. STATIC PRESS. (IWG)	0.250
FAN RPM	1,750
MOTOR RPM	1,750
MOTOR TYPE	VARIGREEN (ECM)
MOTOR OPERATING HP	1.19
MOTOR HP	2.0
AMCA SOUND RATING (SONES)	30.0
BACK DRAFT DAMPER	PROVIDE MOTORIZED TYPE
ACCESSORIES	SEE ACCESSORIES LIST BELOW
ELECTRICAL (V/PH/HZ)	480/3/60
ELECTRICAL FLA (AMPS)	3.2
ELECTRICAL MOCP (AMPS)	15
WEIGHT (LBS)	292
MODEL	AER-24-VG
MANUFACTURER	GREENHECK OR APPROVED EQUAL

STANDARD CONSTRUCTION FEATURES:
GALVANIZED STEEL FAN PANEL - DIE FORMED, GALVANIZED STEEL DRIVE FRAME ASSEMBLY.
CAST ALUMINUM AIRFOIL BLADE PROPELLER - BALL BEARING MOTORS - CORROSION RESISTANT FASTENERS.

ACCESSORIES:
SELECTED OPTIONS & ACCESSORIES:
MOTOR - VARI-GREEN EC MOTOR
CONTROL - DIAL FOR BALANCING
AIRFLOW DIRECTION: EXHAUST
LONG WALL HSG, FLUSH EXTERIOR, W/OSHA GRD., FACTORY INSTALLED, CTD WITH PERMATECTOR, CONCRETE GRAY-RAL 7023
MOTOR ACCESS: FROM INT. OF BLDG.
MOUNTING STYLE - FLUSH
WEATHERHOOD, GALVANIZED 45 DEG. WITH BIRD SCREEN, SHIPPED LOOSE FROM FACTORY
CTD PERMATECTOR, CONCRETE GRAY-RAL 7023
PROPELLER GUARD, COATED STEEL, FACTORY ATTACHED
COATED WITH PERMATECTOR, CONCRETE GRAY-RAL 7023, FAN AND ATTACHED ACC
DAMPER SHIPPED LOOSE, WD-320-PB-26X26, COATED
DAMPER ACTUATOR (MP-310), 460 VAC ACTUATED
END SWITCH

LOUVER SCHEDULE											
DESIGNATION	DESCRIPTION	LENGTH (IN)	HEIGHT (IN)	MAX AIR FLOW (CFM)	FREE AREA (SF)	STAIC PRESS. DROP (IWG), NOTE 1	FINISH	COLOR	ACCESSORIES	MODEL	MANUFACTURER
INTAKE											
LVI-1	INTAKE, WIND DRIVEN RAIN RESISTANT LOUVER	60	48	6,000	8.32	0.1	AAMA 2605 COMPLIANT COATING, 100% FLUOROPOLYMER (FEVE) OR 2-COAT 70% KYNAR (PVDF)	AS SELECTED BY ARCHITECT	BIRD SCREEN	EHH-401	GREENHECK OR APPROVED EQUAL

NOTES:
1. MAXIMUM ALLOWABLE PRESSURE DROP AT MAXIMUM CFM, IN OF H2O.

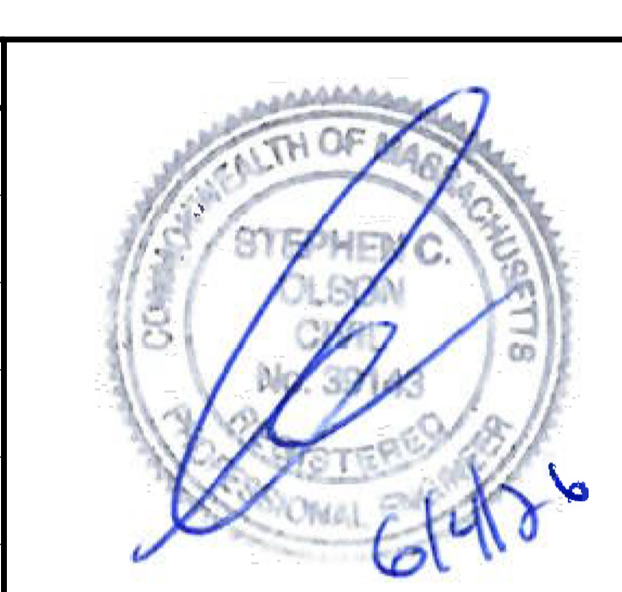
FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION



PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	GJG
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
MECHANICAL DIAGRAMS & SCHEDULES

DRAWING NO.:
H-3

GENERAL NOTES

1. PROJECT SCOPE: PROVIDE COMPLETE AND OPERATIONAL SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS INCLUDING ALL NECESSARY MATERIAL, LABOR, AND EQUIPMENT.
2. CONSTRUCTION\CONTRACT DOCUMENTS: CONTRACT DOCUMENTS INCLUDING PLANS, DETAILS, AND ONE-LINE DIAGRAMS SHOW THE GENERAL LOCATION AND ARRANGEMENT OF THE WORK. THESE DOCUMENTS ARE DIAGRAMMATIC AND DO NOT SHOW ALL CONNECTORS, FITTINGS, HANGERS, AND ADDITIONAL ELEMENTS WHICH THE CONTRACTOR MUST PROVIDE TO COMPLETE THE SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN, THAT MAY EXIST, THUS REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE PROJECT AREA BEFORE PERFORMING THE WORK. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BY FIELD MEASUREMENTS.
3. COORDINATION:
   A. THE CONTRACTOR SHALL COORDINATE THEIR WORK WITH ALL CONSTRUCTION DOCUMENTS AND OTHER TRADES ASSOCIATED WITH THE PROJECT.
   B. THE CONTRACTOR SHALL VISIT THE SITE OF WORK AND FAMILIARIZE HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE NATURE OF THE INSTALLATION AND CONDITIONS.
   C. BEFORE SELECTING MATERIAL, EQUIPMENT AND PROCEEDING WITH WORK, INSPECT AREAS WHERE MATERIAL AND EQUIPMENT ARE TO BE INSTALLED TO INSURE SUITABILITY, AND CHECK NEEDED SPACE FOR PLACEMENT, CLEARANCES AND INTERCONNECTIONS.
   D. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN THAT MAY EXIST; THUS, REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE SPACE BEFORE PERFORMING THE WORK.
   E. BEFORE CUTTING OR DRILLING INTO BUILDING ELEMENTS INSPECT AND LAYOUT WORK TO AVOID DAMAGING STRUCTURAL ELEMENTS AND BUILDING UTILITIES.
   F. ARRANGE FOR CHASES, SLOTS, AND OPENINGS IN OTHER BUILDING COMPONENTS DURING PROGRESS OF CONSTRUCTION, TO ALLOW FOR PROPER SYSTEM INSTALLATIONS.
   G. COORDINATE THE INSTALLATION OF REQUIRED SUPPORTING DEVICES AND SLEEVES TO BE SET IN POURED IN PLACE CONCRETE AND OTHER STRUCTURAL COMPONENTS, AS THEY ARE CONSTRUCTED.
   H. H) SEQUENCE, COORDINATE, AND INTEGRATE INSTALLATIONS OF MATERIALS AND EQUIPMENT FOR EFFICIENT FLOW OF THE WORK. GIVE PARTICULAR ATTENTION TO LARGE EQUIPMENT REQUIRING POSITIONING PRIOR TO CLOSING IN THE BUILDING.
   I. FAILURE OF THE CONTRACTOR TO ACQUAINT HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE ABOVE CONDITIONS AND NOT PERFORMING PROPER COORDINATION WILL NOT RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY FOR ESTIMATING THE DIFFICULTIES AND COSTS FOR SUCCESSFULLY PERFORMING THE COMPLETE WORK UNDER THIS PROJECT.
4. SHUTDOWNS: WRITTEN REQUESTS FOR APPROVAL FOR PLANNED SHUTDOWNS OR INTERRUPTION OF OWNER'S UTILITIES, SYSTEMS AND EQUIPMENT SHALL BE MADE 72 HOURS PRIOR TO THE START OF THE REQUESTED SHUTDOWN PERIODS.
5. CODES AND STANDARDS: THE CONTRACTOR SHALL FOLLOW ALL FEDERAL, STATE AND LOCAL CODES THAT HAVE JURISDICTION WHERE THE WORK IS BEING PERFORMED. THROUGHOUT THE CONTRACT DOCUMENTS CERTAIN CODES AND STANDARDS ARE REFERENCED. THE CONTRACTOR SHALL USE THE LATEST VERSIONS OF CODES AND STANDARDS REFERENCED UNLESS OTHERWISE NOTED. IF THE CONTRACTOR IS NOT FAMILIAR WITH THE REFERENCED STANDARD THEY SHALL CONTACT THE OWNER'S REPRESENTATIVE FOR DIRECTION.
6. PERMITS: THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED PERMITS AND ARRANGE FOR ALL REQUIRED INSPECTIONS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES.
7. WORKMAN: ALL WORK SHALL BE DONE WITH LICENSED WORKMEN IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES CODES AND REGULATIONS.
8. SUBMITTALS: THE CONTRACTOR SHALL PROVIDE SUBMITTALS FOR ALL EQUIPMENT AND MATERIALS BEING PROVIDED BEFORE SUCH EQUIPMENT AND MATERIALS ARE PURCHASED AND INSTALLED. THE SUBMITTALS SHALL BE REVIEWED AND RETURNED BY THE OWNER'S REPRESENTATIVE WITH APPROPRIATE COMMENTS. SUBMITTALS SHALL BE SUBMITTED ELECTRONICALLY IN PDF FORMAT AND WILL BE RETURNED WITH COMMENTS TO THE CONTRACTOR IN PDF FORMAT.
9. AS-BUILT DOCUMENTATION: THE CONTRACTOR SHALL PROVIDE ONE MARK-UP SET OF CONSTRUCTION DOCUMENTS SHOWING FINAL AS-BUILT CONDITIONS. DOCUMENTS SHALL CLEARLY SHOW THE CHANGES MADE TO THE INSTALLED SYSTEMS.
10. EQUIPMENT WARRANTIES, MAINTENANCE MANUALS AND INSTALLATION MANUALS: TURN OVER TO THE OWNER ALL MANUFACTURERS' WARRANTIES, MAINTENANCE MANUALS, AND INSTALLATION MANUALS FOR EQUIPMENT AND MATERIALS PROVIDED.
11. PHOTOGRAPHS: PHOTOGRAPHS ARE PROVIDED TO SHOW CURRENT CONDITION OF BUILDING SYSTEMS TO ASSIST THE CONTRACTOR. PHOTOGRAPHS DO NOT SHOW ALL AREAS OF THE BUILDING OR ALL SYSTEM CONDITIONS, THUS REQUIRING THE CONTRACTOR TO VISIT THE SITE BEFORE PERFORMING WORK. PHOTOGRAPHS ARE NOT INTENDED TO SHOW SCOPE OF WORK. PLANS, NOTES, SPECIFICATIONS AND OTHER BID DOCUMENTS INDICATE SCOPE OF WORK.
12. TERMINOLOGY:
   A. THE TERM "INDICATED" SHALL MEAN, "AS SHOWN ON CONTRACT DOCUMENTS (SPECIFICATIONS, DRAWINGS, AND RELATED ATTACHMENTS)".
   B. THE TERM "PROVIDE" SHALL MEAN, "TO FURNISH, INSTALL, AND CONNECT COMPLETELY".
   C. THE TERM "COORDINATE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "TO MANAGE, INTERFACE, COMMUNICATE, MAKE ARRANGEMENT, BRING INTO ORDER, ADMINISTER AND HANDLE COMPLETELY".
   D. THE TERM "INTERIOR" IS AN INTERIOR LOCATION WHERE ITS ENVIRONMENT IS HEATED AND/OR AIR CONDITIONED AND NOT SUBJECT TO OUTSIDE WEATHER CONDITIONS.
   E. THE TERM "EXTERIOR" IS ALL LOCATIONS, WHICH ARE NOT INTERIOR, OR UNDERGROUND.
   F. THE TERM "INTERIOR FINISHED SPACE" IS INTERIOR SPACES, WHICH ARE USED FOR OFFICES, CORRIDORS, LOBBIES, TOILETS, STORAGE AND FILING ROOMS, LOUNGES, MECHANICAL ROOMS, ELECTRICAL ROOMS, ETC.
13. DEMOLITION: DEMOLITION OF INDICATED ITEMS INCLUDES THE REMOVAL AND PROPER DISPOSAL OF THOSE ITEMS AND ALL ASSOCIATED PIPING, DUCTWORK, WIRING AND HANGERS. ELECTRICAL BRANCH, CONTROL, TELEPHONE, AND ALARM WIRING SHALL BE REMOVED BACK TO PANELBOARDS OR RELATED SYSTEM PANELS OR BACKBOARDS.
14. EQUIPMENT AND MATERIAL INSTALLATIONS:
   A. ALL EQUIPMENT AND MATERIALS SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING AND MANUFACTURER'S REQUIREMENTS.
   B. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
   C. IF AN EQUIPMENT MANUFACTURER REQUIRES LARGER CAPACITY, CIRCUITRY AND/OR EQUIPMENT, THE CONTRACTOR SHALL PROVIDE SUCH CAPACITY AND/OR EQUIPMENT UNDER HIS CONTRACT AT NO ADDITIONAL COST TO THE OWNER.
   D. LOCATE ALL EQUIPMENT, WHICH REQUIRES SERVICING IN FULLY ACCESSIBLE POSITIONS. IF REQUIRED FOR BETTER ACCESSIBILITY, FURNISH ACCESS DOORS FOR THAT PURPOSE.
   E. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR BETTER ACCESSIBILITY.
   F. ALL WORK IN INTERIOR FINISHED SPACES SHALL BE CONCEALED BEHIND WALLS, ABOVE CEILINGS OR HUNG CEILINGS, OR UNDER THE FLOOR. PROVIDE ALL NECESSARY CUTTING, PATCHING, REPAINTING AND/OR REPLACEMENT OF CEILING TILES AS REQUIRED TO PERFORM WORK.
   G. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO CONFORM WITH APPROVED SUBMITTAL DATA, INCLUDING COORDINATION DRAWINGS (IF REQUIRED), TO GREATEST EXTENT POSSIBLE. CONFORM TO ARRANGEMENTS INDICATED BY THE CONTRACT DOCUMENTS, RECOGNIZING THAT PORTIONS OF THE WORK ARE SHOWN ONLY IN DIAGRAMMATIC FORM. WHERE COORDINATION REQUIREMENTS CONFLICT WITH INDIVIDUAL SYSTEM REQUIREMENTS, REFER CONFLICT TO THE ARCHITECT/ENGINEER.
   H. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT LEVEL AND PLUMB, PARALLEL AND PERPENDICULAR TO OTHER BUILDING SYSTEMS AND COMPONENTS, WHERE INSTALLED EXPOSED IN FINISHED SPACES
   I. INSTALL EQUIPMENT TO FACILITATE SERVICING, MAINTENANCE, AND REPAIR OR REPLACEMENT OF EQUIPMENT COMPONENTS. AS MUCH AS PRACTICAL, CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM OF INTERFERENCE WITH OTHER INSTALLATIONS.
   J. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT GIVING RIGHT OF WAY PRIORITY TO SYSTEMS REQUIRED TO BE INSTALLED AT A SPECIFIED SLOPE.
   K. K) WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE.
   L. ASCERTAIN FROM EXAMINATION OF THE DRAWINGS, ANY SPECIAL TEMPORARY OPENINGS IN THE BUILDING REQUIRED FOR THE ADMISSION OF APPARATUS PROVIDED UNDER THIS DIVISION. NOTIFY THE CONTRACTOR WITH SUFFICIENT NOTICE TO PROVIDE THESE OPENINGS. IN THE EVENT OF FAILURE TO GIVE SUFFICIENT NOTICE, THE CONTRACTOR SHALL ASSUME ALL COSTS OF PROVIDING SUCH OPENINGS THEREAFTER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DISASSEMBLY AND ASSEMBLY OF EQUIPMENT AS REQUIRED TO PLACE EQUIPMENT IN THEIR FINAL LOCATIONS.
   M. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UNDERGROUND UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
15. FIRE RATINGS: THE CONTRACTOR SHALL REVIEW ALL CONTRACT DOCUMENTS FOR FIRE SEPARATION AND FIRE RATED ASSEMBLIES. ALL PIPING, DUCTWORK AND CONDUITS PASSING THROUGH FIRE RATED PENETRATING WALLS, CEILINGS AND FLOORS SHALL BE PROVIDED WITH A UL LISTED FIRE STOPPING ASSEMBLIES. UL LISTED FIRE STOPPING ASSEMBLIES SHALL BE SUITABLE FOR THE CONDITIONS ENCOUNTERED AND SHALL BE RATED EQUAL TO THE RATING OF THE WALL, CEILING OR FLOOR. REVIEW FIRE RATED ASSEMBLIES THAT ALLOW PENETRATIONS OF ITEMS SUCH AS OUTLET BOXES AND CONDUITS THAT DO NOT REQUIRE FIRE STOPPING. SPACE AND POSITION THESE DEVICES AS ALLOWED PER THE ASSEMBLY'S UL RATING.
16. SERVICE LABELING: LABEL EQUIPMENT, PIPING, CONDUITS, INCLUDING FANS, AIR HANDLERS, TERMINAL UNITS, PANELBOARDS, ETC. WITH LABELS MADE OF SELF-STICKING, PLASTIC FILM DESIGNED FOR PERMANENT INSTALLATION. LABELS SHALL MATCH DESIGNATIONS AS INDICATED ON CONTRACT DRAWINGS. IDENTIFY PIPING AND CONDUITS IN ACCORDANCE WITH OSHA 29 CFR 1910.144, EXCEPT THAT LABELS OR TAPES MAY BE USED IN LIEU OF PAINTING OR STENCILING. SPACING OF IDENTIFICATION MARKING ON RUNS SHALL NOT EXCEED 50 FEET. MATERIALS FOR LABELS AND TAPES SHALL CONFORM TO CID A-A-1689. LABELS SHALL BE GENERAL PURPOSE, TYPE AND COLOR OR CLASS.
   A. IN ADDITION IDENTIFY SERVICES AS INDICATED BELOW:
   B. EACH POINT OF ENTRY AND EXIT OF PIPE OR CONDUITS PASSING THROUGH WALLS.
   C. EACH CHANGE IN DIRECTION, I.E., ELBOWS, TEES.
   D. IN CONGESTED OR HIDDEN AREAS AND AT ALL ACCESS PANELS AT EACH POINT REQUIRED TO CLARIFY SERVICE OR INDICATED HAZARD.
   E. IN LONG STRAIGHT RUNS, LOCATE LABELS AT DISTANCES WITHIN EYESIGHT OF EACH OTHER NOT TO EXCEED 50 FEET. ALL LABELS SHALL BE VISIBLE AND LEGIBLE FROM THE PRIMARY SERVICE AND OPERATING AREA.
17. MANUFACTURER'S NAMEPLATE: EACH ITEM OF EQUIPMENT SHALL HAVE A NAMEPLATE BEARING THE MANUFACTURER'S NAME, ADDRESS, MODEL NUMBER, AND SERIAL NUMBER SECURELY AFFIXED IN A CONSPICUOUS PLACE; THE NAMEPLATE OF THE DISTRIBUTING AGENT WILL NOT BE ACCEPTABLE.
18. POSTED OPERATING INSTRUCTIONS: PROVIDE FOR EACH SYSTEM AND PRINCIPAL ITEM OF EQUIPMENT AS SPECIFIED FOR USE BY OPERATION AND MAINTENANCE PERSONNEL. PRINT OR ENGRAVE OPERATING INSTRUCTIONS AND FRAME UNDER GLASS OR IN APPROVED LAMINATED PLASTIC. POST INSTRUCTIONS WHERE DIRECTED. FOR OPERATING INSTRUCTIONS EXPOSED TO THE WEATHER, PROVIDE WEATHER-RESISTANT MATERIALS OR WEATHERPROOF ENCLOSURES. OPERATING INSTRUCTIONS SHALL NOT FADE WHEN EXPOSED TO SUNLIGHT AND SHALL BE SECURED TO PREVENT EASY REMOVAL OR PEELING. THE OPERATING INSTRUCTIONS SHALL INCLUDE THE FOLLOWING:
   A. WIRING DIAGRAMS, CONTROL DIAGRAMS, AND CONTROL SEQUENCE FOR EACH PRINCIPAL SYSTEM AND ITEM OF EQUIPMENT.
   B. START UP, PROPER ADJUSTMENT, OPERATING, LUBRICATION, AND SHUTDOWN PROCEDURES.
   C. SAFETY PRECAUTIONS.
   D. THE PROCEDURE IN THE EVENT OF EQUIPMENT FAILURE.
   E. OTHER ITEMS OF INSTRUCTION AS RECOMMENDED BY THE MANUFACTURER OF EACH SYSTEM OR ITEM OF EQUIPMENT.
19. WARNING SIGNS: PROVIDE WARNING SIGNS FOR THE ENCLOSURES OF ELECTRICAL EQUIPMENT INCLUDING SUBSTATIONS, PAD-MOUNTED TRANSFORMERS, PAD-MOUNTED SWITCHES, GENERATORS, AND SWITCHGEAR HAVING A NOMINAL RATING EXCEEDING 600 VOLTS.
20. EXTERIOR FERROUS MATERIALS: ALL EXTERIOR FERROUS MATERIALS SHALL BE PROTECTED FROM CORROSION BY ONE OF THE FOLLOWING METHODS:
   A. COVERED WITH A NON-FERROUS OR NON-CORRODING MATERIAL.
   B. MATERIALS THAT ARE INSULATED ON THE EXTERIOR.
   C. MATERIALS THAT ARE GALVANIZED.
   D. MATERIALS THAT ARE PAINTED. EXTERIOR PAINTING SHALL CONSIST OF A BASE COAT OF AN APPROPRIATE PRIMER AND TWO COATS OF FINAL PAINT. FINAL PAINT COLOR SHALL BE SELECTED BY THE OWNER'S REPRESENTATIVE.

ELECTRICAL SPECIFICATIONS

PART 1 GENERAL

1. SEE GENERAL NOTES AND REQUIREMENTS.
2. PROVIDE A COMPLETE AND OPERATIONAL ELECTRICAL SYSTEM INCLUDING ALL NECESSARY MATERIAL, LABOR, EQUIPMENT AND TESTING REQUIRED.
3. ELECTRICAL PLANS, DETAILS, AND ONE-LINE DIAGRAMS SHOW THE GENERAL LOCATION AND ARRANGEMENT OF THE ELECTRICAL SYSTEM. THEY ARE DIAGRAMMATIC AND DO NOT SHOW ALL CONDUIT BODIES, CONNECTORS, BENDS, FITTINGS, HANGERS, AND ADDITIONAL PULL AND JUNCTION BOXES WHICH THE CONTRACTOR MUST PROVIDE TO COMPLETE THE ELECTRICAL SYSTEM. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BY FIELD MEASUREMENTS.
4. ELECTRICAL PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN, THAT MAY EXIST, THUS REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE SPACE BEFORE PERFORMING THE WORK.
5. ALL EQUIPMENT AND MATERIAL SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING.
6. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS AND ARRANGE FOR ALL REQUIRED INSPECTIONS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES.
7. ALL WORK SHALL BE DONE WITH LICENSED WORKMEN IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES AND CODES.
8. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE CONNECTICUT BUILDING CODE, FIRE CODE, AND THE NATIONAL ELECTRIC CODE (NEC) ANSI/NFPA 70 2014 EDITION.
9. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC) ANSI/NFPA 70 2014 EDITION.
10. INSTALLATION OF EMERGENCY LIGHTING AND EXIT SIGNS SHALL MEET ALL APPLICABLE CODES AND REGULATIONS INCLUDING BUILDING CODES, NEC AND ADA.
11. THE DEFINITION OF ELECTRICAL TERMS USED SHALL BE AS DEFINED IN THE 2017 EDITION OF THE NATIONAL ELECTRICAL CODE (NEC).
12. THE TERM "INDICATED" SHALL MEAN, "AS SHOWN ON CONTRACT DOCUMENTS (SPECIFICATIONS, DRAWINGS, AND RELATED ATTACHMENTS)".
13. THE TERM "PROVIDE" SHALL MEAN, "TO FURNISH, INSTALL, AND CONNECT COMPLETELY".
14. THE TERM "SIZE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "LENGTH, CURRENT AND VOLTAGE RATING, NUMBER OF POLES, NEMA SIZE, AND OTHER SIMILAR ELECTRICAL CHARACTERISTICS".
15. THE TERM "SPACE" ON PANELBOARD AND SWITCHBOARD SCHEDULES SHALL MEAN, "PROVIDE SPACE TO INSTALL THE NUMBER OF POLES AND SIZE OF THE PROTECTIVE DEVICE INDICATED WITH ALL THE NECESSARY SPACE ON THE BUSBAR AND FITTINGS TO INSTALL THE DEVICE AT SOME FUTURE DATE".
16. THE TERM "COORDINATE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "TO MANAGE, INTERFACE, COMMUNICATE, MAKE ARRANGEMENT, BRING INTO ORDER, ADMINISTER AND HANDLE COMPLETELY".
17. COORDINATE ELECTRICAL WORK WITH OWNER.
18. PROVIDE AS-BUILT, AND OPERATIONAL AND MAINTENANCE (O&M) DOCUMENTATION TO OWNER.

PART 2 PRODUCTS AND EXECUTION

1. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UNDERGROUND UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
2. THE CONTRACTOR SHALL VISIT THE SITE OF WORK AND FAMILIARIZE HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE NATURE OF THE INSTALLATION AND CONDITIONS. FAILURE OF THE CONTRACTOR TO ACQUAINT HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE ABOVE CONDITIONS WILL NOT RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY FOR ESTIMATING THE DIFFICULTIES AND COSTS FOR SUCCESSFULLY PERFORMING THE COMPLETE WORK UNDER THIS PROJECT.
3. WHERE ELECTRICAL OUTLET BOXES AND DEVICES ARE INSTALLED IN FIRE RATED WALLS, SEE ARCHITECTURAL DRAWING FOR RATED WALLS. LOCATE BOX OPENINGS AND SIZE OF OPENINGS IN WALL IN ACCORDANCE WITH U.L. RATING REQUIREMENTS TO MAINTAIN FIRE RATING OF WALL. PROVIDE FIRE STOPPING PRODUCTS AND ASSEMBLIES AS REQUIRED BY THE CODES, BY U.L. LISTED ASSEMBLIES AND BY LOCAL FIRE AND BUILDING INSPECTION DEPARTMENTS TO MEET THEIR FINAL APPROVALS.
4. WHERE ELECTRICAL CABLES AND RACEWAYS PASS THROUGH FIRE RATED WALLS AND FLOORS, PENETRATIONS IN WALLS AND FLOORS SHALL BE FIRE SEALED WITH U.L. RATED PRODUCTS SUITABLE FOR CONDITIONS ENCOUNTERED AND RATING REQUIRED TO MAINTAIN THE RATING OF THE U.L. FIRE RATED ASSEMBLY INVOLVED.
5. THE RIGHT IS RESERVED BY THE ENGINEER OR OWNER TO MAKE REASONABLE CHANGES IN LOCATIONS OF EQUIPMENT, OUTLETS, OR WIRING PRIOR TO THE INSTALLATION WITHOUT INVOLVING ADDITIONAL COST OR EXPENSE TO THE OWNER.
6. TURN OVER TO THE OWNER ALL MANUFACTURER'S WARRANTIES FOR EQUIPMENT AND MATERIALS PROVIDED.
7. UNLESS OTHERWISE INDICATED, ALL ELECTRICAL EQUIPMENT HAS BEEN BASED ON GENERAL ELECTRIC PRODUCTS. THE CONTRACTOR MAY SUBSTITUTE PRODUCTS OF ANOTHER MANUFACTURER IF IT IS OF EQUAL QUALITY AND RATING, SUBJECT TO ENGINEER'S REVIEW AND OWNER'S ACCEPTANCE.
8. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
14. **ELECTRIC SERVICE**
15. COORDINATE ELECTRIC SERVICE INSTALLATION WITH POWER COMPANY.
16. PROVIDE A TEMPORARY ELECTRIC SERVICE FOR ELECTRICAL POWER DURING CONSTRUCTION.
17. **PANELBOARDS**
18. ALL PANELBOARDS SHALL BE PROVIDED WITH AN EQUIPMENT GROUNDING BUS CONNECTED TO PANELBOARD ENCLOSURE. WHEN SCHEDULES ON THE PANELBOARDS REQUIRE AN ADDITIONAL ISOLATED GROUND BUS, WHICH IS TO BE INSULATED FROM THE ENCLOSURE AND GROUNDED BACK TO THE ELECTRICAL SERVICE, EQUIPMENT GROUND THIS BUS USING INSULATED EQUIPMENT GROUNDING CONDUCTOR IN PANELBOARD FEEDER.
19. PROVIDE PANEL NAME PLATE WITH 3 LINES OF TEXT. PANEL NAME ON TOP, FEEDER INFORMATION ON SECOND LINE AND FEED SOURCE LOCATION ON THIRD LINE. EXAMPLE "PANEL A / FED FROM MAIN SWITCH BOARD 1 / MAIN ELECTRIC RM 123". COORDINATE FINIAL PANEL AND ROOM NAMES FOR EACH PANEL WITH OWNER. LABEL SOURCE FEED DISTRIBUTION PANEL AND OR SWITCH BOARD WITH ANY REVISIONS.
20. PROVIDE A TYPED PANEL SCHEDULE FOR ALL PANELS INSTALLED OR MODIFIED IN THE PROJECT. SCHEDULE SHALL BE PROVIDED IN A CLEAR PLASTIC PROTECTIVE COVERING INSIDE THE DOOR TO THE PANEL.
21. UNLESS OTHERWISE INDICATED, ALL ENCLOSURES FOR EQUIPMENT SHALL BE NEMA TYPE 1.
22. EXTERIOR EQUIPMENT ENCLOSURES SHALL BE WEATHERPROOF FOR CONDITION ENCOUNTERED AND SHALL MEET THE MINIMUM REQUIREMENTS OF NEMA TYPE 3R.
23. UNLESS OTHERWISE INDICATED, EXTERNALLY OPERATED SAFETY SWITCHES (DISCONNECT SWITCHES) SHALL BE UN-FUSED, SOLID NEUTRAL HEAVY DUTY AND SIZED TO MEET THE LOAD REQUIREMENTS.
24. **WIRING METHODS**
25. PROVIDE POWER WIRING FOR HEATING, VENTILATION AND AIR CONDITIONING SYSTEM. CONTROL WIRING WILL BE PROVIDED UNDER DIVISION 15, "MECHANICAL".
26. CONDUIT SIZE FOR INDICATED CONDUCTORS SHALL BE BASED ON ARTICLE [illegible] AND APPENDIX C OF NEC.
27. THE CONTRACTOR [illegible] GROUP BRANCH CIRCUIT HOMERUN CONDUIT", [illegible] RACEWAY IN ACCORDANCE WITH ARTICL[illegible] OF THE NEC, UTILIZING CORR[illegible]CTORS FOR CON[illegible]GER CONDUCTORS AS MA[illegible]
28. UNLESS [illegible]CH WIRING AND FEEDERS [illegible]RTITIONS, WALLS, BELO[illegible]
29. METALLIC CON[illegible]NG MAY BE EXPOSED ABOVE [illegible], MECHANICAL, AND A[illegible]
30. MINIMUM SIZE CONDU[illegible]MT OR 3/4" RSC AND PVC
31. UNLESS OTHERWISE INDIC[illegible]ERS TO BE RUN IN EMT CONDUIT.
32. UNLESS OTHERWISE INDICATED, BRANCH AND CONTROL WIRING SHALL BE INSTALLED IN EMT.
33. NONMETALLIC CABLE SHALL NOT BE INSTALLED EXPOSED OR WALLS HAVING FIRE RATED CONSTRUCTION.
34. UNLESS OTHERWISE INDICATED, WIRING TO EQUIPMENT AND MOTORS MAY BE INSTALLED IN LIQUID TIGHT FLEXIBLE METALLIC CONDUIT. FOR INTERIOR DRY LOCATIONS FLEXIBLE METAL CONDUIT MAY BE USED. MAXIMUM LENGTH OF FLEXIBLE CONDUIT SHALL BE 5 FEET. PROVIDE INSULATED GROUND CONDUCTOR IN ALL FLEXIBLE CONDUIT.
35. UNLESS OTHERWISE INDICATED, FLEXIBLE METAL CONDUIT MAY BE USED FOR LIGHTING FIXTURE DROPS, CONNECTION OF VIBRATING EQUIPMENT, UNDER COUNTER AND DISPLAY CASE WIRING.
36. BEFORE SELECTING MATERIAL, EQUIPMENT AND PROCEEDING WITH WORK, INSPECT AREAS WHERE MATERIAL AND EQUIPMENT ARE TO BE INSTALLED TO INSURE SUITABILITY, AND CHECK NEEDED SPACE FOR PLACEMENT, CLEARANCES AND INTERCONNECTIONS.
37. BEFORE CUTTING OR DRILLING INTO BUILDING ELEMENTS, INSPECT AND LAYOUT WORK TO AVOID DAMAGING STRUCTURAL ELEMENTS AND BUILDING UTILITIES.
38. THE MEASUREMENT FROM ABOVE FINISHED FLOOR (AFF) OF BOXES, DEVICES OR LIGHTING FIXTURES SHALL BE TAKEN FROM THE FINISHED FLOOR SURFACE TO THE ELEVATION INDICATED. IN NO CASE THE MOUNTING HEIGHT SHALL VIOLATE THE REQUIREMENTS OF THE CONNECTICUT BUILDING CODE, THE CONNECTICUT FIRE SAFETY CODE, AND THE NATIONAL ELECTRIC CODE (NEC) ANSI/NFPA 70.

MOTOR AND PHASE ROTATION

1. CONTRACTOR TO COORDINATE ROTATION OF ALL MOTORS WITH MECHANICAL OR DIVISION SPECIFYING MOTORS.
2. ALL MOTOR SHALL HAVE SAFETY DISCONNECTS WITHIN IN SITE OF MOTOR. PROVIDE DISCONNECT SIZED TO MOTOR HP.
3. TURN OVER TO THE OWNER ALL MANUFACTURER'S WARRANTIES FOR EQUIPMENT AND MATERIALS PROVIDED.
4. UNLESS OTHERWISE INDICATED, ALL ELECTRICAL EQUIPMENT HAS BEEN BASED ON GENERAL ELECTRIC PRODUCTS. THE CONTRACTOR MAY SUBSTITUTE PRODUCTS OF ANOTHER MANUFACTURER IF IT IS OF EQUAL QUALITY AND RATING, SUBJECT TO ENGINEER'S REVIEW AND OWNER'S ACCEPTANCE.
5. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.

14. **MOTOR AND PHASE ROTATION**

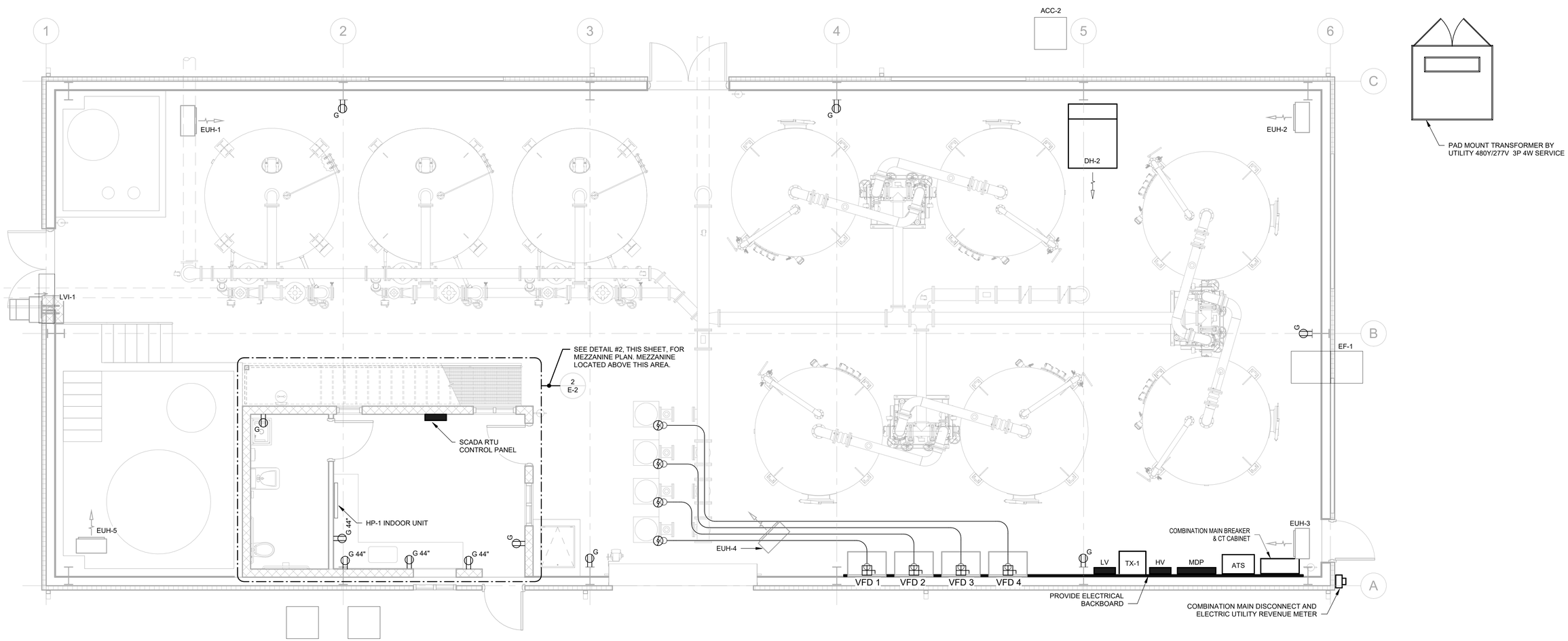
1. CONTRACTOR TO COORDINATE ROTATION OF ALL MOTORS WITH MECHANICAL OR DIVISION SPECIFYING MOTORS.
2. ALL MOTOR SHALL HAVE SAFETY DISCONNECTS WITHIN IN SITE OF MOTOR. PROVIDE DISCONNECT SIZED TO MOTOR HP.

1. TURN OVER TO THE OWNER ALL MANUFACTURER'S WARRANTIES FOR EQUIPMENT AND MATERIALS PROVIDED.
2. UNLESS OTHERWISE INDICATED, ALL ELECTRICAL EQUIPMENT HAS BEEN BASED ON GENERAL ELECTRIC PRODUCTS. THE CONTRACTOR MAY SUBSTITUTE PRODUCTS OF ANOTHER MANUFACTURER IF IT IS OF EQUAL QUALITY AND RATING, SUBJECT TO ENGINEER'S REVIEW AND OWNER'S ACCEPTANCE.
3. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.

1. FOR INTERIOR CONCEALED BRANCH AND CONTROL WIRING LOCATED IN WALLS AND CEILINGS THAT HAVE NUMBER 6 AWG AND SMALLER CONDUCTORS MAY BE METAL CLAD CABLE (MC CABLE, TYPE MC) WITH ONE INSULATED EQUIPMENT GROUNDING CONDUCTOR.
2. ALL CONDUCTORS TO BE 12 AWG, UNLESS OTHERWISE INDICATED.
3. ALL CONDUCTORS TO BE COPPER DUAL RATED THWN / THHN, UNLESS OTHERWISE INDICATED.
4. ALUMINUM CONDUCTORS SHALL NOT BE USED.
5. THE TEMPERATURE RATING OF CONNECTIONS SHALL BE A MINIMUM OF 75 DEGREES CENTIGRADE, UNLESS OTHERWISE INDICATED.
6. PROVIDE A DEDICATED NEUTRAL CONDUCTOR FOR ALL FEEDERS AND BRANCH WIRING, UNLESS OTHERWISE INDICATED. NEUTRAL SHALL NOT BE SHARED WITH OTHER BRANCH CIRCUITS OR OTHER PHASES.
7. UNLESS OTHERWISE INDICATED, NEUTRAL CONDUCTORS FOR 3 PHASE 208Y/120 AND 480Y/277V SYSTEMS SHALL BE RATED FOR 1.0 TIMES THE AMPACITY OF THE PHASE CONDUCTORS.

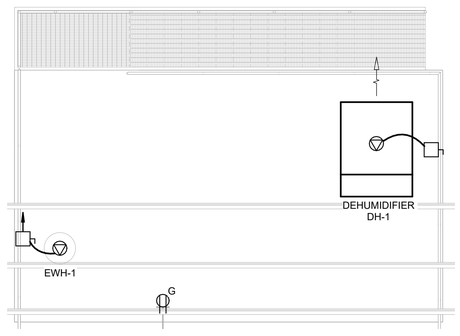
HVAC POWER AND CONTROL

1. ALL ROOFTOP EQUIPMENT



1 / E-2 POWER PLAN

Scale: 1/4" = 1'-0"



2 / E-2 MEZZANINE POWER PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON
ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

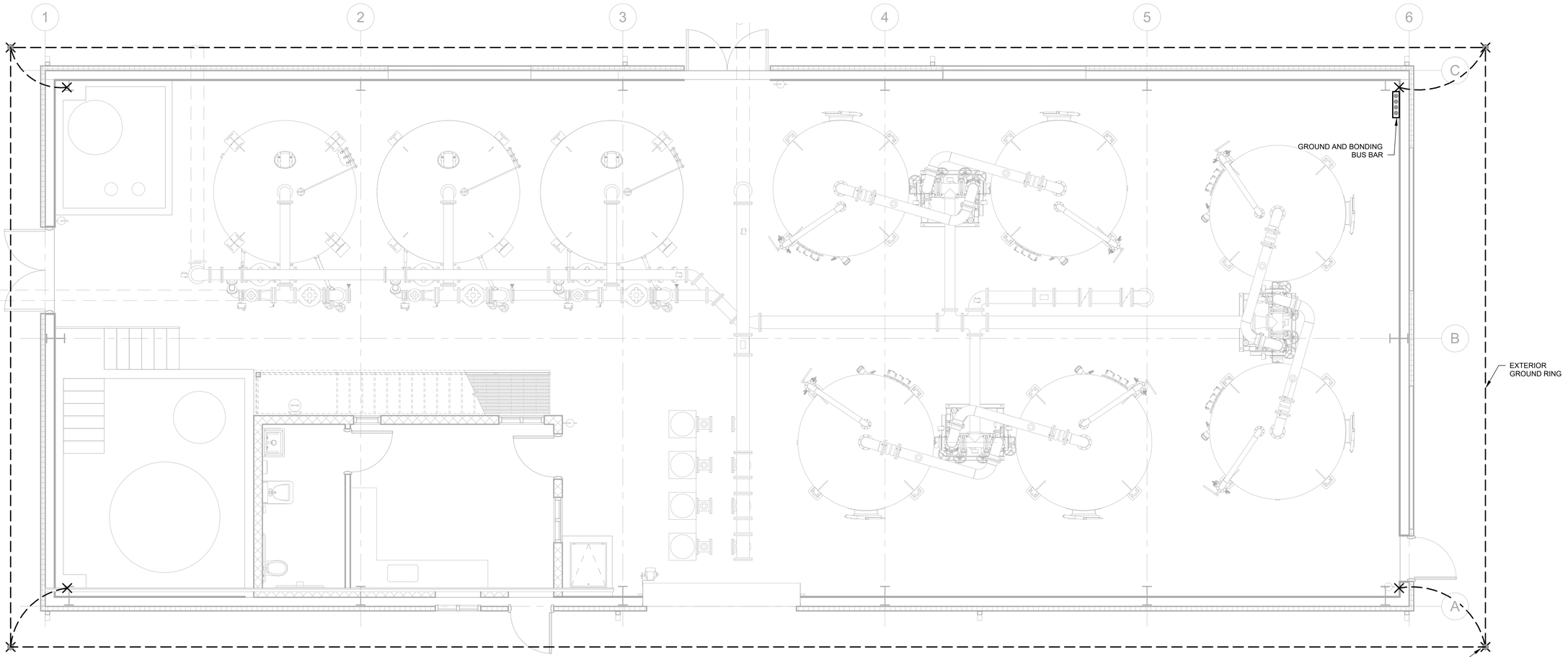
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
ELECTRICAL PLANS
POWER

DRAWING NO.:
E-2

SHEET NO. 52 OF 57



1
E-3

GROUNDING & BONDING PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
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REVISIONS		
NO.	DATE	DESCRIPTION

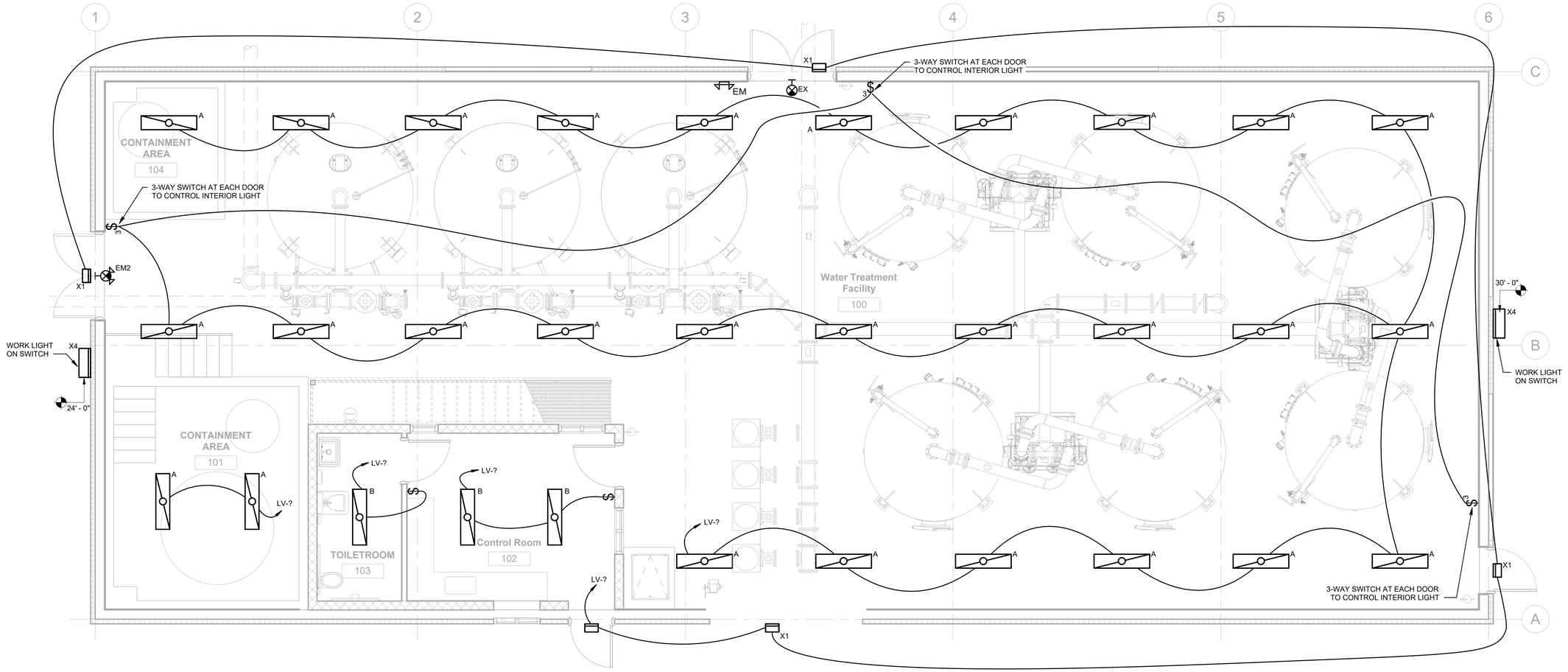
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
ELECTRICAL PLANS
GROUNDING &
BONDING

DRAWING NO.:
E-3

SHEET NO. 53 OF 57



1
E-4

LIGHTING PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

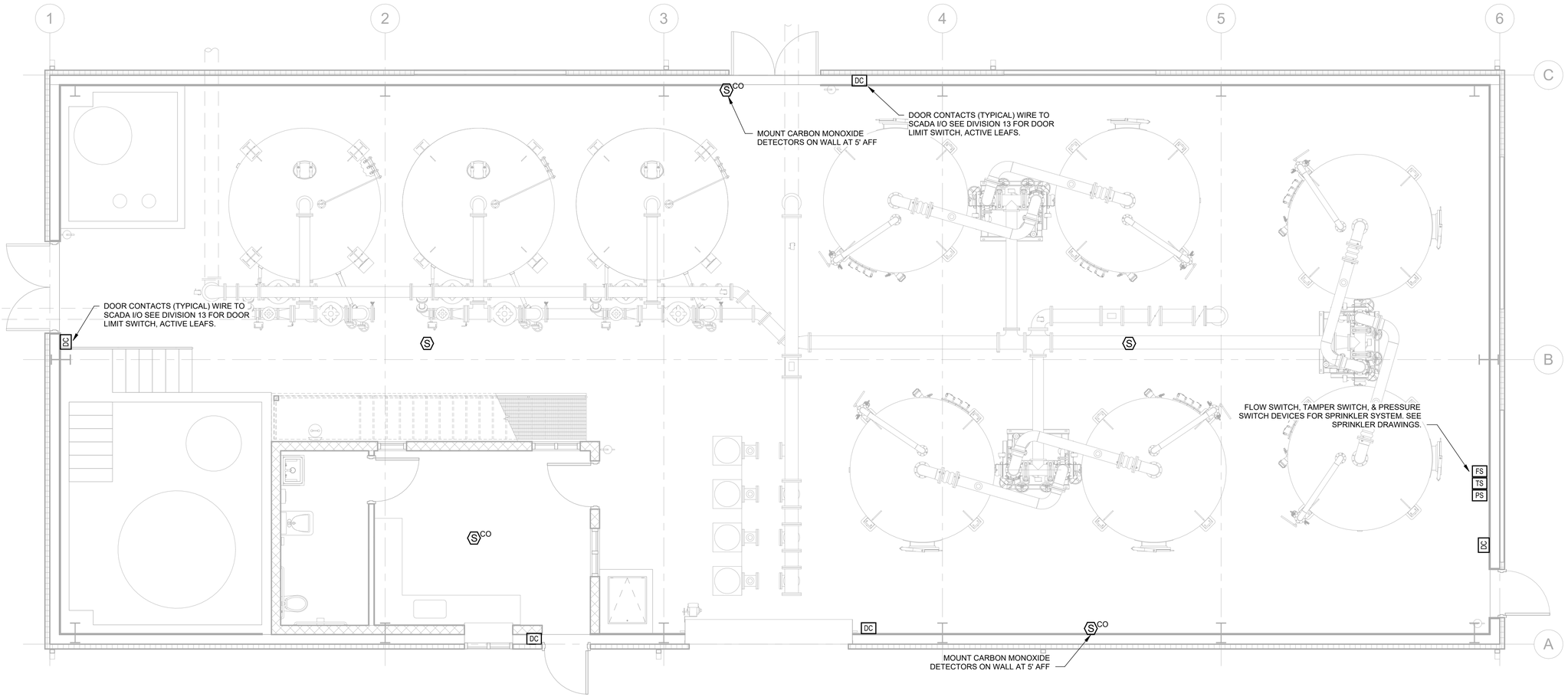
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
TREATMENT PLANT
ELECTRICAL
LIGHTING PLANS

DRAWING NO.:
E-4

SHEET NO. 54 OF 57



1
E-5

INSTRUMENTATION & CONTROL WIRING PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

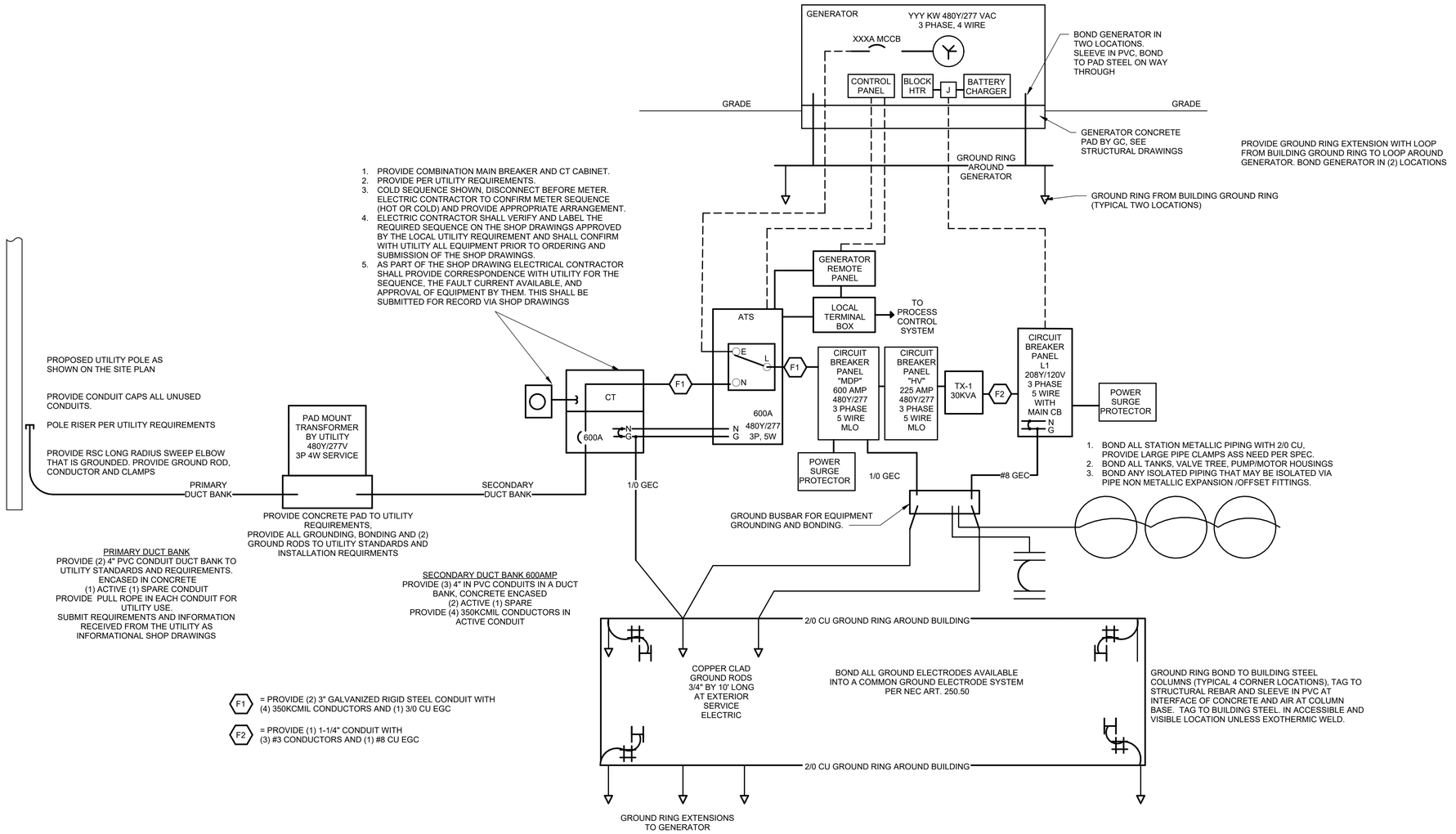
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
INSTRUMENTATION PLANS & CONTROL PLAN

DRAWING NO.:
E-5

SHEET NO. 55 OF 57



1
E-6

ONE LINE DIAGRAM - POWER PS/PFAS 600AMP SERVICE

Scale: 12" = 1'-0"

FOR PERMITTING

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DRINKING WATER PROFESSIONALS

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www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	12" = 1'-0"
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
ELECTRICAL ONE LINE DIAGRAM

DRAWING NO.:
E-6

SHEET NO. 56 OF 57

FIXTURE TYPE "A"


CS CONTRACTOR SELECT™

LITHONIA LIGHTING.

Catalog Number	
Notes	
Type	

Contractor Select™

CSVT

Vapor Tight LED Strip Light

These fully-gasketed, wet-location, and code-compliant vapor tights are and IP65 and IP66 rated. They can be surface mounted on the ceiling or wall and are designed for continuous row mounting. The CSVT vapor tights are ideal for outdoor venues, canopies and locker rooms.

FEATURES:

- The fully gasketed, polycarbonate housing with polycarbonate captive latches provides a water-tight seal and stands up to dust and dirt with its IP65 and IP66 ratings
- Provides the performance you need with the UV-stabilized, high-impact, frosted polycarbonate lens for uniform light output and high impact-resistance
- Quick and simple to install with the snap-lock tool-less access
- Available with Switchable technology

Catalog Number	UPC	Description	Lumens	Wattage	Voltage	Color Temperature	Color Rendering Index
CSVT L48 5000LM MVOLT 40K 80CRI	00194995069408	4' MVOLT Vapor Tight LED Strip Light	4946	42	MVOLT (120-277)	4000K	80CRI
CSVT L48 ALO3 MVOLT SWW3 80CRI	00194995069507	4' MVOLT Switchable LED Vapor Tight Strip Light	3106 - 4946	27 - 42	MVOLT (120-277)	35K/40K/50K	80CRI
CSVT L96 10000LM MVOLT 40K 80CRI	00194995280858	8' MVOLT LED Vapor Tight Strip Light	10300	87.9	MVOLT(120-277)	4000K	80CRI
CSVT L96 ALO4 MVOLT SWW3 80CRI	00194995069446	8' MVOLT LED Vapor Tight Strip Light	6495-10300	55.3-87.9	MVOLT(120-277)	35K/40K/50K	80CRI

More configurations are available. Click here or visit www.acuitybrands.com and search for CSVT LED.

Accessories: *Order as separate catalog number.*

CSVT STSL LATCH	Stainless steel latch kit (Set of 10) ‡
CSVTRMBA	Angle mount bracket (QTY of 2) (316 stainless steel)
CSVTRMBU	Rigid mount U-bolt bracket (QTY of 2) (316 stainless steel)
CSVTRMBK	Rigid mount bracket (QTY of 2) (316 stainless steel)
CSVTSMB	Replacement standard mounting brackets (QTY of 2) (301 stainless steel)
MHCH36SS	36" stainless steel chain (QTY of 2)

‡ Option Value Ordering Restrictions	
Option value	Restriction
CSVT STSL LATCH	Requires two for L96

Shown with CSVTRMBA

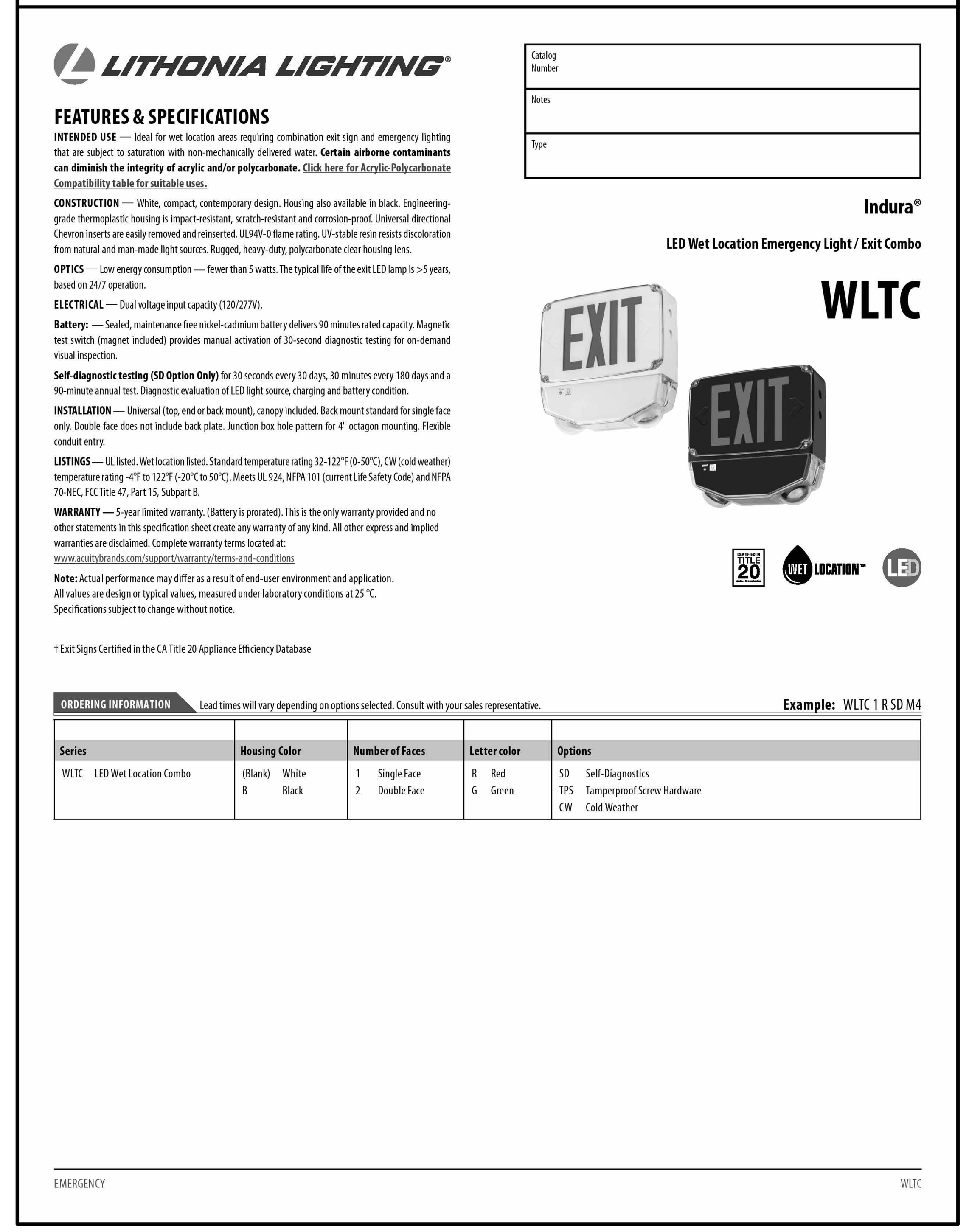
Shown with CSVTSMB (ships standard with fixture)

Shown with CSVTRMBU

Shown with CSVTRMBK

CONTRACTOR SELECT-CSVT   Page 1 of 2

FIXTURE TYPE "EM2"


LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	

Indura®

LED Wet Location Emergency Light / Exit Combo

WLTC

FEATURES & SPECIFICATIONS

INTENDED USE — Ideal for wet location areas requiring combination exit sign and emergency lighting that are subject to saturation with non-mechanically delivered water. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate.** Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.

CONSTRUCTION — White, compact, contemporary design. Housing also available in black. Engineering-grade thermoplastic housing is impact-resistant, scratch-resistant and corrosion-proof. Universal directional Chevron inserts are easily removed and reinserted. UL94V-0 flame rating. UV-stable resin resists discoloration from natural and man-made light sources. Rugged, heavy-duty, polycarbonate clear housing lens.

OPTICS — Low energy consumption — fewer than 5 watts. The typical life of the exit LED lamp is >5 years, based on 24/7 operation.

ELECTRICAL — Dual voltage input capacity (120/277V).

Battery: — Sealed, maintenance free nickel-cadmium battery delivers 90 minutes rated capacity. Magnetic test switch (magnet included) provides manual activation of 30-second diagnostic testing for on-demand visual inspection.

Self-diagnostic testing (SD Option Only) for 30 seconds every 30 days, 30 minutes every 180 days and a 90-minute annual test. Diagnostic evaluation of LED light source, charging and battery condition.

INSTALLATION — Universal (top, end or back mount), canopy included. Back mount standard for single face only. Double face does not include back plate. Junction box hole pattern for 4" octagon mounting. Flexible conduit entry.

LISTINGS — UL listed. Wet location listed. Standard temperature rating 32-122°F (0-50°C), CW (cold weather) temperature rating -4°F to 122°F (-20°C to 50°C). Meets UL 924, NFPA 101 (current Life Safety Code) and NFPA 70-NEC, FCC Title 47, Part 15, Subpart B.

WARRANTY — 5-year limited warranty. (Battery is prorated). This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

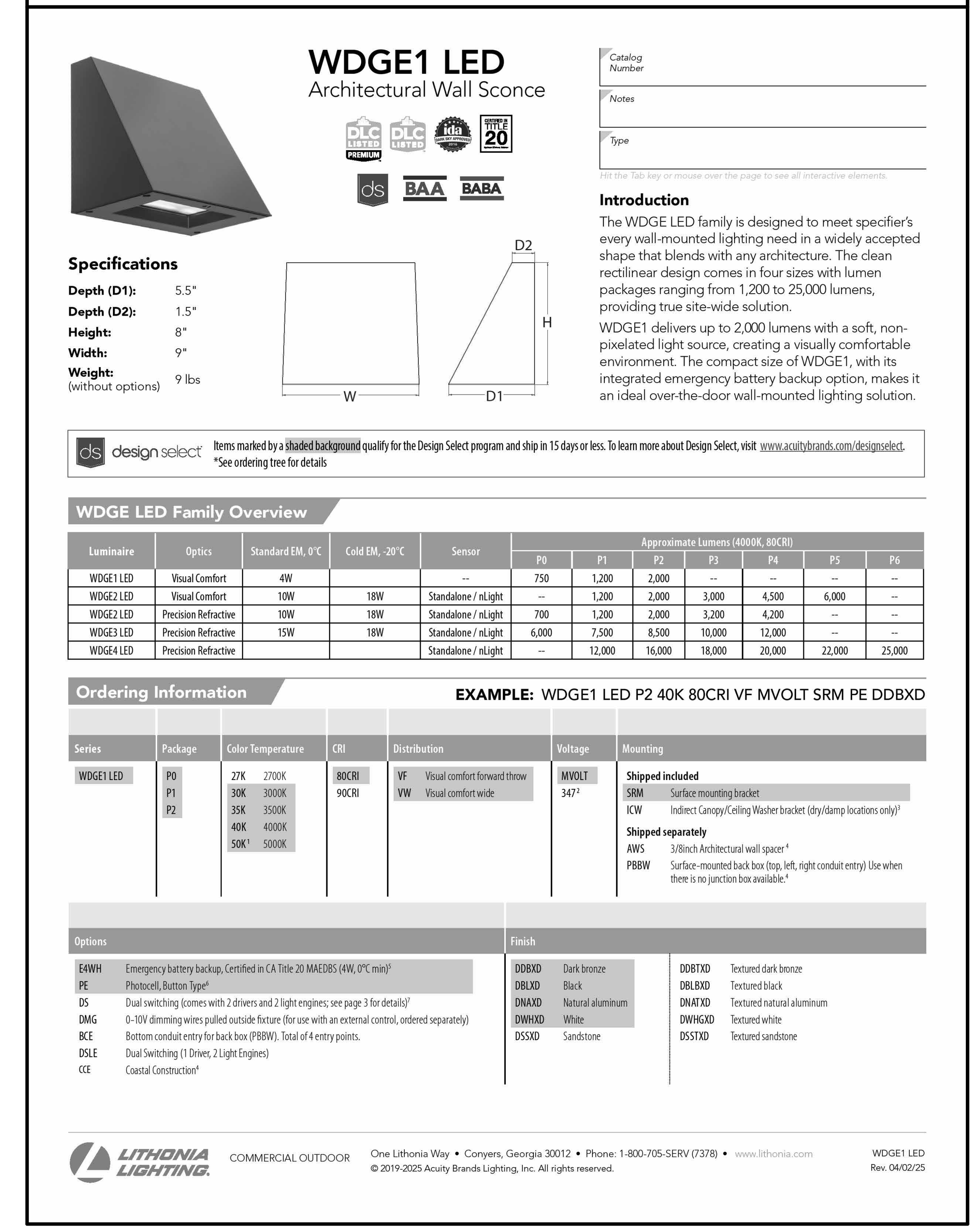
† Exit Signs Certified in the CA Title 20 Appliance Efficiency Database

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative. **Example:** WLTC 1 R SD M4

Series	Housing Color	Number of Faces	Letter color	Options
WLTC LED Wet Location Combo	(Blank) White B Black	1 Single Face 2 Double Face	R Red G Green	SD Self-Diagnostics TPS Tamperproof Screw Hardware CW Cold Weather

EMERGENCY   WLTC

FIXTURE TYPE" X1"


WDGE1 LED

Architectural Wall Sconce

Catalog Number	
Notes	
Type	

Hit the Tab key or mouse over the page to see all interactive elements.

Introduction

The WDGE LED family is designed to meet specifier's every wall-mounted lighting need in a widely accepted shape that blends with any architecture. The clean rectilinear design comes in four sizes with lumen packages ranging from 1,200 to 25,000 lumens, providing true site-wide solution.

WDGE1 delivers up to 2,000 lumens with a soft, non-pixelated light source, creating a visually comfortable environment. The compact size of WDGE1, with its integrated emergency battery backup option, makes it an ideal over-the-door wall-mounted lighting solution.

Specifications

Depth (D1):	5.5"
Depth (D2):	1.5"
Height:	8"
Width:	9"
Weight: (without options)	9 lbs

design select — Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect. *See ordering tree for details

WDGE LED Family Overview

Luminaire	Optics	Standard EM, 0°C	Cold EM, -20°C	Sensor	P0	P1	P2	P3	P4	P5	P6
WDGE1 LED	Visual Comfort	4W		--	750	1,200	2,000	--	--	--	--
WDGE2 LED	Visual Comfort	10W	18W	Standalone / nLight	--	1,200	2,000	3,000	4,500	6,000	--
WDGE2 LED	Precision Refractive	10W	18W	Standalone / nLight	700	1,200	2,000	3,200	4,200	--	--
WDGE3 LED	Precision Refractive	15W	18W	Standalone / nLight	6,000	7,500	8,500	10,000	12,000	--	--
WDGE4 LED	Precision Refractive			Standalone / nLight	--	12,000	16,000	18,000	20,000	22,000	25,000

Approximate Lumens (4000K, 80CRI)

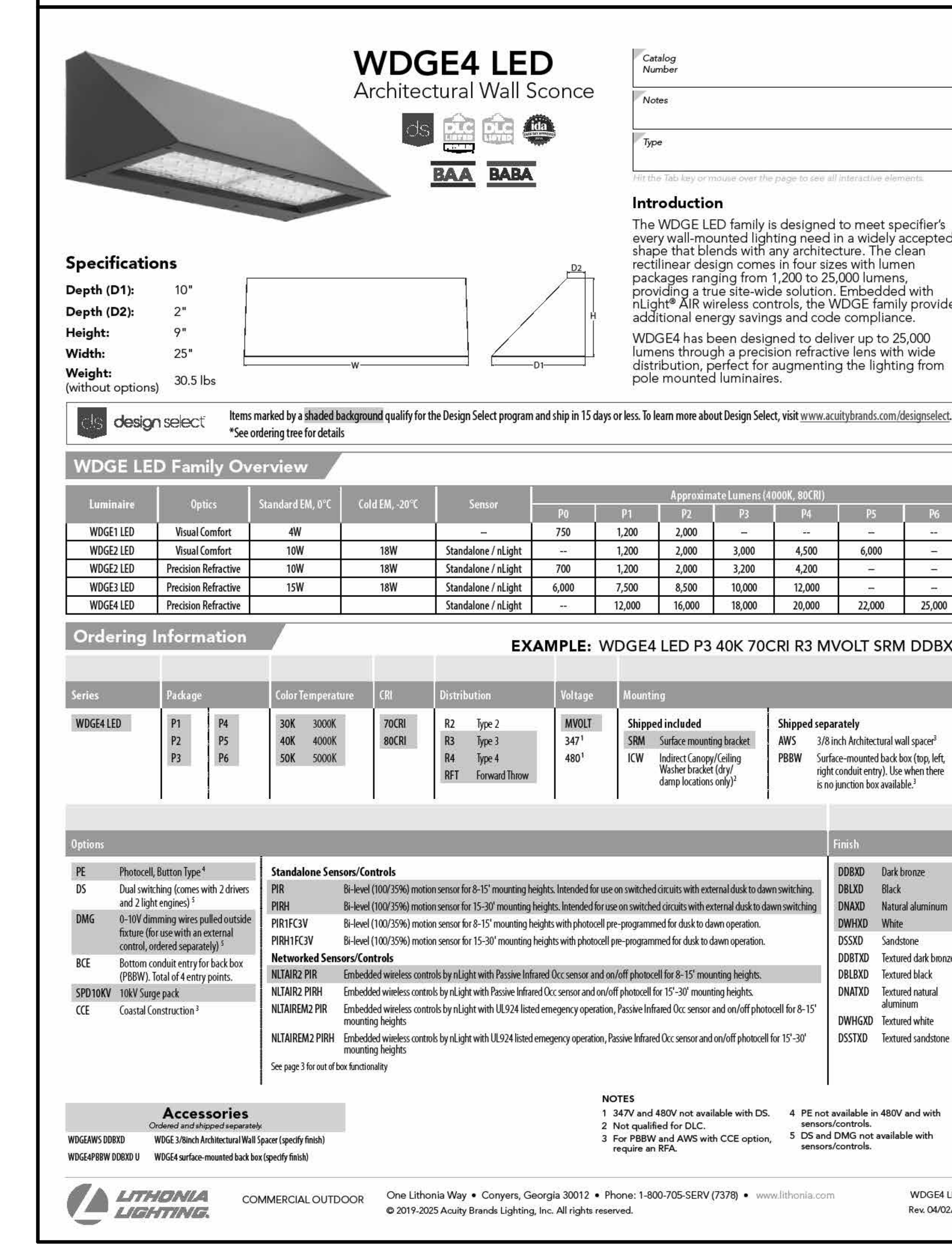
Ordering Information **EXAMPLE:** WDGE1 LED P2 40K 80CRI VF MVOLT SRM PE DDBXD

Series	Package	Color Temperature	CRI	Distribution	Voltage	Mounting
WDGE1 LED	P0 P1 P2	27K 2700K 30K 3000K 35K 3500K 40K 4000K 50K[1] 5000K	80CRI 90CRI	VF Visual comfort forward throw VW Visual comfort wide	MVOLT 347[2]	Shipped included: SRM Surface mounting bracket; ICW Indirect Canopy/Ceiling Washer bracket (dry/damp locations only)[3] Shipped separately: AWS 3/8inch Architectural wall spacer[4]; PBBW Surface-mounted back box (top, left, right conduit entry) Use when there is no junction box available.[4]

Options	Finish
E4WH Emergency battery backup, Certified in CA Title 20 MAEDBS (4W, 0°C min)[5] PE Photocell, Button Type[6] DS Dual switching (comes with 2 drivers and 2 light engines; see page 3 for details)[7] DMG 0-10V dimming wires pulled outside fixture (for use with an external control, ordered separately) BCE Bottom conduit entry for back box (PBBW). Total of 4 entry points. DSLE Dual Switching (1 Driver, 2 Light Engines) CCE Coastal Construction[4]	DDBXD Dark bronze DBLXD Black DNAXD Natural aluminum DWHXD White DSSXD Sandstone DDBTXD Textured dark bronze DBLBXD Textured black DNATXD Textured natural aluminum DWHGXD Textured white DSSTXD Textured sandstone

LITHONIA LIGHTING. COMMERCIAL OUTDOOR One Lithonia Way • Conyers, Georgia 30012 • Phone: 1-800-705-SERV (7378) • www.lithonia.com © 2019-2025 Acuity Brands Lighting, Inc. All rights reserved. WDGE1 LED Rev. 04/02/25

FIXTURE TYPE" X4"


WDGE4 LED

Architectural Wall Sconce

Catalog Number	
Notes	
Type	

Hit the Tab key or mouse over the page to see all interactive elements.

Introduction

The WDGE LED family is designed to meet specifier's every wall-mounted lighting need in a widely accepted shape that blends with any architecture. The clean rectilinear design comes in four sizes with lumen packages ranging from 1,200 to 25,000 lumens, providing a true site-wide solution. Embedded with nLight® AIR wireless controls, the WDGE family provides additional energy savings and code compliance.

WDGE4 has been designed to deliver up to 25,000 lumens through a precision refractive lens with wide distribution, perfect for augmenting the lighting from pole mounted luminaires.

Specifications

Depth (D1):	10"
Depth (D2):	2"
Height:	9"
Width:	25"
Weight: (without options)	30.5 lbs

design select — Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect. *See ordering tree for details

WDGE LED Family Overview

Luminaire	Optics	Standard EM, 0°C	Cold EM, -20°C	Sensor	P0	P1	P2	P3	P4	P5	P6
WDGE1 LED	Visual Comfort	4W		--	750	1,200	2,000	--	--	--	--
WDGE2 LED	Visual Comfort	10W	18W	Standalone / nLight	--	1,200	2,000	3,000	4,500	6,000	--
WDGE2 LED	Precision Refractive	10W	18W	Standalone / nLight	700	1,200	2,000	3,200	4,200	--	--
WDGE3 LED	Precision Refractive	15W	18W	Standalone / nLight	6,000	7,500	8,500	10,000	12,000	--	--
WDGE4 LED	Precision Refractive			Standalone / nLight	--	12,000	16,000	18,000	20,000	22,000	25,000

Approximate Lumens (4000K, 80CRI)

Ordering Information **EXAMPLE:** WDGE4 LED P3 40K 70CRI R3 MVOLT SRM DDBXD

Series	Package	Color Temperature	CRI	Distribution	Voltage	Mounting
WDGE4 LED	P1 P4 P2 P5 P3 P6	30K 3000K 40K 4000K 50K 5000K	70CRI 80CRI	R2 Type 2 R3 Type 3 R4 Type 4 RFT Forward Throw	MVOLT 347[1] 480[1]	Shipped included: SRM Surface mounting bracket; ICW Indirect Canopy/Ceiling Washer bracket (dry/damp locations only)[2] Shipped separately: AWS 3/8 inch Architectural wall spacer[3]; PBBW Surface-mounted back box (top, left, right conduit entry). Use when there is no junction box available.[3]

Options	Finish
PE Photocell, Button Type[4] DS Dual switching (comes with 2 drivers and 2 light engines)[5] DMG 0-10V dimming wires pulled outside fixture (for use with an external control, ordered separately)[5] BCE Bottom conduit entry for back box (PBBW). Total of 4 entry points. SPD10KV 10kV Surge pack CCE Coastal Construction[3] **Standalone Sensors/Controls** PIR Bi-level (100/35%) motion sensor for 8-15' mounting heights. Intended for use on switched circuits with external dusk to dawn switching. PIRH Bi-level (100/35%) motion sensor for 15-30' mounting heights. Intended for use on switched circuits with external dusk to dawn switching PIR1FC3V Bi-level (100/35%) motion sensor for 8-15' mounting heights with photocell pre-programmed for dusk to dawn operation. PIRH1FC3V Bi-level (100/35%) motion sensor for 15-30' mounting heights with photocell pre-programmed for dusk to dawn operation. **Networked Sensors/Controls** NLTAIR2 PIR Embedded wireless controls by nLight with Passive Infrared Occ sensor and on/off photocell for 8-15' mounting heights. NLTAIR2 PIRH Embedded wireless controls by nLight with Passive Infrared Occ sensor and on/off photocell for 15'-30' mounting heights. NLTAIREM2 PIR Embedded wireless controls by nLight with UL924 listed emegency operation, Passive Infrared Occ sensor and on/off photocell for 8-15' mounting heights NLTAIREM2 PIRH Embedded wireless controls by nLight with UL924 listed emegency operation, Passive Infrared Occ sensor and on/off photocell for 15'-30' mounting heights See page 3 for out of box functionality	DDBXD Dark bronze DBLXD Black DNAXD Natural aluminum DWHXD White DSSXD Sandstone DDBTXD Textured dark bronze DBLBXD Textured black DNATXD Textured natural aluminum DWHGXD Textured white DSSTXD Textured sandstone

Accessories

Ordered and shipped separately.

WDGEAWS DDBXD	WDGE 3/8inch Architectural Wall Spacer (specify finish)
WDGE4PBBW DDBXD U	WDGE4 surface-mounted back box (specify finish)

NOTES
1 347V and 480V not available with DS.
2 Not qualified for DLC.
3 For PBBW and AWS with CCE option, require an RFA.
4 PE not available in 480V and with sensors/controls.
5 DS and DMG not available with sensors/controls.

LITHONIA LIGHTING. COMMERCIAL OUTDOOR One Lithonia Way • Conyers, Georgia 30012 • Phone: 1-800-705-SERV (7378) • www.lithonia.com © 2019-2025 Acuity Brands Lighting, Inc. All rights reserved. WDGE4 LED Rev. 04/02/25

LIGHT FIXTURE SCHEDULE

DESIGNATION	DESCRIPTION	MANUFACTURER [1]	MODEL [1]	WATTS	LUMENS	LAMP TYPE [2] [3]	COLOR DEGREES K	OPERATING VOLTS [6]	NSTALLATION & MOUNTING [7] [8]	COUNT
A	4' MVOLT VAPOR TIGHT STRIP LIGHT	LITHONIA	CSVT	42.00 W	4946	LED	4000	120 V	THIS LUMINAIRE MAY BE SURFACE MOUNTED OR SUSPENDED BY CABLE OR CHAIN. FOR ALL MOUNTING METHODS MAKE SURE THE FACILITY MOUNTING POINTS AND MOUNTING HARDWARE ARE RATED FOR 4X THE FIXTURE LOAD.	28
B		LITHONIA				LED	4000	120 V	CEILING, SEE ARCHITECTURAL DRAWINGS FOR CEILING TYPE	3
EM	2-HEAD EMERGENCY LIGHT UNIT, WHITE THERMOPLASTIC HOUSING, PROVIDES A MINIMUM 90 MINUTESOF EMERGENCY ILLUMINATION, SEALED MAINTENANCE-FREE BATTERY WITH TEST SWITCH AND STATUS INDICATOR, UL 924 LISTED AND NFPA 101 COMPLIANT	LITHONIA	EU2C	9.40 W		LED	4000	120 V	WALL SURFACE, 3 FT EGRESS WITDTH MH OF 7.5' WITH 15' SPACING, AIM FIXTURES AT 45 DEGRESS OUT AND CENTERED ON EGRESS PATH	1
EM2	HIGH-OUTPUT COMBO EXIT / EMERGENCY LIGHT WITH DUAL HEAD. IMPACT RESISTANT THERMOPLASTIC HOUSING. RED LETTERING 6" HIGH WITH 3/4" STROKE, PROVIDES 90 MINUTES OF EMERGENCY ILLUMINATION, SEALED MAINTENANCE-FREE BATTERY WITH TEST SWITCH AND STATUS INDICATOR. PROVIDE WITH DUAL INDOOR REMOTE HEADS.	LITHONIA	LHQM-HO	4.30 W		LED	4000	120 V	WALL SURFACE	1
EX	THERMOPLASTIC EXIT SIGN, RED LETTERING 6" HIGH WITH 3/4" STROKE, IMPACT RESISTANT, PROVIDES 90 MINUTES OF EMERGENCY ILLUMINATION, SEALED MAINTENANCE-FREE BATTERY WITH TEST SWITCH AND STATUS INDICATOR	LITHONIA	LQM			LED	4000	120 V	SINGLE OR DUAL FACE, WALL OR CEILING MOUNT, CONNECT TO UNSWITCHED LIGHT CIRCUIT OF AREA / EGREES SERVED.	1
X1	WDGE1 LED WITH P2 - PERFORMANCE PACKAGE 4000K 80CRI VISUAL COMFORT FORWARD OPTIC	LITHONIA	WDGE2	15.00 W	10360	LED	4000	120 V	WALL SURFACE	5
X4	WDGE4 LED WITH P6 - PERFORMANCE PACKAGE 4000K 70CRI TYPE 3 OPTIC	LITHONIA	WDGE4	185.00 W	25233	LED	4000	120 V	WALL SURFACE	2

LIGHT FIXTURE SCHEDULE NOTES

#	DESCRIPTION
1	GENERAL NOTE - CATALOG NUMBER MAY NOT SPECIFY ALL OPTIONS, ACCESSORIES, ADAPTERS THAT MUST BE PROVIDED FOR A COMPLETE INSTALLATION, OR SPARE ITEMS, SEE OTHER COLUMNS IN THIS SCHEDULE, CONTRACT DOCUMENTS AND ACTUAL CONDITIONS ENCOUNTERED.
2	GENERAL NOTE - MOUNTING INDICATED SHOWS BASIC FIXTURE MOUNTING ARRANGEMENT. SEE ARCHITECTURAL AND OTHER DOCUMENTS FOR ADDITIONAL INFORMATION WHICH AMY EFFECT FIXTURE PLACEMENT AND MOUNTING STRUCTURES (CEILING AND WALL CONSTRUCTION, ETC). PROVIDE MOUNTING ADAPTERS AS
3	GENERAL NOTE - CONTRACTOR MUST PROVIDE ADJUSTMENTS (ALIGNMENTS AND FOCUSING) FOR FIXTURES WHICH ARE ADJUSTABLE. ADJUSTMENTS SHALL PROVIDE OPTIMAL ILLUMINATION OF AREA TO BE ILLUMINATED. ADJUSTMENTS SHALL BE MADE TO PROVIDE EVEN ILLUMINATION.

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS

NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS STEPHEN C. OLSON CIVIL No. 32143 REGISTERED PROFESSIONAL ENGINEER 6/4/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

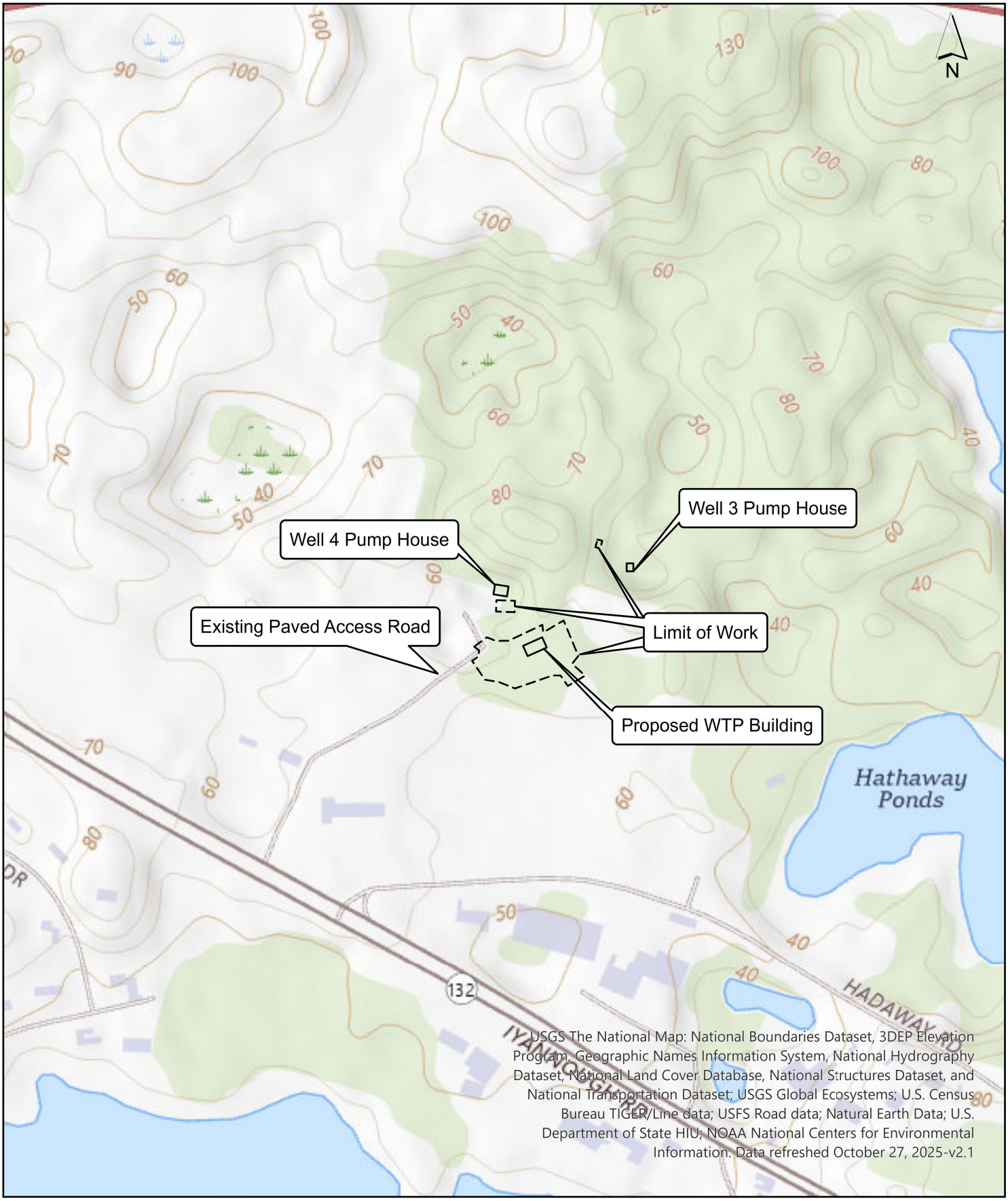
DRAWING TITLE:
TREATMENT PLANT ELECTRICAL SCHEDULES & DIAGRAMS

DRAWING NO.:
E-7

SHEET NO. 57 OF 57

ATTACHMENT B

Figures



0 320 640 1,280 Feet

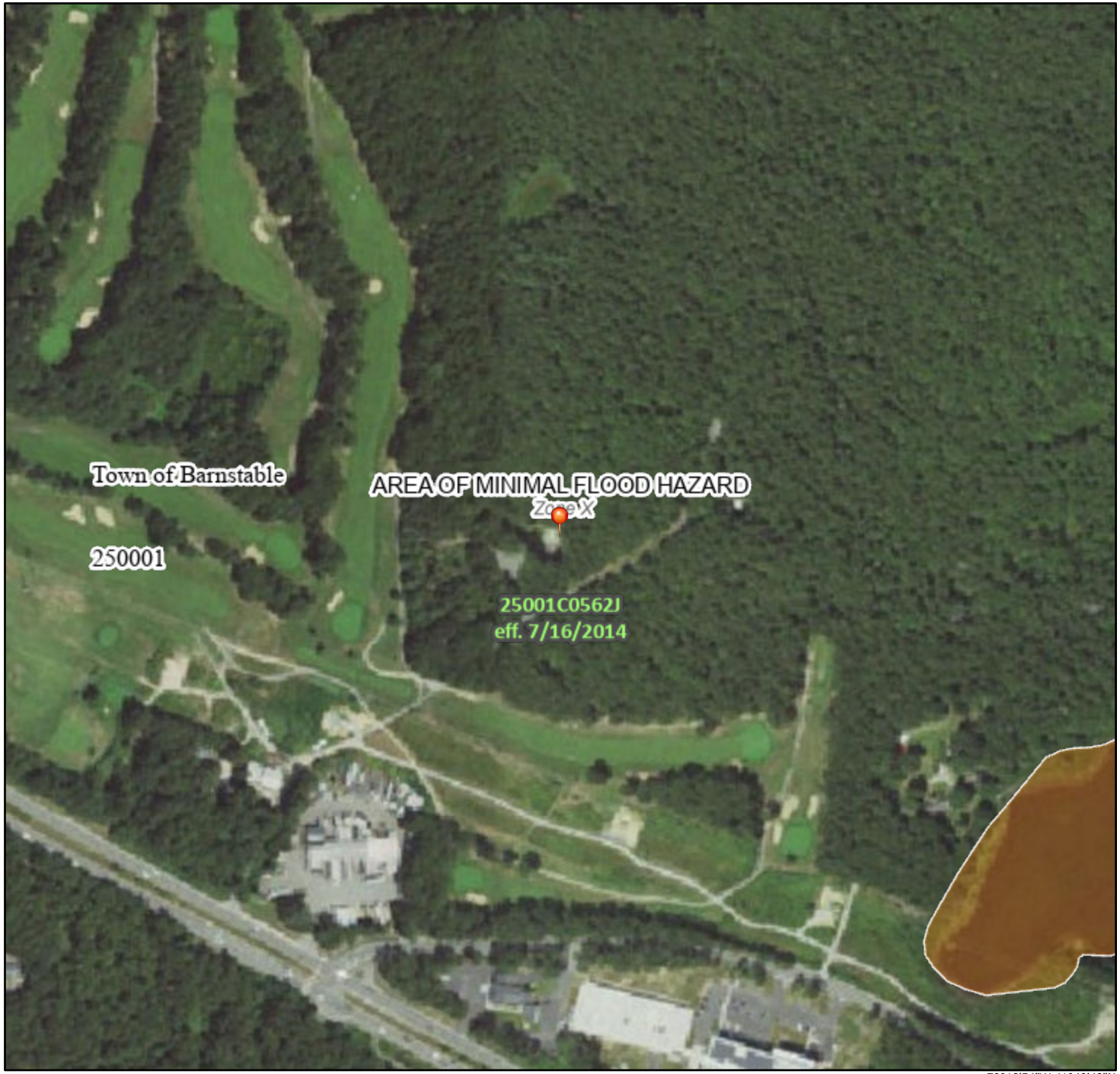
H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

Site Locus Map
Barnstable Fire District Wells 3&4 WTP
Barnstable, Massachusetts
June 2026

National Flood Hazard Layer FIRMette

FEMA

70°19'32"W 41°41'15"N



70°18'54"W 41°40'48"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/6/2026 at 3:26 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

ZONING MAP

of the

TOWN OF BARNSTABLE MASSACHUSETTS

INDEX MAP

SEPTEMBER 1, 1998

APPROVED SEPTEMBER 17, 1998
AMENDED NOVEMBER 12, 1998
AMENDED JULY 15, 1999
AMENDED OCTOBER 26, 2000
AMENDED FEBRUARY 1, 2001
AMENDED JUNE 28, 2001
AMENDED JULY 19, 2001
AMENDED AUGUST 16, 2001
AMENDED NOVEMBER 15, 2001
AMENDED SEPTEMBER 19, 2002
AMENDED APRIL 15, 2004
AMENDED SEPT. 2, 2004
AMENDED NOV. 18, 2004
AMENDED JULY 14, 2005
AMENDED JUNE 1, 2006
AMENDED MAY 3, 2007
AMENDED FEBRUARY 28, 2008
AMENDED APRIL 3, 2008
AMENDED JULY 16, 2009
AMENDED MARCH 4, 2010
AMENDED JUNE 17, 2010
AMENDED OCTOBER 7, 2010
AMENDED JANUARY 19, 2011
AMENDED SEPTEMBER 8, 2011
AMENDED FEBRUARY 16, 2012
AMENDED FEBRUARY 6, 2014
AMENDED MARCH 19, 2015
AMENDED MAY 7, 2015
AMENDED MAY 19, 2016
AMENDED JULY 21, 2016
AMENDED APRIL 27, 2017
AMENDED JUNE 1, 2017
AMENDED FEBRUARY 28, 2019
AMENDED FEBRUARY 4, 2021
AMENDED OCTOBER 21, 2021
AMENDED SEPTEMBER 1, 2023
AMENDED FEBRUARY 2, 2023

SEAL OF THE TOWN OF BARNSTABLE, MASS. 1639. ADOPTED MAY 4, 1889

TOWN OF SANDWICH

TOWN OF MASHPEE

TOWN OF YARMOUTH

Cape Cod Bay

Barnstable Harbor

Centerville Harbor

Hyannis Harbor

Lewis Bay

Nantucket Sound

Great Marshes

Mystic Lake

Middle Pond

Hamblin Pond

Wequaquet Lake

North Bay

East Bay

West Bay

Cotuit Bay

Popponesset Bay

RF

RF-1

RF-2

RG

RD-1

RC

RC-1

RC-2

RB

RB-1

RB-2

CBD

B

IND

IND Ltd

HB

HC

TC

MB-A

MB-B

R-2C

AP

WP

GP

S&D

WBWBD

BA

Map Legend

- HB — Zoning District
- WP — Wellhead Protection Overlay District
- GP — Groundwater Protection Overlay District
- AP — Aquifer Protection Overlay District
  All other areas not identified as Wellhead or Groundwater Protection Overlay Districts
- Adult Use Overlay District
- Dock and Pier Overlay District
- Former Grade 5 School Planned Unit Development Overlay District
- Medical Services Overlay District
- Mixed-Use Sub Zone of the Medical Services Overlay District
- Resource Protection Overlay District
- Shopping Center Redevelopment Overlay District
- Drive Through Restaurant Sub Zone of the Shopping Center Redevelopment Overlay Dist.
- Senior Continuing Care Retirement Community - SCCRCOD 2008-1
- Recreational Shellfish Area and Shellfish Relay Area Dock & Pier Overlay District
- Ground Mounted Solar Photovoltaic Overlay District
- Medical Marijuana Overlay District
- Registered Recreational Marijuana Cultivators, Research Facilities, and Testing Laboratories Overlay
- Craigville Village Neighborhood Overlay
- Long / Short Beach Neighborhood Overlay
- Craigville Beach Neighborhood Overlay
- Centerville River North Bank Neighborhood Overlay
- ★ C-O #12 — Existing Public Well Site
- ★ C-O #18 — Proven Future Public Well Site
- ★ C-O #20 — Proposed Future Public Well Site
- Paved Road
- Unimproved Road
- Railroad Track
- Town Boundary Line
- Marsh Area
- Stream / Edge of Water

SEE TEXT OF ZONING ORDINANCE FOR COMPLETE INFORMATION ON BULK REGULATIONS.

Where a zoning district boundary is located at the edge of a water body, that zone that applies to the land shall apply to structures and uses such as piers and commercial boating operations to the extent of the territorial jurisdiction of the town.

Where zoning district boundaries are located along the edge of a roadway and a distance is shown from such point to another zoning boundary, such distance and points shall be from the edge of the road layout. The ultimate location of such point shall be determined by survey as the line shown on this map is considered an approximation.

Sheet Index Grid



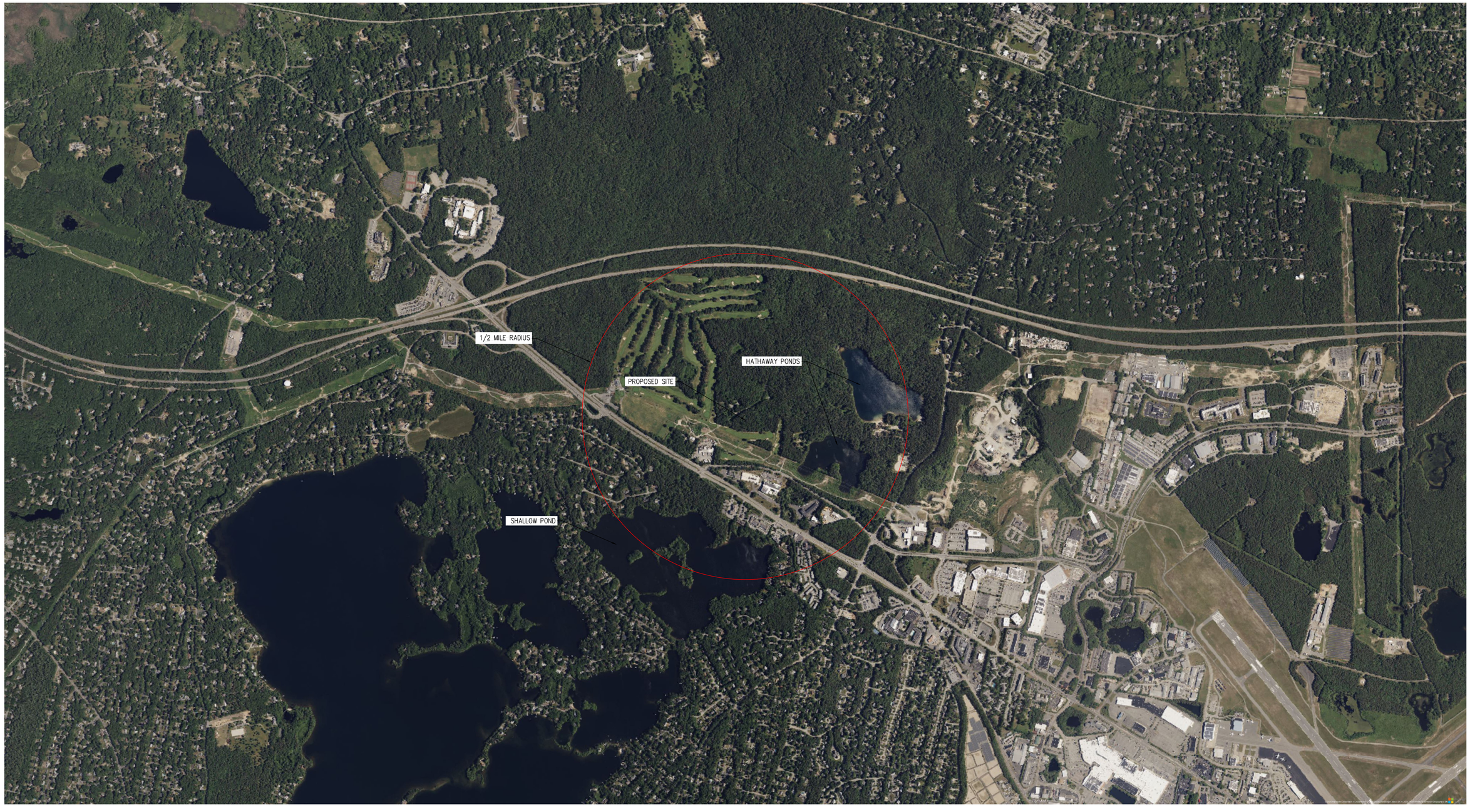
N W E S

SCALE 1"=1800'

feet 3000 2000 1000 0 1/4 1/2 1 mile

1" = 0.34 miles 1:21,600

TOWN OF BARNSTABLE G.I.S. UNIT FILE: townzone.dgn A.N.M. 3-21-2023



PLAN VIEW
SCALE: 1/64" = 1'

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 49,036
REGISTERED PROFESSIONAL ENGINEER
6/1/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1/64" = 1'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SITE ORTHOPHOTO MAP

DRAWING NO.:
SHEET NO. 1 OF 1

C:\Users\GenevieveH\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C-Sheets.dwg

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

HYANNIS QUADRANGLE
MASSACHUSETTS - BARNSTABLE COUNTY
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid:Universal Transverse Mercator, Zone 19T

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, August 2018 - August 2018
Roads.....U.S. Census Bureau, 2018
Names.....GNIS, 1974 - 2023
Hydrography.....National Hydrography Dataset, 2005 - 2022
Contours.....National Elevation Dataset, 2023
Boundaries.....Multiple sources; see metadata file 2021 - 2022

Wetlands.....FWS National Wetlands Inventory 2008 - 2011

MN
GN
14°20'
255 MILS
0°52'
15 MILS
UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
CG
Grid Zone Designation
19T

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

MASSACHUSETTS
QUADRANGLE LOCATION

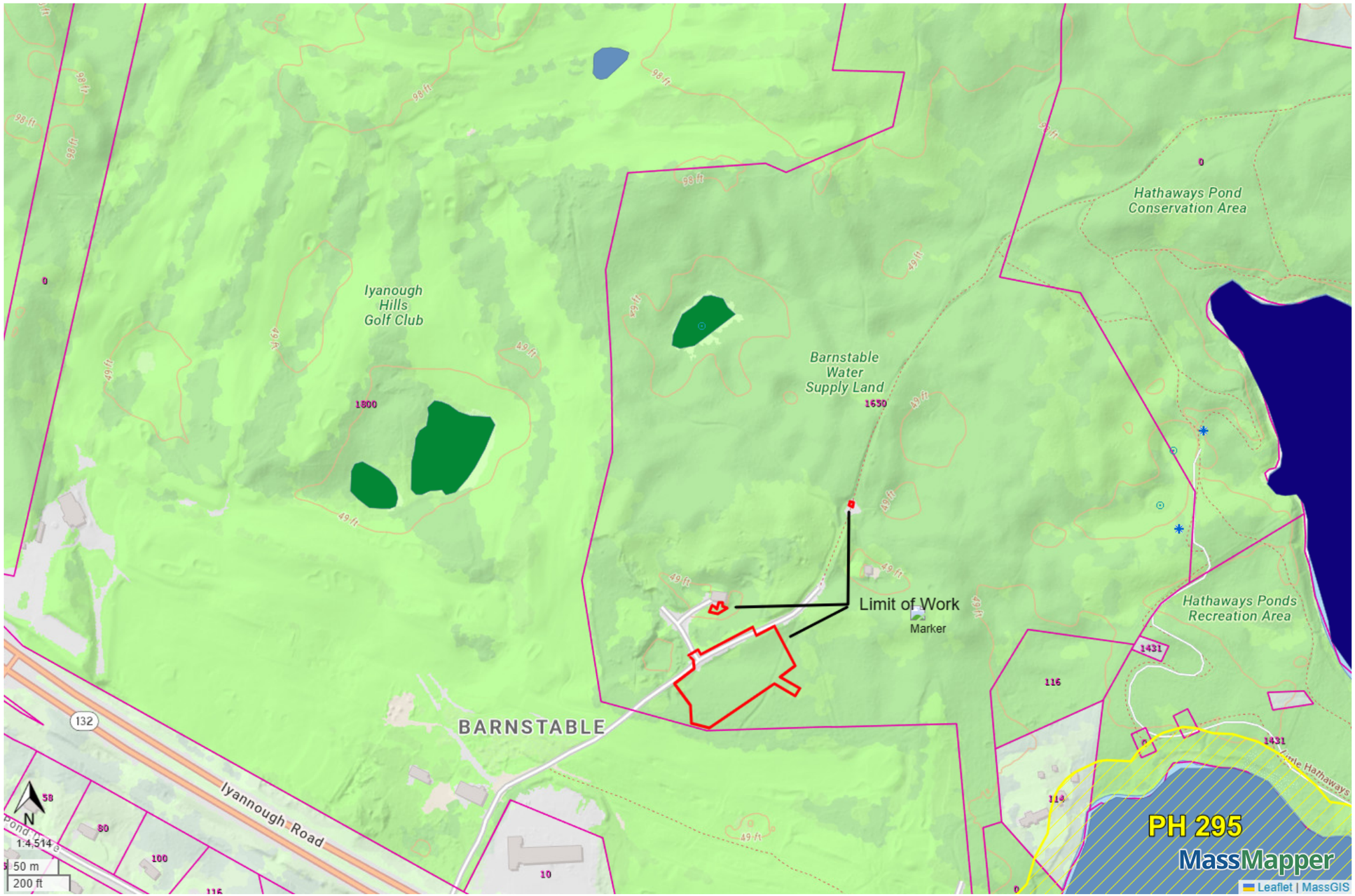
1 Sandwich OE N
2 Dennis OE N
3 Sandwich
4 Dennis
5 Cotuit
6 Hyannis OE S
ADJOINING QUADRANGLES

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

HYANNIS, MA
2024

NSN 7643016369553
NGA REF NO. USGSX24K74869

MassGIS Environmental Constraints Map



NHESP Priority Habitats of Rare Species

Potential Vernal Pools

NHESP Certified Vernal Pools

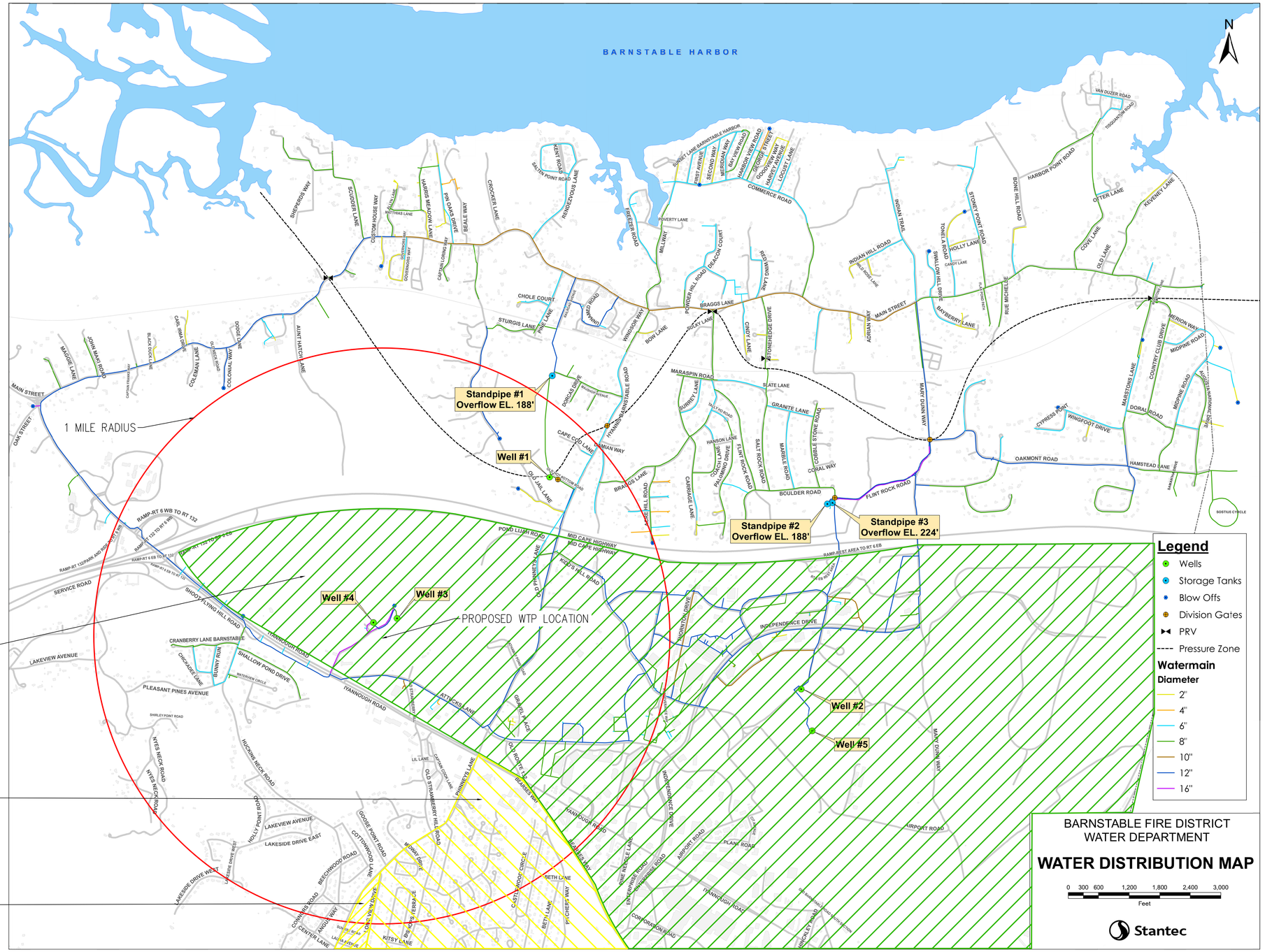
Areas of Critical Environmental Concern
ACECs Transparent Green

NWI Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Other

Property Tax Parcels

Printed May 4, 2026



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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
WATER DISTRICT EJ POPULATION MAP

DRAWING NO.:

SHEET NO. 1 OF 1

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C Sheets.dwg

ATTACHMENT C

MEPA Emissions Footprint Estimation Tool Printout

Emissions Footprint Estimation Tool

The objective of this tool is to provide an estimate of project emissions for ENF reporting.

To use the tool:
- populate the area of each proposed building (column B), in square feet.
- use the pull down menu to select building use (column C)

For mixed use buildings, use multiple rows. For example, if a building is proposed to be 10,000-sf ground floor retail and 40,000-sf residential use two rows, one for the retail and one for the residential.

If more then twenty rows are needed, use multiples of this spreadsheet and sum the totals.

Electric and gas EUI estimates are based on pre-solved prototypes available here https://www.energycodes.gov/prototype-building-models

Emission rates are: 600 lbs/MWhr for grid electricitly and 116 lbs/MMBtu

For office sizes
- Use "small office" if <=20,000-sf
- Use "large office" if >20,000-sf

For hotel sizes
- Use "small hotel" if <=50,000-sf
- Use "large hotel" if >50,000-sf

			EUI (kBtu/sf-yr)		Annual Emissions (tpy)		
Building (or use) No.	Area (sf)	Use	fossil fuel	electric	fossil	electric	total
1	2,020	office (small)	5.5	20.5	0.6	3.6	4.3
2	2,020	warehouse	4.3	6.0	0.5	1.1	1.6
3			-	-	-	-	-
4			-	-	-	-	-
5			-	-	-	-	-
6			-	-	-	-	-
7			-	-	-	-	-
8			-	-	-	-	-
9			-	-	-	-	-
10			-	-	-	-	-
11			-	-	-	-	-
12			-	-	-	-	-
13			-	-	-	-	-
14			-	-	-	-	-
15			-	-	-	-	-
16			-	-	-	-	-
17			-	-	-	-	-
18			-	-	-	-	-
19			-	-	-	-	-
20			-	-	-	-	-
			-	-	-	-	-

Total project emissions to enter into ENF form - represents near-term emissions rate	5.9	**tpy**

ATTACHMENT D

Pilot Scale Treatability Study Report

Barnstable Fire District Water Department Well 3 & 4
Pilot Scale Treatability Study

Section 1: Introduction

With the assistance of the Barnstable Fire District Water Department (BFD) staff, H2Olson Engineering, Inc. (H2Olson) completed a pilot scale treatability study using pressurized media filtration columns for the removal of source water iron, and manganese in accordance with the Massachusetts Department of Environmental Protection (MassDEP) permit application BRP-WS21 approved on February 24, 2025. The pilot study was completed over a 2-week period in April 2025 using three (3) filter columns filled with GreensandPlus™ media capped with anthracite. Presented herein are the results, findings, and conclusions of the pilot scale treatability study.

Background

The Barnstable Fire District Water Department supplies water to its customers from three active groundwater supply wellfields: the Phinney's Lane well (Well 1); the Breeds Hill Road wells (Well 2 and Well 5); and the Route 132 wells (Well 3 and Well 4). Groundwater from the Route 132 wells is treated at a combined chemical addition facility located at the Well 4 pump station, where potassium hydroxide is added for pH adjustment and sodium hypochlorite is added for disinfection. Both the raw water and chemically treated water are routinely sampled and tested. A summary of recent existing available water quality information for Well 3 and Well 4 is summarized in Table 1.

Table 1
Water Quality Sampling Results

Testing Location	Parameter	Averages	Range
Well 3 Raw Water	Iron (mg/L)	0.06	0.06-0.06
	Manganese (mg/L)	0.02	0.0087-0.025
	Alkalinity (mg/L as $CaCO_3$)	7.33	5.9-10
	Turbidity (NTU)	0.56	0.23-0.93
	pH (pH units)	6.03	5.9-6.3
Well 4 Raw Water	Iron (mg/L)	0.77	0.72-0.8
	Manganese (mg/L)	0.05	0.026-0.094
	Alkalinity (mg/L as $CaCO_3$)	20.00	15-24
	Turbidity (NTU)	1.01	0.21-2.5
	pH (pH units)	6.20	6-6.6

Testing Location	Parameter	Averages	Range
Well 3 & 4 Finished Water	Iron (mg/L)	0.22	0.21-0.22
	Manganese (mg/L)	0.03	0.028-0.03
	Alkalinity (mg/L as $CaCO_3$)	72.67	64-81
	Turbidity (NTU)	0.25	0.22-0.3
	pH (pH units)	6.45	6-6.9

In addition to the routine water quality parameters summarized in Table 1, per and perfluoro sulfonic PFAS compounds have been detected in the raw water at these wells above the USEPA MCLs of 4 ppt for PFOS and PFOA. An evaluation of PFAS treatment options identified that GAC is the recommended treatment alternative based on the individual PFAS compounds and levels detected in the source water. However, the presence of source water iron and manganese can make the use of GAC media problematic due to accumulated headloss. Therefore, based on an evaluation of raw water quality, a pilot scale treatability study was proposed to investigate the use of a pressurized media filtration system for the efficient removal of iron and manganese.

Section 2: Pilot Test Description

The pilot scale pressurized media filtration system was supplied by Hungerford & Terry and consisted of three (3) individual filter columns; GreensandPlus™ and anthracite filter media; and chemical feed systems for potassium hydroxide, sodium permanganate, and sodium hypochlorite. H2Olson installed and operated the system and all associated interconnecting piping and valves for feed water, backwashing, filter effluent, and sampling.

The pilot study involved an evaluation of two different chemicals for pre-oxidation (sodium permanganate and chlorine). Treatment Train #1 consisted of the application of potassium hydroxide for pH adjustment and sodium permanganate for oxidation. Treatment Train #2 consisted of the application of potassium hydroxide for pH adjustment and chlorine for oxidation. Each treatment train utilized a 50% blend of raw water from wells 3 and 4. The feed water was obtained from the raw water line prior to the addition of chemicals. After chemical addition for each treatment train, the pretreated water was piped to the filter columns. Filter #1 was dedicated to Train 1 and Filter #3 was dedicated to Train 2. The feed water for Filter #2 was alternated between Train 1 and Train 2. A schematic diagram of the pilot treatment system is provided in Appendix A. Each filter column consisted of a 12" of gravel base, 24" of GreensandPlus™ media, topped with 12" of anthracite. The design criteria for the pilot filter columns are presented in Table 2.

All three filter columns included manual control valves, a flow meter, and influent/effluent pressure gauges for operational control and monitoring. Control valves were adjusted regularly throughout the course of each filter run to maintain target filter loading rates. The GreensandPlus™ filter media was conditioned by soaking the media in a 7.1% solution of chlorine overnight prior to operating the filters. When the target filter run time (24 to 48 hours) was achieved, the filters were backwashed individually for approximately 20 minutes at a backwash rate of 12 gpm/sf to achieve 25% expansion of the media. The filter backwash waste was collected in a basin for decanting, and the next filter run was started after the backwashing process was completed.

Table 2
Pressure Vessel Pilot Units

	GreensandPlus™ Filter
	Top Layer
Media Type	Anthracite
Media Depth	12”
Effective Size	0.6 – 0.8 mm
Uniformity Coefficient	Less than 1.6
	Bottom Layer
Media Type	GreensandPlus™
Media Depth	24”
Effective Size	0.3 – 0.35 mm
Uniformity Coefficient	Less than 1.60
Media Support	12” of ¼” x 1/8” Gravel
Column Diameter	6”
Average Loading Rates	3.0, 3.5, 5.2 gpm/sf
Peak Loading Rates	3, 4, 6 gpm/sf
Backwash Loading Rate	Target 12 gpm/sf
Backwash Duration	Up to 20 minutes

The pilot system and equipment were set up and operated between April 14, 2025 and April 25, 2025. The first filter run began on April 17th. Four filter runs were completed between April 14th and April 25th. The pilot system was staffed 8 to 12 hours per day while the filters were in operation. Detailed operating records were recorded including flow rate, loading rate, head loss, run time, and chemical dosages.

Water Quality Sampling

Raw, pretreated, filter effluent, and process residuals were collected and tested for various water quality parameters as outlined in Table 3. Routine water quality analyses {temperature, pH, turbidity, iron (total and dissolved), manganese (total and dissolved), color, total and free chlorine (Train 2 only) and UV-254} were completed on-site by the pilot operations staff using bench-top analytical instruments, including a HACH ratio turbidimeter, HACH spectrophotometer (DR 1900), HACH Sensor portable water pH meter, and a Real Tech UV-254 portable UVT meter. Dissolved iron and manganese samples were tested by filtering the water samples with 0.45 µm filters. All bench top laboratory equipment was calibrated daily. All other water quality parameters and supplemental samples were collected and sent to Pace Analytical, an independent laboratory located in Mansfield, Massachusetts, certified by the Massachusetts DEP.

Table 3
Water Quality Sampling Schedule

Parameter	Sample Location	Lab Testing Frequency	Field Testing Frequency
Temperature	Raw, Filter Effluent	N/A	1 to 3 times during each filter run
pH	Raw, Treated, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Turbidity	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Alkalinity	Raw, Filter Effluent	2 Filter Runs	Not Applicable
Carbon Dioxide	Raw, Filter Effluent	2 Filter Runs	Not Applicable
Iron (total and dissolved)	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Manganese (total and dissolved)	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
UV-254	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Color	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Total Organic Carbon	Raw, Filter Effluent	2 Filter Runs	Not Applicable
Total Coliform	Raw, Filter Effluent	1 Filter Run	Not Applicable
VOCs	Raw, Filter Effluent	1 Filter Run	Not Applicable
PFAS	Raw, Filter Effluent	1 Filter Run	Not Applicable
Sanitary Group (Ca, Mg, K, Na, SO_4, NO_3, NO_2, Hardness)	Raw, Filter Effluent	1 Filter Run	Not Applicable
IOCs (As, Ba, Cd, Cr, Pb, Hg, Se, Ag)	Raw, Filter Effluent	1 Filter Run	Not Applicable
TSS, Fe, Mn, pH	Filter Backwash Supernatant	1 Occurrence	Not Applicable
TSS	Filter Backwash Residuals	1 Occurrence	Not Applicable
RCRA8 Metals	Filter Backwash Residuals	1 Occurrence	Not Applicable

Residuals testing consisted of total suspended solids (TSS), and heavy metals. The filter backwash waste was collected in a common storage tank and allowed to settle after each filter run. An observable supernatant layer was established after an hour of settling, and the basin was entirely clear except for a thin layer of solids on the bottom of the basin after 16 hours of settling. The supernatant from the filter backwash waste was sampled and tested for TSS, iron, manganese, and pH.

Water Quality Goals

The water quality performance goals that were established for the pilot scale treatability study are presented in Table 4.

Table 4
Treated Water Quality Goals

Location	Parameter	Goal
Filter Effluent	Iron	Less than 0.10 mg/L
Filter Effluent	Manganese	Less than 0.025 mg/L
Filter Effluent	pH	Between 6.8 and 7.2

Section 3: Results and Conclusions

After testing and optimizing chemical treatment and backwashing the filters, four filter runs were completed for the pilot scale treatability study. A summary of the operational data for each filter run including: filter run times, average filter flows, average filter loading rates, and head loss at the end of each filter run is presented in Table 5. The complete set of operating records and log sheets documenting the filter flows, loading rates, head loss, run times, and chemical dosages are provided in Appendix B. In addition, filter head loss graphs for each filter run are also provided in Appendix B.

Table 5
Proposed Pilot Test Run Plan

Filter Number	Train	Run Time (hours)	Filter Flow (gpm)	Filter Loading Rate (gpm/sf)	Headloss (psi)
Filter Run #1 (4/17 – 4/18)					
Filter #1	1	26.75	0.35	4.01	1.2
Filter #2	1	26.75	0.44	5.04	4.5
Filter #3	2	26.75	0.35	4.01	0.9
Filter Run #2 (4/21 – 4/23)					
Filter #1	1	47.75	0.35	4.01	1.5
Filter #2	2	47.75	0.44	5.04	4.8
Filter #3	2	47.75	0.35	4.01	0.9
Filter Run #3 (4/23 – 4/24)					
Filter #1	1	23.50	0.35	4.01	1.1
Filter #2	2	23.50	0.52	5.96	4.5
Filter #3	2	23.50	0.35	4.01	1.0
Filter Run #4 (4/24 – 4/26)					
Filter #1	1	54.45	0.35	4.01	1.0
Filter #2	1	54.45	0.52	5.96	5.0
Filter #3	2	54.45	0.35	4.01	0.9

Operations

The initial target filter loading rates employed in Filters #1, #2, and #3 were 4 gpm/sf, 5 gpm/sf, and 4 gpm/sf respectively. However, the loading rate for Filter #2 was adjusted to 6 gpm/sf for Filter Runs 3 and 4. Prior to the start of Filter Run 1, the dosages for chlorine, potassium hydroxide and sodium permanganate were adjusted to meet target pretreatment conditions. The average applied chemical dosages for sodium permanganate, potassium hydroxide and chlorine during the pilot study were 0.35 mg/L, 44 mg/L and 0.48 mg/L, respectively.

A review of the operating data provided in Appendix B and Table 5 indicates that filter 2, which experienced highest loading rate, also experienced the greatest head loss. The lower filter loading rates generally experienced lower headloss. Each of the three filters achieved their respective run times without any degradation of water quality. Filter run times greater than 48 hours were achieved in Filter Run #2 without any negative impacts to effluent water quality or headloss. The accumulated headloss for all the three filters was less than the recommended terminal headloss of 8-10 psi after nearly 48 hours of runtime in Filter Run #2 and over 54 hours of runtime in Filter Run #4.

A summary of the average field-testing water quality results for each filter run is presented in Table 6. Individual field test results for each filter run and the independent laboratory water quality analyses are provided in Appendix C.

Table 6
Water Quality Summary: Average Field Test Results

Filter Run	Temp. (C°)	pH (S.U.)	Turb. (NTU)	UV-254 (1/cm)	Color (C.U.)	Total Fe (mg/L)	Diss. Fe (mg/L)	Avg T. Mn (mg/L)	*Min T. Mn (mg/L)	Diss. Mn (mg/L)
Raw Water										
1	N/A	6.69	0.28	0.009	2	0.31	0.25	0.033	0.021	0.025
2	14.55	6.93	0.17	0.005	3	0.26	0.23	0.023	0.019	0.025
3	N/A	6.36	0.46	0.010	2	0.29	0.23	0.021	0.017	0.022
4	N/A	6.36	0.21	0.009	5	0.22	0.18	0.026	0.023	0.024
Filter #1										
1	N/A	6.90	0.16	0.013	2	0.02	0.01	0.005	0.000	0.005
2	15.2	7.08	0.00	0.005	0	0.02	0.01	0.002	0	0.002
3	N/A	6.93	0.04	0.005	0	0.03	0.01	0.000	0	0.001
4	N/A	7.01	0.06	0.003	4	0.02	0.01	0.004	0.003	0.004
Filter #2										
1	N/A	6.89	0.06	0.012	2	0.14	0.01	0.003	0.000	0.003
2	15.67	7.13	0	0.006	0	0.01	0.02	0	0	0
3	N/A	6.96	0.04	0.016	0	0.02	0.02	0.000	0	0.001
4	N/A	7.08	0.05	0.004	1	0.01	0.01	0.004	0.003	0.004
Filter #3										
1	N/A	6.90	0.06	0.012	1	0.02	0.01	0.005	0	0.002
2	15.77	7.1	0	0.006	0	0.02	0.02	0.001	0	0.001
3	N/A	6.95	0.01	0.006	0	0.02	0.03	0.002	0	0.001
4	N/A	7.17	0.13	0.005	3	0.02	0.01	0.006	0.003	0.003
Train 1 Treated Water										
Filter Run	Temp. (C)	pH (S.U.)	Free Cl2 (mg/L)	Total Cl2 (mg/L)	Color (C.U.)	Total Fe (mg/L)	Diss Fe (mg/L)	Avg T. Mn (mg/L)	*Min T. Mn (mg/L)	Diss. Mn (mg/L)
1		6.90								
2		7.12								
3		6.96								
4		7.02								
Train 2 Treated Water										
1		6.96	0.02	0.13						
2		7.20	0.09	0.13						
3		7.04	0.10	0.12						
4		6.99	0.11	0.15						

* Minimum total manganese concentration measured for the filter run

Water Quality

A review of the water quality information provided in Appendix C and Table 6 indicates that all of the pilot study water quality goals established in Table 4 were met. There was one field testing error in the 3rd sample round for Filter #2 in Filter Run #1 for manganese that was erroneous, and this individual result was not included in the average for the filter run.

A review and evaluation of the filter effluent pH results indicated that the pre-treatment conditions were conducive to iron and manganese removal using permanganate as oxidant and GreensandPlus™ filter media (average pH levels were between 6.89 and 7.17, within target pH levels). Filter effluent turbidity results were also all favorable. A review of the individual and average turbidity results indicate that filter effluent turbidities were all less than 1 NTU and exhibited not upward trend during the filter runs.

The presence of natural organic matter (NOM) was evaluated during the pilot study by testing for both ultraviolet light absorbance at a wavelength of 245 nm (UV-254) and total organic carbon (TOC). Raw water and filter effluent NOM water quality results exhibited extremely low levels. The average level of UV-254 was 0.007 1/cm (raw and filter effluent) and the average TOC concentration reported by the laboratory was 0.34 mg/L (raw and filter effluent, with 3 out of 8 samples reported as non-detect).

A review of filter effluent manganese results indicates that greater than 96% of all the individual field test the results were $\leq$ 0.01 The remaining 4% of the total field tests were less than 0.015 mg/L, less than half of the Secondary Standard of 0.05 mg/L, and below the pilot study water quality goal of 0.025 mg/L. Similarly, a review and evaluation of filter effluent iron test results greater than 96% of all the individual field test the results were $\leq$ 0.05 mg/L. The remaining 4% of the total field tests were less than 0.07 mg/L, well below the Secondary Standard of 0.3 mg/L and the water quality goal of 0.01 mg/L.

In addition to the field-tested routine water quality parameters listed in Table 3, water samples from the pilot study were also sampled and tested at a MassDEP certified laboratory for various other organic, inorganic, and metallic compounds as noted in Table 3 for Filter Runs. These supplemental test results are also included in Appendix C, and a summary of the results based on a review and evaluation of the data is provided below:

- The presence of E. Coli and Coliforms were not detected in either the source water or treated water.
- Chemical addition of potassium hydroxide to achieve a treated water pH resulted in an average increase in alkalinity of approximately 45 mg/L as $CaCO_3$
- The source water from Well 3 and 4 exhibits low levels of background natural organic matter (NOM), as noted by the low levels of total organic carbon (TOC) (0.54 mg/L and ND), color (7 APCU and ND), and UV-254 (0.005 1/cm and ND).
- The source water is soft, with low levels of calcium 5.84 mg/L. Magnesium concentrations were also low (3.77 mg/L). The total hardness level was 30.1 mg/L. Treatment at both locations did not significantly alter hardness.
- Potassium levels increased by approximately 43 mg/L as a result of the addition of potassium hydroxide for pH adjustment. However, there was no significant increase in

sodium levels as a result of adding sodium permanganate. This is likely due to the low levels of sodium permanganate required for effective oxidation.

- Nitrite was not detected in either the raw or filtered water, however nitrate was detected in both locations in the raw and filtered water with a concentration of 1.1 mg/L
- Heavy metals testing showed a very low concentration of barium in the source and filter effluent samples. There were no other detectable levels of heavy metals in the source water or treated water.
- Volatile organic compounds where not detected in the raw or filtered water.
- The only PFAS compound detected in the pilot study was PFOS. The PFOS concentration reported for the raw water was 3.5 nanograms per liter (ng/L). The reported levels of PFOS in the filter effluent were slightly higher, with an average concentration of 4.1 ng/L. This could be due to the materials of construction for the pilot equipment such as Teflon pipe tape, or just laboratory instrument variability at these levels.

The supernatant from the backwash waste was sampled after being allowed to settle for 24 hours. The reported sampling results indicate a pH of 6.68 and the reported level of suspended solids was "not detected". The manganese concentration of the backwash supernatant (0.167 mg/L) was higher than the source water manganese level (0.026 mg/L). However, the iron concentration of the backwash supernatant (0.172 mg/L) was lower than the source water iron level (0.27 mg/L). Lower iron levels were anticipated since the iron in the filter backwash waste had already been oxidized and the solids were allowed to settle. Settled solids from the filter backwash waste (residuals) were sampled and tested for metals. A review and evaluation of the reported results indicates low levels of arsenic, barium, cadmium and lead, while the follow metals were not detected in the residuals sample: chromium, mercury, selenium, and silver.

Section 4: Summary and Recommendations

1. The use of GreensandPlus^{TM} and anthracite as filter media and the addition of sodium permanganate at a dose of ~ 0.35 mg/L or the addition of sodium hypochlorite at a dose of 0.5 mg/L and a pH between 6.9 and 7.2 were both shown to be equally effective for the oxidation and removal of source water iron and manganese levels.
2. Although the pilot scale study indicated low levels of PFAS (~ 4 ng/L of PFOS), historic PFAS levels for these 2 sources indicate PFAS6 levels in the order of 10 ng/L. Therefore, treatment for PFAS6 is recommended, and will be required to meet future USEPA PFAS MCLs. Based on the predominant PFAS6 compounds present in the raw water (PFOS, PFOA, and PFHxS) the use of granular activated carbon (GAC) is the recommended treatment alternative for the removal of PFAS.
3. Since sodium hypochlorite is already used, the future use for pre-oxidation would allow the existing chemical addition facility to be reused for pretreatment.
4. The use of chorine for pre-oxidation is recommended due to the low levels of NOM and the fact that sodium hypochlorite is already used for treatment. Continued use of chlorine for pre-oxidation would allow the continued use of the existing chemical addition facilities for pretreatment.
5. Low levels of chlorine residual will not negatively impact the ability of the post filtration GAC contactors to remove PFAS since the mechanism for the removal of chlorine using GAC is catalytic reduction. Therefore, the adsorptive capacity of the GAC will not be

degraded by influent chlorine residuals in the range of 0.2 mg/L, and may even extend bed life due to oxidation of other organic compounds with chlorine.

6. Based on the current source water iron and manganese levels, the pilot scale results for iron, manganese, headloss, and filter run time support a recommended filter loading rate up to 6 gpm/sf.

Section 5: Conceptual Design

Based on the results of the pilot study, pressure filtration using GreensandPlus™ and anthracite filter media using potassium hydroxide for pH adjustment and sodium hypochlorite for pre-oxidation are recommended for the treatment of the blended source water from the Barnstable Fire District Well 3 and Well 4 for the removal of iron and manganese levels. Furthermore, based on the presence and levels of various PFAS compounds, the use of granular activated carbon (GAC) contactors with an empty bed contact time of 10 minutes, using bituminous based GAC with an iodine number greater than 950 mg/g is recommended to meet MassDEP and future USEPA water quality standards for PFAS.

The treatment facility will be designed to effectively remove iron, manganese, and PFAS at a design flow of 1,500 gpm (2.16 MGD). The source water will be pre-treated with potassium hydroxide for pH adjustment and sodium hypochlorite for pre-oxidation in the existing chemical addition facility at Well 4. The existing chemical storage, handling, and feed facilities at Well 4 will continue to be used for pre-treatment for the recommended GAC facilities. Following pre-treatment, four (4) 9-ft diameter GreensandPlus™ pressure vessels connected in parallel will be used to remove the oxidized source water iron and manganese. Following iron and manganese removal, a total of six (6) 12-ft GAC filters configured in three (3) trains of two (2) vessels in series (lead/lag) will be used to remove PFAS compounds from the filter effluent. After treatment by GAC, a secondary sodium hypochlorite system in the new building will be employed for disinfection and to meet target distribution system chlorine residuals. A washwater supply tank and backwash pumping system will be used to provide sufficient washwater to backwash all four GreensandPlus™ filters, and for conditioning the GAC media. Filter backwash waste will be discharged into gravity sand filters followed by infiltration basins to be constructed on site.

Based on standard pressure vessel sizing, four (4) 9-foot diameter GreensandPlus™ pressure vessels were selected yielding a combined hydraulic capacity of 1,500 gpm (2.16 MGD), 375 gpm per filter. The preliminary design is based upon Hungerford & Terry GreensandPlus™ vertical pressure filter system. To meet treatment and hydraulic requirements for PFAS removal, three sets of two 12-ft diameter GAC pressure vessels are needed to treat a design capacity of 1,500 gpm. The hydraulic capacity of each set of GAC pressure vessels will be 500 gpm to ensure an empty bed contact time (EBCT) of 10 minutes.

Filter backwash loading rates recommended for GreensandPlus™ are 12 gallons per minute per square foot (gpm/sf) representing a required backwash flow rate of 763 gpm per filter. This backwash flow rate must be delivered after PFAS treatment. During a backwash, the treatment facilities will still be able to produce a combined flow of 1,125 gpm, based on three (3) on-line GreensandPlus™ filters and the GAC filter trains. It is anticipated that each filter backwash will

generate approximately 10,000 gallons of backwash waste. To ensure adequate washwater availability, a washwater supply tank is proposed to be constructed below the building integral to the foundation. The tank will be sized to hold four washwater volumes, to allow backwash of each of the four filters. The tank size will be approximately 40,000 gallons. The backwash waste will be directed to two (2) gravity sand filters and two (2) infiltration basins designed with a storage capacity of 35,000 gallons each, representing a sufficient volume of storage for one (1) full cycle of filter backwashes. A summary of the engineering design parameters, including target chemical dosages, for the proposed Well 3 and 4 WTP are presented in Table 7. A 6-month full scale demonstration study consisting of monthly PFAS sampling will be conducted if necessary to demonstrate the performance of the GAC contactors.

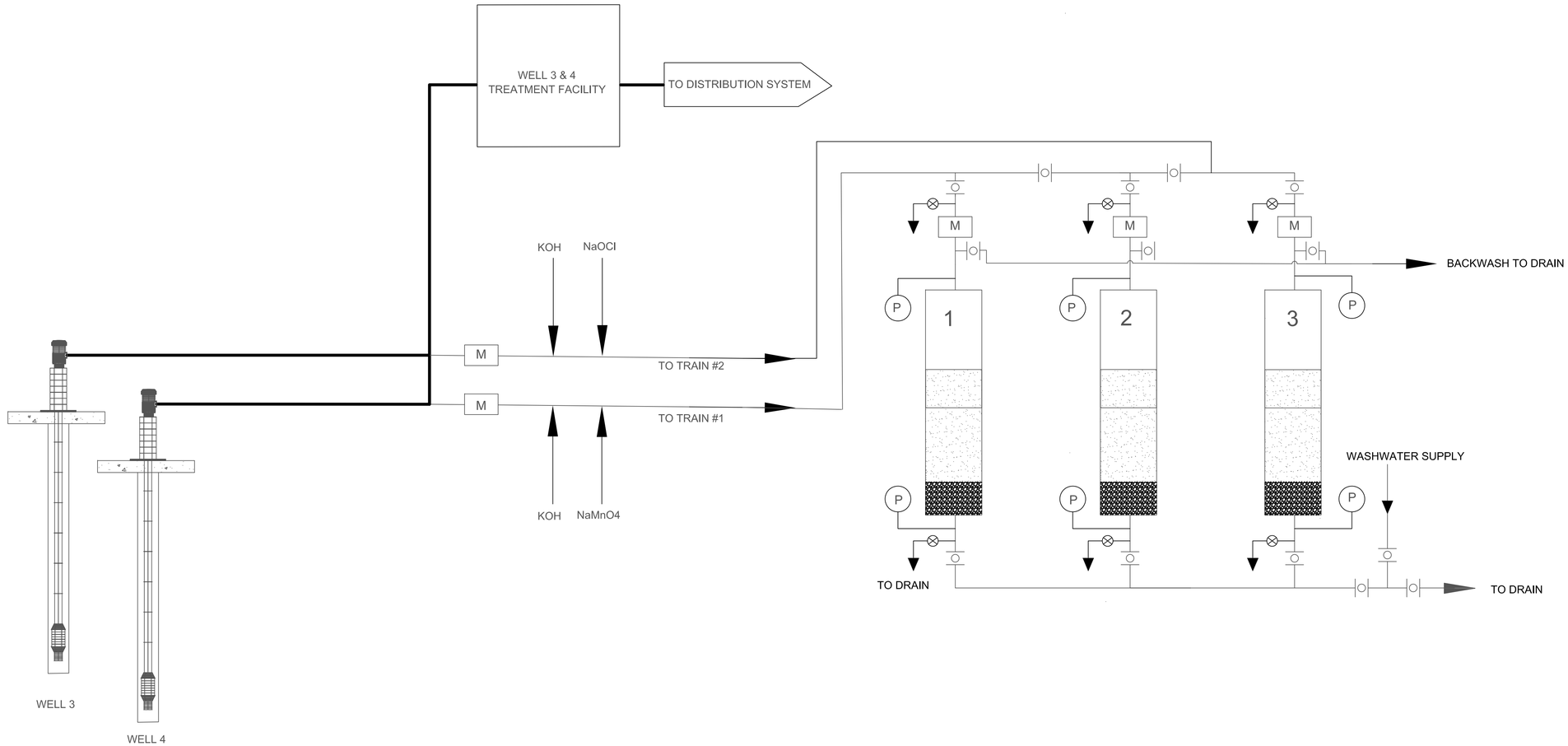
Table 7
Treatment Facility Design Parameters

Hydraulic Design Capacity	1,500 gpm (2.16 MGD)
GreensandPlus™ Filter Parameters	
Fe/Mn Filter Loading Rate	6 gpm/sf
Number of Fe/Mn Filters	4
Fe/Mn Filter Size	9 ft diameter
Hydraulic Filter Capacity (per filter)	375 gpm
Filter Run Time	24 – 48 hours
Backwash Rate	12 gpm/sf
Backwash Flow Rate	763 gpm
Backwash Volume	7,630 gallons
Rinse to Waste Flow Rate	382 gpm
Rinse to Waste Volume	1,145 gallons
GAC Contactor Parameters	
Loading Rate	6.37 gpm/sf
EBCT	10 min
GAC Media	Bituminous, 12x40 mesh, Iodine # > 950 mg/g
Number of Contactors	6
Contactor Size	10 ft diameter
Hydraulic Capacity (per contactor)	500 gpm
Residuals Handling	
Gravity Sand Filter Daily Volume	35,000 gallons
Number of Sand Drying Beds	2
Rinsewater Basin Volume	35,000 gallons
Number of Rinsewater Basins	2
Chemical Feed	
Pre Sodium Hypochlorite dosage	0.5 mg/L
Pre-Potassium Hydroxide dosage	50 mg/L
Post Sodium Hypochlorite dosage	2 mg/L

A conceptual floor plan and conceptual site civil plans are shown in Appendix D. An engineer's opinion of probable project costs is also included in Appendix D.

Appendix A

Schematic of the Pilot System



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DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JULY 2025
SCALE:	N.T.S.
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	MGN
APPROVED BY:	SCO

WELL 3 & 4 PILOT SCALE TREATABILITY STUDY

BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
PILOT TREATMENT SYSTEM SCHEMATIC

DRAWING NO.:
APP. A

Appendix B

Pilot Study Operating Records, Log Sheets, and Chemical Dosage Records

Town of Barnstable
Well 3 & 4 Pilot Study

Flow Log

	Flow		Filter 1					Filter 2					Filter 3					Comments
Date and Time	WTP Feed gpm	Pilot Feed gpm	Flow (gpm)	Headloss Out (psi)	Headloss In (psi)	Headloss Difference (psi)	Run Time (hrs)	Flow (gpm)	Headloss Out (psi)	Headloss In (psi)	Headloss Difference (psi)	Run Time (hrs)	Flow (gpm)	Headloss Out (psi)	Headloss In (psi)	Headloss Difference (psi)	Run Time (hrs)	
4/17 10:15 a.m.		2/2	0.35	51	52	1		0.44	45	51	6		0.35	50	50	0		Start Filter 1
4/17 12:25 p.m.		1.8/2	0.35	51	52	1		0.27	48	52	4		0.33	49	50	1		**Adjusted F1, F2, T1**
4/17 1:10 p.m.		2/2	0.33	51	52	1		0.4	47	53	6		0.34	48	49	1		Adjusted F1, F2, F3
4/17 2:10 p.m.		2/2	0.35	51	52	1		0.425	47.5	51	3.5		0.35	49	49.5	0.5		Adjusted F2
4/17 3:30 p.m.		2/2	0.35	51	52	1		0.44	47	51.5	4.5		0.35	49	49.5	0.5		
4/17 5:40 p.m.		2/2	0.325	51	52	1		0.38	48	52	4		0.34	49.5	50	0.5		Adjusted F1, F2, F3
4/18 8:05 a.m.		2/2	0.34	51	52	1		0.39	47	51.5	4.5		0.34	49	5	-44		Adjusted F1, F2, F3
4/18 10:05 a.m.		2/2	0.35	50.5	52	1.5		0.42	47	51.5	4.5		0.35	49	50	1		Adjusted F2
4/18 11:20 a.m.		2/2	0.35	50.5	52	1.5		0.44	46	51	5		0.35	49	50	1		
4/18 1:00 p.m.		2/2	0.35	50.5	52	1.5		0.425	46.5	51.5	5		0.35	49	50	1		
4/21 8:30 a.m.		2/2	0.35	50	51	1		0.44	51	54	3		0.35	52	52	0		
4/21 8:45 a.m.		2/2	0.35	53	53.5	0.5		0.44	51	54	3		0.35	51	52	1		
4/21 9:30 a.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.35	47	48	1		
4/21 10:30 a.m.		2/2	0.35	51	52	1		0.44	47	51.5	4.5		0.35	48.5	49	0.5		
4/21 11:30 a.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.31	49	49	0		Adjusted F3
4/21 12:30 a.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.35	49	49	0		
4/21 1:30 p.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.35	49	49	0		
4/21 2:36 p.m.		2/2	0.35	51	52	1		0.4	47	52	5		0.33	49	49	0		Adjusted F2, F3
4/21 3:30 p.m.		2/2	0.35	51	52	1		0.44	47	52	5		0.35	49	49	0		
4/21 3:50 p.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.35	49	49	0		
4/22 8:15 a.m.		2/2	0.35	50	52	2		0.3	48	52	4		0.32	47	48	1		Adjusted F2, F3
4/22 9:15 a.m.		2/2	0.35	50	52	2		0.44	47	52	5		0.35	48	49	1		Filter Run 2 (start)
4/22 10:10 a.m.		2/2	0.35	51	52.5	1.5		0.44	47	52	5		0.35	48	49	1		
4/22 11:35 a.m.		2/2	0.35	50	52	2		0.44	47	52	5		0.35	48	49	1		
4/22 12:35 a.m.		2/2	0.35	50.5	52	1.5		0.425	47	52	5		0.35	47.5	49	1.5		Adjusted F2
4/22 1:30 p.m.		2/2	0.35	50	52	2		0.44	46	52	6		0.35	48	49	1		
4/22 2:30 p.m.		2/2	0.35	50	52	2		0.44	46	52	6		0.34	47	48.5	1.5		
4/22 3:30 p.m.		2/2	0.35	50.5	52	1.5		0.44	46.5	52	5.5		0.35	47.5	49	1.5		
4/22 4:30 p.m.		2/2	0.35	50.5	52	1.5		0.44	46.5	52	5.5		0.35	47.5	49	1.5		
4/23 8:15 a.m.		2/2	0.36	50	52	2		0.38	45	51.5	6.5		0.33	46	47.5	1.5		Adjusted F1, F2, F3 (End of filter run 2)
4/23 9:45 a.m.		2/2	0.35	51.5	52	0.5		0.52	47.5	51.5	4		0.35	50	50	0		Start of filter run 3
4/23 10:00 a.m.		2/2	0.32	52	52.5	0.5		0.46	48	52	4		0.3	50.5	50.5	0		Adjusted F1, F2, F3
4/23 11:05 a.m.		2/2	0.28	52	53	1		0.46	48	52	4		0.32	50.5	50.5	0		Adjusted F1, F2, F3
4/23 12:12 p.m.		2/2	0.31	51	52	1		0.48	47	51	4		0.34	49.8	50	0.2		Adjusted F1, F2, F3
4/23 1:03 p.m.		2/2	0.33	50	51	1		0.52	46.5	51	4.5		0.35	49	49.9	0.9		Adjusted F1
4/23 2:15 p.m.		2/2	0.32	50.5	52	1.5		0.51	47	51	4		0.33	49.1	50	0.9		Adjusted F1, F2, F3
4/23 3:58 p.m.		2/2	0.35	51	51.9	0.9		0.52	47	51.5	4.5		0.35	49.1	50	0.9		
4/23 4:45 p.m.		2/2	0.35	51	52	1		0.52	47	51	4		0.35	50	50	0		
4/24 8:15 a.m.		2/2	0.32	50	52	2		0.47	46	51	5		0.33	49	50	1		Adjusted F1, F2, F3
4/24 9:15 a.m.		2/2	0.35	51	52	1		0.52	46	51.5	5.5		0.35	49	50	1		End of filter run 3
4/24 10:00 a.m.		2/2	0.35	51.5	52	0.5		0.52	47.5	51.5	4		0.35	49.5	50	0.5		Start of filter run 4
4/24 10:15 a.m.		2/2	0.31	52	52	0		0.47	48	52	4		0.325	50	50	0		Adjusted F1, F2, F3
4/24 11:10 a.m.		2/2	0.33	51.5	52	0.5		0.5	48	52	4		0.34	50	50	0		Adjusted F1, F2, F3
4/24 12:00 p.m.		2/2	0.31	52	52	0		0.51	47.5	52	4.5		0.34	50	50	0		Adjusted F1, F2, F3
4/24 1:05 p.m.		2/2	0.31	51	52	1		0.52	47	52	5		0.35	49	50	1		Adjusted F1
4/24 2:02 p.m.		2/2	0.35	51	52	1		0.48	47	51.5	4.5		0.3	49	50	1		Adjusted F2, F3
4/24 3:08 p.m.		2/2	0.34	51	51.5	0.5		0.52	47	51	4		0.35	49	49.5	0.5		Adjusted F1
4/24 3:55 p.m.		2/2	0.32	51	51.9	0.9		0.52	47	51	4		0.35	49	49.5	0.5		Adjusted F1
4/25 8:15 a.m.		1.9/2	0.27	51	52	1		0.48	46	51.2	5.2		0.34	48.9	50	1.1		Adjusted F1, F2, F3
4/25 10:00 a.m.		2/2	0.35	50.5	51.5	1		0.5	46	51	5		0.35	48.5	49.5	1		Adjusted F2 (Start of filter run 4)
4/25 11:45 a.m.		2/2	0.35	50	51	1		0.52	45	51	6		0.35	48	49	1		
4/25 1:00 p.m.		2/2	0.34	50	51	1		0.52	45	51	6		0.35	48	49	1		Adjusted F1
4/25 2:05 p.m.		2/2	0.35	50	51	1		0.52	45	51	6		0.35	48	49	1		
4/25 3:00 p.m.		2/2	0.35	50	51	1		0.52	45	51	6		0.35	48	49	1		
4/25 3:45 p.m.		2/2	0.35	50.1	52	1.9		0.52	45	51.1	6.1		0.35	48.1	49.9	1.8		
4/25 4:27 p.m.		2/2	0.34	50	52	2		0.51	44	52	8		0.35	47.5	50	2.5		Adjusted F1

Town of Barnstable
Well 3 & 4 Pilot Study
Chemical Usage Log

		Pump 1 NaMnO4					Pump 2 KOH					Pump 3 KOH					Pump 4 NaOCl					
Date	Time	Batch Conc	Level L	Pump Setting	mL/min	Dosage (mg/L)	Batch Conc	Level L	Pump Setting	mL/min	Dosage (mg/L)	Batch Conc	Level L	Pump Setting	mL/min	Dosage (mg/L)	Batch Conc	Level L	Pump Setting	mL/min	Dosage (mg/L)	Comments
4/17/25	10:41 AM		39.8	0.25				47	2.3				46.5	2.3				12.3	2			
4/17/25	3:20 PM		39.5	0.25				46	2.35				46	2.3				12	2			pH = 6.63, Increase Pump 2 and 3 by 0.05%
4/17/25	6:00 PM		39	0.25				45.5	2.35				45.1	2.3				11.9	2			
4/18/25	8:05 AM		38.6	0.25				43	2.35				43.5	2.3				11.5	2			pH = 7.43/7.65, Decrease Pump 2 and 3 by 0.05%
4/18/25	10:45 AM		38.5	0.25	0.902778			42.8	2.3				43	2.25				11.4	2			
4/18/25	1:00 PM		38.2	0.25				42.5	2.3				42.8	2.25				11.2	2			End of Filter Run 1
4/21/25	8:30 AM		39	0.24				42	2.3				42	2.25				11.2	2			
4/21/25	9:50 AM		39	0.24				42	2.3				43	2.25				11.2	2			Start of Filter Run 2
4/21/25	1:11 PM		39	0.24				42	2.3				43	2.25				11	2			
4/21/25	4:00 PM		39	0.24				41	2.3				41	2.25				10.9	2			
4/22/25	8:15 AM		38	0.24	0.694444			39	2.3				39	2.25				10.3	2			
4/22/25	11:35 AM		38	0.24				39	2.3				39	2.25				10.2	2			
4/22/25	2:30 PM		37.5	0.24				38	2.3				38.7	2.25				10.1	2			
4/23/25	8:15 AM		37	0.24	0.694444			35	2.3				35	2.25				9.4	2			End of Filter Run 2
4/23/25	11:05 AM		37	0.24				34.9	2.3				34.9	2.25				9.4	2			
4/23/25	1:00 PM		37	0.24	0.520833			34.9	2.3				34.9	2.25				9.3	2			Start of Filter Run 3
4/23/25	2:10 PM		37	0.24				34.9	2.3				34.9	2.25				9.25	2.5			
4/23/25	2:40 PM		37	0.24				34.9	2.3				34.9	2.25				9.25	2.25			
4/23/25	4:00 PM		37	0.24				34.8	2.3				34.9	2.25				9.1	2.25			
4/24/25	8:15 AM		36.5	0.24	0.347222			31.5	2.3				31.5	2.25				8.2	2.25			
4/24/25	11:15 AM		36.5	0.24				31.2	2.3				31.25	2.25				8.2	2.25			Start of Filter Run 4
4/24/25	1:05 PM		36.5	0.24				31.5	2.3				31.5	2.25				8.2	2.25			
4/25/25	10:15 AM		36	0.24	0.347222			27.5	2.3				27.5	2.25				7.3	2.25			
4/25/25	3:30 PM		36	0.24				26	2.3				26	2.25				7	2.25			
4/26/25	4:30 AM		37	0.24				23	2.3				23	2.25				6	2.25			

Appendix C

Water Quality Sampling Results

Town of Barnstable
Well 3 & 4 Pilot Study

Location: BFD Well 3 & 4
Filter Run: 1

Water Quality Sampling Log

Raw

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.			6.98	0.19	0.006	3	0.35	0.25	0.022	0.018
4/17 2:11 p.m.			6.62	0.74	0.026	4	0.29	0.18	0.067	0.036
4/17 3:45 p.m.			6.88	0.26	0.004	UR	0.33	0.24	0.033	0.029
4/18 8:20 a.m.			6.49	0.12	0.008	-2	0.29	0.27	0.023	0.024
4/18 11:30 a.m.			6.47	0.09	0.002	2	0.30	0.29	0.021	0.019

Treated - Train 1

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.			6.82							
4/17 2:11 p.m.			6.63							
4/17 3:45 p.m.			6.93							
4/18 8:20 a.m.			7.43							
4/18 11:30 a.m.			6.69							

Treated - Train 2

Run / Date / Time		Temp C	pH S.U.	Free Cl2	Total CL2	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.			6.80	0.01	0.020					
4/17 2:11 p.m.			6.68	0.01	0.150					
4/17 3:45 p.m.			6.93	0.03	0.190					
4/18 8:20 a.m.			7.65	0.02	0.170					
4/18 11:30 a.m.			6.72	0.01	0.130					

Filter #1

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.	0.00		6.78	0.40	0.006	1	0.03	0.03	0.004	0.006
4/17 2:11 p.m.	3.18		6.77	0.01	0.040	0	0.01	0.01	0.002	0.002
4/17 3:45 p.m.	4.75		6.82	0.32	0.006	5	0.06	0.06	0.013	0.012
4/18 8:20 a.m.	21.33		7.41	0.07	0.008	-1	0.02	0.00	0.004	0.004
4/18 11:30 a.m.	24.50		6.70	0.02	0.004	5	0.00	0.00	0.000	-0.001

Filter #2

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.	0.00		6.78	0.10	0.008	2	0.03	0.03	-0.001	0.000
4/17 2:11 p.m.	3.18		6.77	0.08	0.040	0	0.02	0.02	0.008	0.009
4/17 3:45 p.m.	4.75		6.78	*1.76	0.002	-1	*0.62	0.00	*0.152	0.002
4/18 8:20 a.m.	21.33		7.35	0.04	0.010	UR	0.02	0.01	0.003	0.005
4/18 11:30 a.m.	24.50		6.75	0.03	0.002	5	-0.01	-0.01	0.000	0.000

Filter #3

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.	0.00		6.78	0.10	0.008	2	0.02	0.02	0.004	-0.001
4/17 2:11 p.m.	3.18		6.77	0.08	0.040	0	0.01	0.00	0.007	0.003
4/17 3:45 p.m.	4.75		6.84	0.00	0.002	-1	0.00	0.00	0.007	0.004
4/18 8:20 a.m.	21.33		7.31	0.09	0.007	4	0.07	0.01	0.008	0.005
4/18 11:30 a.m.	24.50		6.79	0.02	0.005	1	0.00	0.00	-0.001	0.000

Notes:

F1 = T1 = 4 gpm/sf
F2 = T1 = 5 gpm/sf
F3 = T2 = 5 gpm/sf

	Fe (tot)	Fe (dissolved)
Well 3	0.06	0.02
Well 4	0.63	0.59

	Mn (tot)	Mn (dissolved)
Well 3	ND	ND
Well 4	0.055	0.058

Possible bad sample

* Sampling Error, not used for average.

H2Olson Engineering, Inc.

Town of Barnstable
Well 3 & 4 Pilot Study

Location: BFD Well 3 & 4
Filter Run: 2

Water Quality Sampling Log

Raw

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.		11.6	7.38	0.26	0.002	2	0.30	0.26	0.027	0.024
4/21 11:00 a.m.		14.8	7.44	0.04	0.003	-1	0.26	0.24	0.024	0.029
4/21 2:00 p.m.		13.8	7.60	0.27	0.007	1	0.25	0.22	0.024	0.032
4/22 8:45 a.m.		15.4	6.49	0.24	0.004	0	0.24	0.22	0.030	0.026
4/22 11:40 a.m.		N/A	6.29	0.12	0.007	6	0.24	0.21	0.020	0.024
4/22 2:30 p.m.		16.3	6.34	0.17	0.005	7	0.28	0.25	0.019	0.018
4/23 8:40 a.m.		15.4	7.00	0.07	0.004	4	0.24	0.21	0.019	0.021

Treated - Train 1

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.		11.5	6.96							
4/21 11:00 a.m.		13.3	7.36							
4/21 2:00 p.m.		13.7	7.54							
4/22 8:45 a.m.		13.6	6.99							
4/22 11:40 a.m.		12.4	6.88							
4/22 2:30 p.m.		N/A	7.11							
4/23 8:40 a.m.		15.3	7.07							

Treated - Train 2

Run / Date / Time		Temp C	pH S.U.	Free Cl2	Total CL2	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.		11.5	7.00	0.20	0.200					
4/21 11:00 a.m.		13.9	7.50	0.11	0.170					
4/21 2:00 p.m.		12.8	7.55	0.12	0.140					
4/22 8:45 a.m.		13.6	7.01	0.08	0.014					
4/22 11:40 a.m.		12.2	7.02	0.08	0.140					
4/22 2:30 p.m.		N/A	7.15	0.00	0.070					
4/23 8:40 a.m.		15.2	7.14	0.07	0.170					

Filter #1

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.	0.00	15.8	6.94	0.09	0.009	8	0.02	0.02	0.001	-0.004
4/21 11:00 a.m.	2.42	15.5	7.34	0.01	0.007	-2	0.02	0.01	0.006	0.007
4/21 2:00 p.m.	5.42	14.5	7.30	0.00	0.010	2	0.02	0.02	0.009	-0.002
4/22 8:45 a.m.	24.17	14.4	6.96	-0.10	0.004	-3	0.03	0.01	0.002	0.004
4/22 11:40 a.m.	27.08	N/A	6.99	-0.07	0.005	-2	0.02	0.01	0.000	0.000
4/22 2:30 p.m.	29.92	15	7.12	0.09	0.003	-3	0.01	0.01	0.000	0.002
4/23 8:40 a.m.	48.08	16	6.89	0.01	0.002	UR	0.02	0.02	-0.003	0.004

Filter #2

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.	0.00	15.1	6.99	0.06	0.017	UR	0.02	0.02	-0.003	-0.004
4/21 11:00 a.m.	2.42	15.2	7.39	-0.27	0.004	-2	0.01	0.01	-0.003	-0.004
4/21 2:00 p.m.	5.42	14.2	7.36	0.05	0.006	1	0.01	0.03	-0.001	0.002
4/22 8:45 a.m.	24.17	15.9	7.25	-0.05	0.003	-2	0.02	0.02	-0.001	0.002
4/22 11:40 a.m.	27.08	18.1	6.93	0.07	0.003	2	0.01	0.01	-0.004	-0.005
4/22 2:30 p.m.	29.92	15.2	7.07	0.03	0.002	-5	0.01	0.01	0.000	0.001
4/23 8:40 a.m.	48.08	16	6.97	0.02	0.004	-4	0.02	0.03	-0.003	-0.001

Filter #3

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.	0.00	14.6	7.00	0.05	0.009	0	0.02	0.02	0.000	0.007
4/21 11:00 a.m.	2.42	15.1	7.37	-0.24	0.004	-1	0.03	0.01	0.008	0.003
4/21 2:00 p.m.	5.42	14.7	7.33	0.02	0.009	-3	0.03	0.02	0.000	0.000
4/22 8:45 a.m.	24.17	15.8	6.94	-0.02	0.007	-2	0.01	0.01	0.000	-0.001
4/22 11:40 a.m.	27.08	18	6.99	0.06	0.004	2	0.01	0.01	-0.003	-0.004
4/22 2:30 p.m.	29.92	16.3	7.05	-0.03	0.002	-3	0.01	0.01	-0.001	0.000
4/23 8:40 a.m.	48.08	15.9	6.99	0.01	0.004	-2	0.01	0.03	0.003	0.000

Notes:

F1 = T1 = 4 gpm/sf
F2 = T2 = 5 gpm/sf
F3 = T2 = 4 gpm/sf

Turn on Chem Pumps @ 8:30 a.m.
Run to waste until 8:45 a.m.
Start FR#2 @ 8:45 a.m.

H2Olson Engineering, Inc.

Town of Barnstable
Well 3 & 4 Pilot Study

Location: BFD Well 3 & 4
Filter Run: 3

Water Quality Sampling Log

Raw

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.			6.14	0.71	0.009	3	0.33	0.22	0.017	0.019
4/23 1:30 p.m.			6.49	0.61	0.016	4	0.27	0.22	0.026	0.026
4/24 8:45 a.m.			6.44	0.06	0.005	0	0.27	0.24	0.021	0.020

Treated - Train 1

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.			7.11							
4/23 1:30 p.m.			6.68							
4/24 8:45 a.m.			7.09							

Treated - Train 2

Run / Date / Time		Temp C	pH S.U.	Free Cl2	Total CL2	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.			7.07	0.03	0.090					
4/23 1:30 p.m.			7.00	0.15	0.150					
4/24 8:45 a.m.			7.04	0.12	0.120					

Filter #1

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.	0.00		6.92	0.09	0.005	0	0.05	0.01	-0.004	-0.002
4/23 1:30 p.m.	2.75		6.81	0.05	0.006	-1	0.02	0.01	0.002	0.004
4/24 8:45 a.m.	22.00		7.05	-0.01	0.005	-4	0.02	0.01	0.001	0.000

Filter #2

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.	0.00		6.97	0.03	0.007	-5	0.02	0.02	-0.006	-0.006
4/23 1:30 p.m.	2.75		6.90	0.05	0.034	2	0.02	0.02	0.003	0.003
4/24 8:45 a.m.	22.00		7.00	0.04	0.006	4	0.01	0.01	0.003	0.001

Filter #3

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.	0.00		6.95	0.06	0.005	-4	0.03	0.05	-0.002	-0.002
4/23 1:30 p.m.	2.75		6.89	0.01	0.008	7	0.03	0.02	0.008	0.002
4/24 8:45 a.m.	22.00		7.01	-0.03	0.006	-3	0.00	0.01	0.001	0.002

Notes:

Adjusted Cl2 pump from 2 to 2.5%

Train 2

	Tot Cl2	Free Cl2
2:30 p.m.	0.34	0.31

F1 = T1 = 4 gpm/sf
F2 = T2 = 6 gpm/sf
F3 = T2 = 4 gpm/sf

H2Olson Engineering, Inc.

Town of Barnstable
Well 3 & 4 Pilot Study

Location: BFD Well 3 & 4
Filter Run: 4

Water Quality Sampling Log

Raw

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.			6.51	0.37	0.012	-4	0.22	0.18	0.023	0.020
4/24 2:00 p.m.			6.35	0.31	0.008	8	0.21	0.16	0.026	0.025
4/25 8:20 a.m.			6.42	0.07	0.008	7	0.23	0.21	0.025	0.024
4/25 1:30 p.m.			6.14	0.07	0.008	7	0.2	0.18	0.029	0.025

Treated - Train 1

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.			7.16							
4/24 2:00 p.m.			6.82							
4/25 8:20 a.m.			6.99							
4/25 1:30 p.m.			7.12							

Treated - Train 2

Run / Date / Time		Temp C	pH S.U.	Free Cl2	Total CL2	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.			6.99	0.06	0.11					
4/24 2:00 p.m.			6.81	0.13	0.19					
4/25 8:20 a.m.			7.12	0.13	0.16					
4/25 1:30 p.m.			7.05	0.13	0.15					

Filter #1

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.	0.00		6.99	0.12	0.003	4	0.01	0.01	0.008	0.005
4/24 2:00 p.m.	1.92		6.87	0.11	0.003	5	0.01	0	0.003	0.002
4/25 8:20 a.m.	20.25		7.04	0.13	0.002	5	0.02	0.01	0.003	0.003
4/25 1:30 p.m.	25.42		7.12	-0.14	0.005	1	0.03	0.02	0.003	0.005
4/26 4:20 p.m.										

Filter #2

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.	0.00		7.1	0.12	0.004	1	0.01	0.01	0.004	0.006
4/24 2:00 p.m.	1.92		6.95	0.05	0.007	6	0	-0.01	0.006	0.005
4/25 8:20 a.m.	20.25		7.16	0.1	0.003	-1	0.01	0.01	0.004	0.003
4/25 1:30 p.m.	25.42		7.09	-0.06	0.003	-2	0.03	0.01	0.003	0.002
4/26 4:20 p.m.			7.09				0.01	0.01		

Filter #3

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.	0.00		7.05	0	0.004	3	0.01	0	0.005	0.006
4/24 2:00 p.m.	1.92		6.88	0.42	0.006	2	0.03	0.02	0.012	0.001
4/25 8:20 a.m.	20.25		7.16	0.08	0.004	-2	0.01	0.01	0.004	0.003
4/25 1:30 p.m.	25.42		7.07	0.01	0.004	10	0.02	0.02	0.003	0.002
4/26 4:20 p.m.			7.69				0.02	0.01		

Notes:

F1 = T1 = 4 gpm/sf
F2 = T1 = 6 gpm/sf
F3 = T2 = 4 gpm/sf

H2Olson Engineering, Inc.

Town of Barnstable
Well 3 & 4 Pilot Study
Barnstable Fire District
Laboratory Water Quality Results

Parameter	Run-1						Run-2					
	Raw	Treatment Train 1	Treatment Train 2	Filter 1	Filter 2	Filter 3	Raw	Treatment Train 1	Treatment Train 2	Filter 1	Filter 2	Filter 3
Total Metals												
Antimony, Total (mg/L)							ND			ND	ND	ND
Arsenic, Total (mg/L)							ND			ND	ND	ND
Barium, Total (mg/L)							0.0074			0.0123	0.0167	0.019
Beryllium, Total (mg/L)							ND			ND	ND	ND
Cadmium, Total (mg/L)							ND			ND	ND	ND
Calcium, Total (mg/L)							5.84			5.61	5.6	5.6
Chromium, Total (mg/L)							ND			ND	ND	ND
Iron, Total (mg/L)	0.304			ND	ND	ND	0.33			ND	ND	ND
Magnesium, Total (mg/L)							3.77			3.85	3.85	3.84
Manganese, Total (mg/L)	0.0214			ND	ND	ND	0.0178			ND	ND	ND
Mercury, Total (mg/L)							ND			ND	ND	ND
Nickel, Total (mg/L)							0.0045			ND	0.0025	0.0026
Potassium, Total (mg/L)							ND			43.4	36.3	37.7
Selenium, Total (mg/L)							ND			ND	ND	ND
Sodium, Total (mg/L)							18.2			18.6	18.8	18.8
Thallium, Total (mg/L)							ND			ND	ND	ND
General Chemistry												
Turbidity (NTU)	0.29			ND	0.2	ND	0.77			0.61	0.61	0.65
Color, Apparent (A.P.C.U.)	7			6	6	5	ND			5	5	ND
UV Absorbance @ 254 nm (Abs/cm)	0.005			0.006	ND	ND	ND			ND	ND	ND
Alkalinity, Total (mg CaCO3/L)	17.8			63.5	68.9	58.6	19			68.9	60.1	61.6
Carbon Dioxide (mg/L)	260			440	420	370	320			470	430	450
Fluoride (mg/L)							ND			ND	ND	ND
pH (H) (SU)	6.63	7.02	6.99	7.12	7	6.89	6.43	7	7.29	6.86	6.83	6.81
Nitrogen, Nitrite (mg/L)							ND			ND	ND	ND
Nitrogen, Nitrate (mg/L)							1.1			1.1	1.1	1.1
Total Organic Carbon (mg/L)	0.54			0.54	ND	ND	ND			0.502	0.585	0.52
Bacteria In Water												
Coliform, Total (col/100 mL)							Negative			Negative	Negative	Negative
Escherichia Coli (col/100 mL)							Negative			Negative	Negative	Negative
Anions by Ion Chromatography												
Chloride (mg/L)							28.1			28	28.4	28.4
Sulfate (mg/L)							10.6			10.4	10.4	10.5
Total Hardness by SM 2340B												
Hardness (mg/L)							30.1			29.8	29.8	29.8
PFAs by EPA 537.1												
Perfluorobutanesulfonic Acid (PFBS) (ng/L)							ND			ND	ND	ND
Perfluorohexanoic Acid (PFHxA) (ng/L)							ND			ND	ND	ND
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA) (ng/L)							ND			ND	ND	ND
Perfluoroheptanoic Acid (PFHpA) (ng/L)							ND			ND	ND	ND
Perfluorohexanesulfonic Acid (PFHxS) (ng/L)							ND			ND	ND	ND
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA) (ng/L)							ND			ND	ND	ND
Perfluorooctanoic Acid (PFOA) (ng/L)							ND			ND	ND	ND
Perfluorononanoic Acid (PFNA) (ng/L)							ND			ND	ND	ND
Perfluorooctanesulfonic Acid (PFOS) (ng/L)							3.50			4.37	3.92	4.12
Perfluorodecanoic Acid (PFDA) (ng/L)							ND			ND	ND	ND
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS) (ng/L)							ND			ND	ND	ND
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA) (ng/L)							ND			ND	ND	ND
Perfluoroundecanoic Acid (PFUnA) (ng/L)							ND			ND	ND	ND
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA) (ng/L)							ND			ND	ND	ND
Perfluorododecanoic Acid (PFDoA) (ng/L)							ND			ND	ND	ND
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS) (ng/L)							ND			ND	ND	ND
Perfluorotridecanoic Acid (PFTrDA) (ng/L)							ND			ND	ND	ND
Perfluorotetradecanoic Acid (PFTA) (ng/L)							ND			ND	ND	ND
PFAS, Total (6) (ng/L)							3.5			4.37	3.92	4.12

Town of Barnstable
Well 3 & 4 Pilot Study
Residuals Sampling Results

Parameter	Run-2 FBW Residuals	Run-2 FBW Supernatant
Total Metals		
Arsenic, Total (mg/L)	0.0047	
Barium, Total (mg/L)	0.0546	
Cadmium, Total (mg/L)	0.0005	
Chromium, Total (mg/L)	ND	
Iron, Total (mg/L)		0.172
Lead, Total (mg/L)	0.0066	
Manganese, Total (mg/L)		0.167
Mercury, Total (mg/L)	ND	
Selenium, Total (mg/L)	ND	
Silver, Total (mg/L)	ND	
General Chemistry		
Solids, Total Suspended (mg/L)	100	ND
pH (H) (SU)		6.68

FBW - Filter Backwash

H2Olson Engineering, Inc.

ANALYTICAL REPORT

Lab Number:	L2523741
Client:	H2Olson Engineering, Inc. 10 Riverside Drive, Suite 103 Lakeville, MA 02347
ATTN:	Stephen Olson
Phone:	(508) 375-7007
Project Name:	WELL 3&4 PILOT STUDY
Project Number:	127.25.01
Report Date:	04/28/25

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Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0826), IL (200077), IN (C-MA-03), KY (KY98045), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), OR (MA-1316), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #525-23-122-91930A1).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Lab Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2523741-01	R1-RW	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-02	R1-T1-F1	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-03	R1-T1-F2	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-04	R1-T2-F3	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-05	R1-T1-TRT	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-06	R1-T2-TRT	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Pace Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments and solids are reported on a dry weight basis unless otherwise noted. Tissues are reported "as received" or on a wet weight basis, unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Pace's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Pace Project Manager and made arrangements for Pace to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

Case Narrative (continued)

Total Organic Carbon

The WG2058429-4 MS recovery performed on L2523741-02 is outside the acceptance criteria for total organic carbon (117%); however, the associated LCS recovery is within criteria. No further action was taken.

Carbon Dioxide

The WG2055722-1 Laboratory Duplicate RPD performed on L2523741-01 is outside the acceptance criteria for carbon dioxide (42%) due to the non-homogeneous nature of the native sample.

Alkalinity, Total

The WG2055723-3 Laboratory Duplicate RPD performed on L2523741-01 is outside the acceptance criteria for alkalinity, total (18%) due to the non-homogeneous nature of the native sample.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:  Kelly Stenstrom

Title: Technical Director/Representative Date: 04/28/25

METALS

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2523741
Project Number: 127.25.01
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-01
Client ID: R1-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.304		mg/l	0.0500	--	1	04/22/25 12:55	04/28/25 15:38	EPA 3005A	19,200.7	JMF
Manganese, Total	0.0214		mg/l	0.0100	--	1	04/22/25 12:55	04/28/25 15:38	EPA 3005A	19,200.7	JMF

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2523741
Project Number: 127.25.01
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-02
Client ID: R1-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.0500	--	1	04/22/25 12:55	04/28/25 15:42	EPA 3005A	19,200.7	JMF
Manganese, Total	ND		mg/l	0.0100	--	1	04/22/25 12:55	04/28/25 15:42	EPA 3005A	19,200.7	JMF

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2523741
Project Number: 127.25.01
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-03
Client ID: R1-T1-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.0500	--	1	04/22/25 12:55	04/28/25 15:47	EPA 3005A	19,200.7	JMF
Manganese, Total	ND		mg/l	0.0100	--	1	04/22/25 12:55	04/28/25 15:47	EPA 3005A	19,200.7	JMF

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2523741
Project Number: 127.25.01
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-04
Client ID: R1-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.0500	--	1	04/22/25 12:55	04/28/25 15:51	EPA 3005A	19,200.7	JMF
Manganese, Total	ND		mg/l	0.0100	--	1	04/22/25 12:55	04/28/25 15:51	EPA 3005A	19,200.7	JMF

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG2056634-1										
Iron, Total	ND		mg/l	0.0500	--	1	04/22/25 12:55	04/23/25 11:06	19,200.7	CEY
Manganese, Total	ND		mg/l	0.0100	--	1	04/22/25 12:55	04/23/25 11:06	19,200.7	CEY

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG2056634-2								
Iron, Total	109		-		85-115	-		
Manganese, Total	107		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2056634-3 QC Sample: L2523388-01 Client ID: MS Sample												
Iron, Total	ND	1	1.12	112		-	-		75-125	-		20
Manganese, Total	0.0199	0.5	0.562	108		-	-		75-125	-		20

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2523741

Report Date: 04/28/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2056634-4 QC Sample: L2523388-01 Client ID: DUP Sample						
Iron, Total	ND	ND	mg/l	NC		20
Manganese, Total	0.0199	0.0195	mg/l	2		20

INORGANICS
&
MISCELLANEOUS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-01
Client ID: R1-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.29		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
Color, Apparent	7.0		A.P.C.U.	5.0	--	1	-	04/17/25 21:52	121,2120B	AAS
UV Absorbance @ 254nm	0.005		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
Alkalinity, Total	17.8		mg CaCO3/L	2.00	NA	1	-	04/18/25 10:54	121,2320B	MRM
Carbon Dioxide	260		mg/l	2.0	--	1	-	04/18/25 10:20	121,4500CO2-D	MRM
pH (H)	6.63		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS
Total Organic Carbon	0.540		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-02
Client ID: R1-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
Color, Apparent	6.0		A.P.C.U.	5.0	--	1	-	04/17/25 21:52	121,2120B	AAS
UV Absorbance @ 254nm	0.006		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
Alkalinity, Total	63.5		mg CaCO3/L	2.00	NA	1	-	04/18/25 10:55	121,2320B	MRM
Carbon Dioxide	440		mg/l	2.0	--	1	-	04/18/25 10:20	121,4500CO2-D	MRM
pH (H)	7.12		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS
Total Organic Carbon	0.540		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-03
Client ID: R1-T1-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.20		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
Color, Apparent	6.0		A.P.C.U.	5.0	--	1	-	04/17/25 21:52	121,2120B	AAS
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
Alkalinity, Total	68.9		mg CaCO3/L	2.00	NA	1	-	04/18/25 10:58	121,2320B	MRM
Carbon Dioxide	420		mg/l	2.0	--	1	-	04/18/25 10:20	121,4500CO2-D	MRM
pH (H)	7.00		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-04
Client ID: R1-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
Color, Apparent	5.0		A.P.C.U.	5.0	--	1	-	04/17/25 21:52	121,2120B	AAS
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
Alkalinity, Total	58.6		mg CaCO3/L	2.00	NA	1	-	04/18/25 11:01	121,2320B	MRM
Carbon Dioxide	370		mg/l	2.0	--	1	-	04/18/25 10:20	121,4500CO2-D	MRM
pH (H)	6.89		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-05
Client ID: R1-T1-TRT
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
pH (H)	7.02		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-06
Client ID: R1-T2-TRT
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
pH (H)	6.99		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2055428-1										
Turbidity	ND		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2055723-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	04/18/25 10:25	121,2320B	MRM
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2055972-1										
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2058429-1										
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-06 Batch: WG2055418-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2055428-2								
Turbidity	91		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2055723-2								
Alkalinity, Total	104		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2055972-2								
UV Absorbance @ 254nm	78		-			-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2058429-2								
Total Organic Carbon	101		-		90-110	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055723-4 QC Sample: L2523741-01 Client ID: R1-RW												
Alkalinity, Total	17.8	100	125	107		-	-		86-116	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2058429-4 QC Sample: L2523741-02 Client ID: R1-T1-F1												
Total Organic Carbon	0.540	16	19.3	**117**	Q	-	-		85-115	-		15

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2523741

Report Date: 04/28/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG2055418-2 QC Sample: L2523899-03 Client ID: DUP Sample						
pH	7.10	7.08	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055422-1 QC Sample: L2523741-04 Client ID: R1-T2-F3						
Color, Apparent	5.0	5.0	A.P.C.U.	0		
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055428-3 QC Sample: L2523923-01 Client ID: DUP Sample						
Turbidity	15	15	NTU	0		13
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055722-1 QC Sample: L2523741-01 Client ID: R1-RW						
Carbon Dioxide	260	400	mg/l	**42**	Q	26
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055723-3 QC Sample: L2523741-01 Client ID: R1-RW						
Alkalinity, Total	17.8	21.4	mg CaCO3/L	**18**	Q	10
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055972-3 QC Sample: L2523741-04 Client ID: R1-T2-F3						
UV Absorbance @ 254nm	ND	ND	Abs/cm	NC		
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2058429-3 QC Sample: L2523741-01 Client ID: R1-RW						
Total Organic Carbon	0.540	ND	mg/l	NC		15

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2523741-01A	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-01B	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-01C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-01D	Plastic 120ml unpreserved	A	7	7	4.5	Y	Absent		TURB-180(2)
L2523741-01E	Plastic 250ml HNO3 preserved	A	<2	<2	4.5	Y	Absent		FE-UI(180),MN-UI(180)
L2523741-01F	Plastic 500ml unpreserved/No Headspace	A	NA		4.5	Y	Absent		ALK-T-2320(14),CO2(1)
L2523741-01G	Amber 500ml unpreserved	A	7	7	4.5	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2523741-02A	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-02B	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-02C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-02D	Plastic 120ml unpreserved	A	7	7	4.5	Y	Absent		TURB-180(2)
L2523741-02E	Plastic 250ml HNO3 preserved	A	<2	<2	4.5	Y	Absent		FE-UI(180),MN-UI(180)
L2523741-02F	Plastic 500ml unpreserved/No Headspace	A	NA		4.5	Y	Absent		ALK-T-2320(14),CO2(1)
L2523741-02G	Amber 500ml unpreserved	A	7	7	4.5	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2523741-03A	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-03B	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-03C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-03D	Plastic 120ml unpreserved	A	7	7	4.5	Y	Absent		TURB-180(2)
L2523741-03E	Plastic 250ml HNO3 preserved	A	<2	<2	4.5	Y	Absent		FE-UI(180),MN-UI(180)
L2523741-03F	Plastic 500ml unpreserved/No Headspace	A	NA		4.5	Y	Absent		ALK-T-2320(14),CO2(1)
L2523741-03G	Amber 500ml unpreserved	A	7	7	4.5	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2523741-04A	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-04B	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)

*Values in parentheses indicate holding time in days

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2523741-04C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-04D	Plastic 120ml unpreserved	A	7	7	4.5	Y	Absent		TURB-180(2)
L2523741-04E	Plastic 250ml HNO3 preserved	A	<2	<2	4.5	Y	Absent		FE-UI(180),MN-UI(180)
L2523741-04F	Plastic 500ml unpreserved/No Headspace	A	NA		4.5	Y	Absent		ALK-T-2320(14),CO2(1)
L2523741-04G	Amber 500ml unpreserved	A	7	7	4.5	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2523741-05C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-06C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)

*Values in parentheses indicate holding time in days

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: Data Usability Report

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

Report Format: Data Usability Report

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

Data Qualifiers

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

MCL References

The following links provide the most up-to-date Maximum Contaminant Levels (MCL) or Maximum Residual Disinfectant Levels (MRDL) from the EPA's National Primary Drinking Water Regulations (NPDWR) and the MassDEP's Drinking Water Standards and Guidelines.

EPA

https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

MassDEP

https://www.mass.gov/guides/drinking-water-standards-and-guidelines

LIMITATION OF LIABILITIES

Pace Analytical Services performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Pace Analytical Services shall be to re-perform the work at it's own expense. In no event shall Pace Analytical Services be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Pace Analytical Services.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581
EPA 624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625.1: alpha-Terpineol
EPA 8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol, Azobenzene; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
SM 2540D: TSS.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
MADEP-APH.
Nonpotable Water: EPA RSK-175 Dissolved Gases
Biological Tissue Matrix: EPA 3050B

Mansfield Facility – 120 Forbes Blvd. Mansfield, MA 02048
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Nonpotable Water: EPA RSK-175 Dissolved Gases

The following test method is not included in our New Jersey Secondary NELAP Scope of Accreditation:

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (via Alpha SOP 23528)

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 524.2: THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables).
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

Certification IDs:

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581
CT PH-0826, IL 200077, IN C-MA-03, KY JY98045, ME MA00086, MD 348, MA M-MA086, NH 2064, NJ MA935, NY 11148, NC (DW) 25700, NC (NPW/SCM) 666, OR MA-1316, PA 68-03671, RI LAO00065, TX T104704476, VT VT-0935, VA 460195

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
CT PH-0825, ANAB/DoD L2474, IL 200081, IN C-MA-04, KY KY98046, LA 3090, ME MA00030, MI 9110, MN 025-999-495, NH 2062, NJ MA015, NY 11627, NC (NPW/SCM) 685, OR MA-0262, PA 68-02089, RI LAO00299, TX T-104704419, VT VT-0015, VA 460194, WA C954

Mansfield Facility – 120 Forbes Blvd. Mansfield, MA 02048
ANAB/DoD L2474, ME MA01156, MN 025-999-498, NH 2249, NJ MA025, NY 12191, OR 4203, TX T104704583, VA 460311, WA C1104.

For a complete listing of analytes and methods, please contact your Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 4/17/25

ALPHA Job #: L2523741

ALPHA ANALYTICAL
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Client Information

Client: H2Olson Engineering, Inc.
Address: 10 Riverside Dr, Suite 103, Lakeville, MA 02347
Phone: 508-375-7067
Email: sco@h2olsonengineering.com

Project Information

Project Name: Well 3 & 4 pilot study
Project Location: 1680 Bayannough Rd, Barnstable, MA
Project #: 12725.01
Project Manager: Stephen C. Olson, P.E.
ALPHA Quote #:

Report Information - Data Deliverables

☐ ADEx ☑ EMAIL

Billing Information

☑ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☑ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☑ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☑ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☑ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved)
Date Due:

Additional Project Information:

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH - ☐ Quant Only ☐ Fingerprint
Turbidity, Alkalinity
Total Metals, Fe, Mn
Color, UV-245
TOC
PH
CO2

SAMPLE INFO

Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

Sample Comments

TOTAL # BOTTLES

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials
23741-01	R1-RW	4/17	1:30 pm	DW	RAT
-02	R1-T1-F1	4/17	1:30 pm	DW	RAT
-03	R1-T1-F2	4/17	1:30 pm	DW	RAT
-04	R1-T2-F3	4/17	1:30 pm	DW	RAT
-05	R1-T1-TRT	4/17	1:30 pm	DW	RAT
-06	R1-T2-TRT	4/17	1:30 pm	DW	RAT

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Container Type																							
Preservative																							

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	4/17/25 1336	[signature] ML	4/17 13:56
[signature] ML	4/17 18:30		4/17/25 1830

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

ANALYTICAL REPORT

Lab Number:	L2524631
Client:	H2Olson Engineering, Inc. 10 Riverside Drive, Suite 103 Lakeville, MA 02347
ATTN:	Stephen Olson
Phone:	(508) 375-7007
Project Name:	WELL 3&4 PILOT STUDY
Project Number:	127.25.01
Report Date:	05/07/25

The original project report/data package is held by Pace Analytical Services. This report/data package is paginated and should be reproduced only in its entirety. Pace Analytical Services holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0826), IL (200077), IN (C-MA-03), KY (KY98045), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), OR (MA-1316), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #525-23-122-91930A1).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Lab Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2524631-01	R2-RW	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-02	R2-T1-F1	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-03	R2-T2-F2	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-04	R2-T2-F3	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-05	R2-T1-TRT	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-06	R2-T2-TRT	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-07	R1-BW-RES	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-08	R1-BW-SUP	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Pace Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments and solids are reported on a dry weight basis unless otherwise noted. Tissues are reported "as received" or on a wet weight basis, unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Pace's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Pace Project Manager and made arrangements for Pace to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Case Narrative (continued)

Report Submission

May 07, 2025: This final report includes the results of all requested analyses.

May 07, 2025: This is a preliminary report.

The analyses of Volatile Organics and Asbestos were subcontracted. Copies of the laboratory reports are included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Sample Receipt

L2524631-01, -02, -03, and -04: The analysis of Subcontract Perchlorate by 331 was requested on the Chain of Custody; however, sample containers were not received. This was verified by the client.

Perfluorinated Alkyl Acids by EPA 537.1

L2524631-04R and WG2061152-2R: The sample was re-analyzed due to QC failures in the original analysis. The results of the re-analysis are reported.

Total Metals

L2524631-01: The sample has an elevated detection limit for chromium due to the prep dilution required by the limited sample volume available for digestion.

The WG2060685-1 Method Blank associated with L2524631-02, -03, -04, and -07 has a concentration above the reporting limit for Chromium. Since the associated sample concentrations are either greater than 10x the blank concentration or non-detect to the RL for this target analyte, no corrective action is required. Any results detected below the reporting limit are qualified with a "B".

The WG2060686-3 MS recovery performed on L2524631-01 is outside the acceptance criteria for potassium (129%). A post digestion spike was performed and was within acceptance criteria.

The WG2060685-4 Laboratory Duplicate RPD performed on L2524631-01 is outside the acceptance criteria for nickel (41%) due to the non-homogeneous nature of the native sample.

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Case Narrative (continued)

The WG2060686-4 Laboratory Duplicate RPD performed on L2524631-01 is outside the acceptance criteria for iron (21%) due to the non-homogeneous nature of the native sample.

Fluoride

WG2060376: An LCS/LCSD was performed in lieu of a Matrix Spike and Laboratory Duplicate due to insufficient sample volume available for analysis.

Anions by Ion Chromatography

The WG2060381-3 MS recovery performed on L2524631-01 does not apply for chloride (76%) because the sample concentration is greater than four times the spike amount added.

Carbon Dioxide

The WG2057496-1 Laboratory Duplicate RPD performed on L2524631-01 is outside the acceptance criteria for carbon dioxide (29%) due to the non-homogeneous nature of the native sample.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Tiffani Morrissey - Tiffani Morrissey

Title: Technical Director/Representative Date: 05/07/25

ORGANICS

SEMIVOLATILES

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-01
Client ID: R2-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 05/04/25 18:44
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--	1
Perfluorooctanesulfonic Acid (PFOS)	3.50		ng/l	2.00	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--	1
PFAS, Total (6)	3.50		ng/l	2.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	98		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	82		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	111		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	93		70-130

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-02
Client ID: R2-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 05/04/25 18:52
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--	1
Perfluorooctanesulfonic Acid (PFOS)	4.37		ng/l	2.00	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--	1
PFAS, Total (6)	4.37		ng/l	2.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	87		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	74		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	100		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	98		70-130

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-03
Client ID: R2-T2-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 05/04/25 19:30
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--	1
Perfluorooctanesulfonic Acid (PFOS)	3.92		ng/l	2.00	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--	1
PFAS, Total (6)	3.92		ng/l	2.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	98		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	80		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	116		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	96		70-130

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-04 R
Client ID: R2-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 05/04/25 21:09
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--	1
Perfluorooctanesulfonic Acid (PFOS)	4.12		ng/l	2.00	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--	1
PFAS, Total (6)	4.12		ng/l	2.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	85		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	73		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	109		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	102		70-130

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

Method Blank Analysis
Batch Quality Control

Analytical Method: 133,537.1
Analytical Date: 05/04/25 16:58
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab for sample(s): 01-04 Batch: WG2061152-1					
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--
PFAS, Total (6)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	96		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	74		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	100		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	91		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 Batch: WG2061152-2								
Perfluorobutanesulfonic Acid (PFBS)	79		-		70-130	-		30
Perfluorohexanoic Acid (PFHxA)	82		-		70-130	-		30
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	76		-		70-130	-		30
Perfluoroheptanoic Acid (PFHpA)	90		-		70-130	-		30
Perfluorohexanesulfonic Acid (PFHxS)	73		-		70-130	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	95		-		70-130	-		30
Perfluorooctanoic Acid (PFOA)	80		-		70-130	-		30
Perfluorononanoic Acid (PFNA)	99		-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	73		-		70-130	-		30
Perfluorodecanoic Acid (PFDA)	102		-		70-130	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	71		-		70-130	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	82		-		70-130	-		30
Perfluoroundecanoic Acid (PFUnA)	101		-		70-130	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	88		-		70-130	-		30
Perfluorododecanoic Acid (PFDoA)	104		-		70-130	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	73		-		70-130	-		30
Perfluorotridecanoic Acid (PFTrDA)	110		-		70-130	-		30
Perfluorotetradecanoic Acid (PFTA)	116		-		70-130	-		30

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 Batch: WG2061152-2								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	86				70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	78				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	94				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	92				70-130

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2061152-3 QC Sample: L2524345-01 Client ID: MS Sample												
Perfluorobutanesulfonic Acid (PFBS)	ND	34.8	33.7	97		-	-		70-130	-		30
Perfluorohexanoic Acid (PFHxA)	ND	39.2	34.9	89		-	-		70-130	-		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	39.2	30.2	77		-	-		70-130	-		30
Perfluoroheptanoic Acid (PFHpA)	ND	39.2	39.1	100		-	-		70-130	-		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	35.8	33.6	94		-	-		70-130	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	37	37.0	100		-	-		70-130	-		30
Perfluorooctanoic Acid (PFOA)	ND	39.2	34.4	88		-	-		70-130	-		30
Perfluorononanoic Acid (PFNA)	ND	39.2	39.1	100		-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	ND	36.4	31.4	86		-	-		70-130	-		30
Perfluorodecanoic Acid (PFDA)	ND	39.2	39.0	99		-	-		70-130	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	36.6	34.6	95		-	-		70-130	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	39.2	36.7	94		-	-		70-130	-		30
Perfluoroundecanoic Acid (PFUnA)	ND	39.2	41.5	106		-	-		70-130	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	39.2	33.9	86		-	-		70-130	-		30
Perfluorododecanoic Acid (PFDoA)	ND	39.2	40.8	104		-	-		70-130	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	37	33.2	90		-	-		70-130	-		30
Perfluorotridecanoic Acid (PFTrDA)	ND	39.2	42.5	108		-	-		70-130	-		30
Perfluorotetradecanoic Acid (PFTA)	ND	39.2	43.2	110		-	-		70-130	-		30

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2061152-3 QC Sample: L2524345-01 Client ID: MS Sample												

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	81				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	101				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	97				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	88				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2061152-4 QC Sample: L2524345-02 Client ID: DUP Sample						
Perfluorobutanesulfonic Acid (PFBS)	ND	ND	ng/l	NC		30
Perfluorohexanoic Acid (PFHxA)	ND	ND	ng/l	NC		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	ND	ng/l	NC		30
Perfluoroheptanoic Acid (PFHpA)	ND	ND	ng/l	NC		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	ND	ng/l	NC		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	ND	ng/l	NC		30
Perfluorooctanoic Acid (PFOA)	ND	ND	ng/l	NC		30
Perfluorononanoic Acid (PFNA)	ND	ND	ng/l	NC		30
Perfluorooctanesulfonic Acid (PFOS)	ND	ND	ng/l	NC		30
Perfluorodecanoic Acid (PFDA)	ND	ND	ng/l	NC		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	ND	ng/l	NC		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	ND	ng/l	NC		30
Perfluoroundecanoic Acid (PFUnA)	ND	ND	ng/l	NC		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	ND	ng/l	NC		30
Perfluorododecanoic Acid (PFDoA)	ND	ND	ng/l	NC		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	ND	ng/l	NC		30
Perfluorotridecanoic Acid (PFTrDA)	ND	ND	ng/l	NC		30
Perfluorotetradecanoic Acid (PFTA)	ND	ND	ng/l	NC		30

Lab Duplicate Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits

Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2061152-4 QC Sample: L2524345-02 Client ID: DUP Sample

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	84		84		70-130
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	78		75		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	93		91		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	89		103		70-130

METALS

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-01
Client ID: R2-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Barium, Total	0.0074		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Calcium, Total	5.84		mg/l	0.100	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Chromium, Total	ND		mg/l	0.0020	--	1	05/01/25 12:15	05/01/25 20:14	EPA 3005A	3,200.8	BLR
Iron, Total	0.330		mg/l	0.0500	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Magnesium, Total	3.77		mg/l	0.100	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Manganese, Total	0.0178		mg/l	0.0100	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 15:43	EPA 245.1	3,245.1	CME
Nickel, Total	0.0045		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Potassium, Total	ND		mg/l	2.50	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Sodium, Total	18.2		mg/l	2.00	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	30.1		mg/l	0.660	NA	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-02
Client ID: R2-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Barium, Total	0.0123		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Calcium, Total	5.61		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Chromium, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Iron, Total	ND		mg/l	0.0500	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Magnesium, Total	3.85		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Manganese, Total	ND		mg/l	0.0100	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 15:53	EPA 245.1	3,245.1	CME
Nickel, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Potassium, Total	43.4		mg/l	2.50	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Sodium, Total	18.6		mg/l	2.00	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	29.8		mg/l	0.660	NA	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-03
Client ID: R2-T2-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Barium, Total	0.0167		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Calcium, Total	5.60		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Chromium, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Iron, Total	ND		mg/l	0.0500	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Magnesium, Total	3.85		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Manganese, Total	ND		mg/l	0.0100	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 15:56	EPA 245.1	3,245.1	CME
Nickel, Total	0.0025		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Potassium, Total	36.3		mg/l	2.50	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Sodium, Total	18.8		mg/l	2.00	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	29.8		mg/l	0.660	NA	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-04
Client ID: R2-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Barium, Total	0.0190		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Calcium, Total	5.60		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Chromium, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Iron, Total	ND		mg/l	0.0500	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Magnesium, Total	3.84		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Manganese, Total	ND		mg/l	0.0100	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 16:06	EPA 245.1	3,245.1	CME
Nickel, Total	0.0026		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Potassium, Total	37.7		mg/l	2.50	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Sodium, Total	18.8		mg/l	2.00	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	29.8		mg/l	0.660	NA	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-07
Client ID: R1-BW-RES
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Arsenic, Total	0.0047		mg/l	0.0010	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Barium, Total	0.0546		mg/l	0.0010	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Cadmium, Total	0.0005		mg/l	0.0002	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Chromium, Total	ND		mg/l	0.0020	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Lead, Total	0.0066		mg/l	0.0010	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 16:09	EPA 245.1	3,245.1	CME
Selenium, Total	ND		mg/l	0.0050	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Silver, Total	ND		mg/l	0.0004	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-08
Client ID: R1-BW-SUP
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.172		mg/l	0.0500	--	1	05/01/25 16:35	05/01/25 22:24	EPA 3005A	19,200.7	JTS
Manganese, Total	0.167		mg/l	0.0100	--	1	05/01/25 16:35	05/01/25 22:24	EPA 3005A	19,200.7	JTS

Project Name: WELL 3&4 PILOT STUDY **Lab Number:** L2524631

Project Number: 127.25.01 **Report Date:** 05/07/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04,07 Batch: WG2060685-1										
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Barium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Chromium, Total	0.0041		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Lead, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Nickel, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Silver, Total	ND		mg/l	0.0004	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG2060686-1										
Calcium, Total	ND		mg/l	0.100	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Iron, Total	ND		mg/l	0.0500	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Magnesium, Total	ND		mg/l	0.100	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Manganese, Total	ND		mg/l	0.0100	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Potassium, Total	ND		mg/l	2.50	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Sodium, Total	ND		mg/l	2.00	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC

Prep Information

Digestion Method: EPA 3005A

Project Name: WELL 3&4 PILOT STUDY **Lab Number:** L2524631

Project Number: 127.25.01 **Report Date:** 05/07/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab for sample(s): 01-04 Batch: WG2060686-1										
Hardness	ND		mg/l	0.660	NA	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04,07 Batch: WG2061054-1										
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 15:36	3,245.1	CME

Prep Information

Digestion Method: EPA 245.1

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG2061179-1										
Chromium, Total	ND		mg/l	0.0010	--	1	05/01/25 12:15	05/01/25 19:56	3,200.8	BLR

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 08 Batch: WG2061276-1										
Iron, Total	ND		mg/l	0.0500	--	1	05/01/25 16:35	05/01/25 22:17	19,200.7	JTS
Manganese, Total	ND		mg/l	0.0100	--	1	05/01/25 16:35	05/01/25 22:17	19,200.7	JTS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

Method Blank Analysis
Batch Quality Control

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 Batch: WG2060685-2								
Antimony, Total	96		-		85-115	-		
Arsenic, Total	94		-		85-115	-		
Barium, Total	103		-		85-115	-		
Beryllium, Total	98		-		85-115	-		
Cadmium, Total	104		-		85-115	-		
Chromium, Total	97		-		85-115	-		
Lead, Total	98		-		85-115	-		
Nickel, Total	101		-		85-115	-		
Selenium, Total	104		-		85-115	-		
Silver, Total	101		-		85-115	-		
Thallium, Total	100		-		85-115	-		
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG2060686-2								
Calcium, Total	109		-		85-115	-		
Iron, Total	112		-		85-115	-		
Magnesium, Total	105		-		85-115	-		
Manganese, Total	111		-		85-115	-		
Potassium, Total	114		-		85-115	-		
Sodium, Total	111		-		85-115	-		

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01-04 Batch: WG2060686-2					
Hardness	107	-	85-115	-	
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 Batch: WG2061054-2					
Mercury, Total	102	-	85-115	-	
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG2061179-2					
Chromium, Total	92	-	85-115	-	
Total Metals - Mansfield Lab Associated sample(s): 08 Batch: WG2061276-2					
Iron, Total	104	-	85-115	-	
Manganese, Total	101	-	85-115	-	

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2060685-3 QC Sample: L2524631-01 Client ID: R2-RW												
Antimony, Total	ND	0.5	0.4831	97		-	-		70-130	-		20
Arsenic, Total	ND	0.12	0.1197	100		-	-		70-130	-		20
Barium, Total	0.0074	2	2.063	103		-	-		70-130	-		20
Beryllium, Total	ND	0.05	0.0488	98		-	-		70-130	-		20
Cadmium, Total	ND	0.053	0.0546	103		-	-		70-130	-		20
Lead, Total	ND	0.53	0.5288	100		-	-		70-130	-		20
Nickel, Total	0.0045	0.5	0.5161	102		-	-		70-130	-		20
Selenium, Total	ND	0.12	0.1281	107		-	-		70-130	-		20
Silver, Total	ND	0.05	0.0503	101		-	-		70-130	-		20
Thallium, Total	ND	0.12	0.1223	102		-	-		70-130	-		20

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery		MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2060685-5 QC Sample: L2524631-07 Client ID: R1-BW-RES										
Antimony, Total	ND	0.5	0.5072	101		-	-	70-130	-	20
Arsenic, Total	0.0047	0.12	0.1200	96		-	-	70-130	-	20
Barium, Total	0.0546	2	2.090	102		-	-	70-130	-	20
Beryllium, Total	ND	0.05	0.0456	91		-	-	70-130	-	20
Cadmium, Total	0.0005	0.053	0.0542	101		-	-	70-130	-	20
Chromium, Total	ND	0.2	0.1924	96		-	-	70-130	-	20
Lead, Total	0.0066	0.53	0.5234	98		-	-	70-130	-	20
Nickel, Total	0.0136	0.5	0.4964	96		-	-	70-130	-	20
Selenium, Total	ND	0.12	0.1261	105		-	-	70-130	-	20
Silver, Total	ND	0.05	0.0504	101		-	-	70-130	-	20
Thallium, Total	ND	0.12	0.1139	95		-	-	70-130	-	20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2060686-3 QC Sample: L2524631-01 Client ID: R2-RW										
Calcium, Total	5.84	10	15.6	98		-	-	75-125	-	20
Iron, Total	0.330	1	1.28	95		-	-	75-125	-	20
Magnesium, Total	3.77	10	14.2	104		-	-	75-125	-	20
Manganese, Total	0.0178	0.5	0.521	101		-	-	75-125	-	20
Potassium, Total	ND	10	12.9	**129**	Q	-	-	75-125	-	20
Sodium, Total	18.2	10	28.0	98		-	-	75-125	-	20
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2060686-3 QC Sample: L2524631-01 Client ID: R2-RW										
Hardness	30.1	66.2	97.2	101		-	-	75-125	-	20

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2061054-3 QC Sample: L2524631-01 Client ID: R2-RW									
Mercury, Total	ND	0.005	0.0048	97	-	-	70-130	-	20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG2061179-3 QC Sample: L2525763-01 Client ID: MS Sample									
Chromium, Total	ND	0.2	0.1968	98	-	-	70-130	-	20
Total Metals - Mansfield Lab Associated sample(s): 08 QC Batch ID: WG2061276-3 QC Sample: L2524631-08 Client ID: R1-BW-SUP									
Iron, Total	0.172	1	1.18	101	-	-	75-125	-	20
Manganese, Total	0.167	0.5	0.652	97	-	-	75-125	-	20
Total Metals - Mansfield Lab Associated sample(s): 08 QC Batch ID: WG2061276-7 QC Sample: L2524677-01 Client ID: MS Sample									
Iron, Total	ND	1	1.01	101	-	-	75-125	-	20
Manganese, Total	ND	0.5	0.487	97	-	-	75-125	-	20

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2524631

Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2060685-4 QC Sample: L2524631-01 Client ID: R2-RW						
Antimony, Total	ND	ND	mg/l	NC		20
Arsenic, Total	ND	ND	mg/l	NC		20
Barium, Total	0.0074	0.0074	mg/l	0		20
Beryllium, Total	ND	ND	mg/l	NC		20
Cadmium, Total	ND	ND	mg/l	NC		20
Nickel, Total	0.0045	0.0029	mg/l	**41**	Q	20
Selenium, Total	ND	ND	mg/l	NC		20
Thallium, Total	ND	ND	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2060685-6 QC Sample: L2524631-07 Client ID: R1-BW-RES						
Arsenic, Total	0.0047	0.0052	mg/l	10		20
Barium, Total	0.0546	0.0560	mg/l	3		20
Cadmium, Total	0.0005	0.0005	mg/l	2		20
Chromium, Total	ND	ND	mg/l	NC		20
Lead, Total	0.0066	0.0070	mg/l	6		20
Selenium, Total	ND	ND	mg/l	NC		20
Silver, Total	ND	ND	mg/l	NC		20

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2524631

Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD		RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2060686-4 QC Sample: L2524631-01 Client ID: R2-RW						
Calcium, Total	5.84	5.88	mg/l	1		20
Iron, Total	0.330	0.268	mg/l	**21**	Q	20
Magnesium, Total	3.77	3.72	mg/l	1		20
Manganese, Total	0.0178	0.0181	mg/l	2		20
Potassium, Total	ND	ND	mg/l	NC		20
Sodium, Total	18.2	18.4	mg/l	1		20
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2060686-4 QC Sample: L2524631-01 Client ID: R2-RW						
Hardness	30.1	30.0	mg/l	0		20
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2061054-4 QC Sample: L2524631-01 Client ID: R2-RW						
Mercury, Total	ND	ND	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 08 QC Batch ID: WG2061276-4 QC Sample: L2524631-08 Client ID: R1-BW-SUP						
Iron, Total	0.172	0.168	mg/l	2		20
Manganese, Total	0.167	0.164	mg/l	2		20

INORGANICS
&
MISCELLANEOUS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-01
Client ID: R2-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.77		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
Color, Apparent	ND		A.P.C.U.	5.0	--	1	-	04/23/25 01:40	121,2120B	CAR
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
Alkalinity, Total	19.0		mg CaCO3/L	2.00	NA	1	-	04/23/25 12:06	121,2320B	MKT
Carbon Dioxide	320		mg/l	2.0	--	1	-	04/23/25 08:17	121,4500CO2-D	MRM
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
pH (H)	6.43		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 09:36	44,353.2	MRM
Nitrogen, Nitrate	1.1		mg/l	0.10	--	1	-	04/23/25 09:36	44,353.2	MRM
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/28/25 13:20	121,5310C	DEW
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Anions by Ion Chromatography - Westborough Lab										
Chloride	28.1		mg/l	0.500	--	1	-	04/29/25 19:46	44,300.0	AVT
Sulfate	10.6		mg/l	1.00	--	1	-	04/29/25 19:46	44,300.0	AVT

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-02
Client ID: R2-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.61		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
Color, Apparent	5.0		A.P.C.U.	5.0	--	1	-	04/23/25 01:40	121,2120B	CAR
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
Alkalinity, Total	68.9		mg CaCO3/L	2.00	NA	1	-	04/23/25 08:34	121,2320B	MKT
Carbon Dioxide	470		mg/l	2.0	--	1	-	04/23/25 08:17	121,4500CO2-D	MRM
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
pH (H)	6.86		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 09:37	44,353.2	MRM
Nitrogen, Nitrate	1.1		mg/l	0.10	--	1	-	04/23/25 09:37	44,353.2	MRM
Total Organic Carbon	0.502		mg/l	0.500	--	1	-	04/28/25 13:41	121,5310C	DEW
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Anions by Ion Chromatography - Westborough Lab										
Chloride	28.0		mg/l	0.500	--	1	-	04/29/25 19:57	44,300.0	AVT
Sulfate	10.4		mg/l	1.00	--	1	-	04/29/25 19:57	44,300.0	AVT

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-03
Client ID: R2-T2-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.61		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
Color, Apparent	5.0		A.P.C.U.	5.0	--	1	-	04/23/25 01:40	121,2120B	CAR
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
Alkalinity, Total	60.1		mg CaCO3/L	2.00	NA	1	-	04/23/25 08:36	121,2320B	MKT
Carbon Dioxide	430		mg/l	2.0	--	1	-	04/23/25 08:17	121,4500CO2-D	MKT
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
pH (H)	6.83		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 09:42	44,353.2	MRM
Nitrogen, Nitrate	1.1		mg/l	0.10	--	1	-	04/23/25 09:42	44,353.2	MRM
Total Organic Carbon	0.585		mg/l	0.500	--	1	-	04/28/25 16:03	121,5310C	DEW
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Anions by Ion Chromatography - Westborough Lab										
Chloride	28.4		mg/l	0.500	--	1	-	04/29/25 20:08	44,300.0	AVT
Sulfate	10.4		mg/l	1.00	--	1	-	04/29/25 20:08	44,300.0	AVT

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-04
Client ID: R2-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.65		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
Color, Apparent	ND		A.P.C.U.	5.0	--	1	-	04/23/25 01:40	121,2120B	CAR
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
Alkalinity, Total	61.6		mg CaCO3/L	2.00	NA	1	-	04/23/25 08:39	121,2320B	MKT
Carbon Dioxide	450		mg/l	2.0	--	1	-	04/23/25 08:17	121,4500CO2-D	MKT
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
pH (H)	6.81		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 09:44	44,353.2	MRM
Nitrogen, Nitrate	1.1		mg/l	0.10	--	1	-	04/23/25 09:44	44,353.2	MRM
Total Organic Carbon	0.516		mg/l	0.500	--	1	-	04/28/25 16:24	121,5310C	DEW
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Anions by Ion Chromatography - Westborough Lab										
Chloride	28.4		mg/l	0.500	--	1	-	04/29/25 20:19	44,300.0	AVT
Sulfate	10.5		mg/l	1.00	--	1	-	04/29/25 20:19	44,300.0	AVT

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-05
Client ID: R2-T1-TRT
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
pH (H)	7.00		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-06
Client ID: R2-T2-TRT
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
pH (H)	7.29		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-07
Client ID: R1-BW-RES
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total Suspended	100		mg/l	25	NA	5	-	04/24/25 07:20	121,2540D	BAY

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-08
Client ID: R1-BW-SUP
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total Suspended	ND		mg/l	5.0	NA	1	-	04/24/25 07:20	121,2540D	BAY
pH (H)	6.68		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY **Lab Number:** L2524631

Project Number: 127.25.01 **Report Date:** 05/07/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab for sample(s): 01 Batch: WG2057303-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Bacteria in Water - Westborough Lab for sample(s): 02-04 Batch: WG2057304-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057305-1										
Turbidity	ND		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057346-1										
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 03:01	44,353.2	MRM
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057347-1										
Nitrogen, Nitrate	ND		mg/l	0.10	--	1	-	04/23/25 02:58	44,353.2	MRM
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057376-1										
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057497-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	04/23/25 08:20	121,2320B	MKT
General Chemistry - Westborough Lab for sample(s): 07-08 Batch: WG2057979-1										
Solids, Total Suspended	ND		mg/l	5.0	NA	1	-	04/24/25 07:20	121,2540D	BAY
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2059374-1										
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/28/25 05:01	121,5310C	DEW
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2060376-1										
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
Anions by Ion Chromatography - Westborough Lab for sample(s): 01-04 Batch: WG2060381-1										
Chloride	ND		mg/l	0.500	--	1	-	04/29/25 17:35	44,300.0	AVT
Sulfate	ND		mg/l	1.00	--	1	-	04/29/25 17:35	44,300.0	AVT

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057305-2								
Turbidity	102		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-06,08 Batch: WG2057306-1								
pH	99		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057346-2								
Nitrogen, Nitrite	100		-		90-110	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057347-2								
Nitrogen, Nitrate	96		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057376-2								
UV Absorbance @ 254nm	89		-			-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057497-2								
Alkalinity, Total	110		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 07-08 Batch: WG2057979-2								
Solids, Total Suspended	93		-		80-120	-		

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2059374-2					
Total Organic Carbon	98	-	90-110	-	
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2060376-2 WG2060376-3					
Fluoride	94	94	90-110	0	
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01-04 Batch: WG2060381-2					
Chloride	102	-	90-110	-	
Sulfate	100	-	90-110	-	

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057346-4 QC Sample: L2524548-01 Client ID: MS Sample												
Nitrogen, Nitrite	ND	4	3.9	98		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057346-6 QC Sample: L2524610-02 Client ID: MS Sample												
Nitrogen, Nitrite	ND	4	4.1	102		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057347-4 QC Sample: L2524548-01 Client ID: MS Sample												
Nitrogen, Nitrate	5.0	4	8.9	98		-	-		83-113	-		6
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057347-6 QC Sample: L2524610-02 Client ID: MS Sample												
Nitrogen, Nitrate	ND	4	3.8	95		-	-		83-113	-		6
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057497-4 QC Sample: L2524631-01 Client ID: R2-RW												
Alkalinity, Total	19.0	100	129	110		-	-		86-116	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2059374-4 QC Sample: L2524047-01 Client ID: MS Sample												
Total Organic Carbon	3.39	16	20.7	108		-	-		85-115	-		15
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2059374-6 QC Sample: L2524047-02 Client ID: MS Sample												
Total Organic Carbon	4.00	16	20.8	105		-	-		85-115	-		15
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2060381-3 QC Sample: L2524631-01 Client ID: R2-RW												
Chloride	28.1	4	31.1	**76**	Q	-	-		90-110	-		18
Sulfate	10.6	8	18.4	98		-	-		90-110	-		20

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057305-3 QC Sample: L2524631-04 Client ID: R2-T2-F3						
Turbidity	0.65	0.62	NTU	5		13
General Chemistry - Westborough Lab Associated sample(s): 01-06,08 QC Batch ID: WG2057306-2 QC Sample: L2524526-01 Client ID: DUP Sample						
pH	6.91	6.90	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057346-3 QC Sample: L2524548-01 Client ID: DUP Sample						
Nitrogen, Nitrite	ND	ND	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057346-5 QC Sample: L2524610-02 Client ID: DUP Sample						
Nitrogen, Nitrite	ND	ND	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057347-3 QC Sample: L2524548-01 Client ID: DUP Sample						
Nitrogen, Nitrate	5.0	5.0	mg/l	0		6
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057347-5 QC Sample: L2524610-02 Client ID: DUP Sample						
Nitrogen, Nitrate	ND	ND	mg/l	NC		6
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057355-1 QC Sample: L2524631-01 Client ID: R2-RW						
Color, Apparent	ND	ND	A.P.C.U.	NC		
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057376-3 QC Sample: L2524631-04 Client ID: R2-T2-F3						
UV Absorbance @ 254nm	ND	ND	Abs/cm	NC		
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057496-1 QC Sample: L2524631-01 Client ID: R2-RW						
Carbon Dioxide	320	240	mg/l	**29**	Q	26

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2524631

Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057497-3 QC Sample: L2524631-01 Client ID: R2-RW					
Alkalinity, Total	19.0	18.8	mg CaCO3/L	1	10
General Chemistry - Westborough Lab Associated sample(s): 07-08 QC Batch ID: WG2057979-3 QC Sample: L2524631-07 Client ID: R1-BW-RES					
Solids, Total Suspended	100	100	mg/l	0	32
General Chemistry - Westborough Lab Associated sample(s): 07-08 QC Batch ID: WG2057979-4 QC Sample: L2524990-01 Client ID: DUP Sample					
Solids, Total Suspended	200	200	mg/l	0	32
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2059374-3 QC Sample: L2524047-01 Client ID: DUP Sample					
Total Organic Carbon	3.39	3.34	mg/l	1	15
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2059374-5 QC Sample: L2524047-02 Client ID: DUP Sample					
Total Organic Carbon	4.00	3.96	mg/l	1	15
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2060381-4 QC Sample: L2524631-01 Client ID: R2-RW					
Chloride	28.1	28.5	mg/l	1	18
Sulfate	10.6	10.6	mg/l	0	20

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent
C	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2524631-01A	Vial HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-01B	Vial HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-01C	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-01D	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-01E	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),NO3-353(2),PH-4500(.01)
L2524631-01F	Plastic 120ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),NO3-353(2),PH-4500(.01)
L2524631-01G	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		CD-2008T(180),CA-UI(180),NI-2008T(180),K-UI(180),BE-2008T(180),HARDU(180),FE-UI(180),MG-UI(180),SE-2008T(180),HG-U(28),AS-2008T(180),BA-2008T(180),MN-UI(180),NA-UI(180),SB-2008T(180),TL-2008T(180),CR-2008T(180)
L2524631-01H	Plastic 500ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14),CO2(1)
L2524631-01I	Amber 500ml unpreserved	A	7	7	4.9	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2524631-01J	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-01K	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-01L	Plastic 500ml unpreserved	C	7	7	3.1	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),NO3-353(2),PH-4500(.01)
L2524631-01M	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-01N	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2524631-01Y	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-01Z	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-02A	Vial HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-02B	Vial HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-02C	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-02D	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-02E	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),PH-4500(.01),NO3-353(2)
L2524631-02F	Plastic 120ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),PH-4500(.01),NO3-353(2)
L2524631-02G	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		CD-2008T(180),CA-UI(180),NI-2008T(180),BE-2008T(180),K-UI(180),HARDU(180),FE-UI(180),MG-UI(180),HG-U(28),AS-2008T(180),SE-2008T(180),NA-UI(180),BA-2008T(180),MN-UI(180),SB-2008T(180),CR-2008T(180),TL-2008T(180)
L2524631-02H	Plastic 500ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14),CO2(1)
L2524631-02I	Amber 500ml unpreserved	A	7	7	4.9	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2524631-02J	Bacteria Cup Na2S2O3 preserved	B	NA		2.1	Y	Absent		T-COLI-C(1.25)
L2524631-02K	Bacteria Cup Na2S2O3 preserved	B	NA		2.1	Y	Absent		T-COLI-C(1.25)
L2524631-02L	Plastic 500ml unpreserved	C	7	7	3.1	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),PH-4500(.01),NO3-353(2)
L2524631-02M	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-02N	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-02Y	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-02Z	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-03A	Vial Ascorbic Acid/HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-03B	Vial Ascorbic Acid/HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-03C	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-03D	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2524631-03E	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),PH-4500(.01),NO3-353(2)
L2524631-03F	Plastic 120ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),PH-4500(.01),NO3-353(2)
L2524631-03G	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		CD-2008T(180),CA-UI(180),NI-2008T(180),K-UI(180),BE-2008T(180),MG-UI(180),HARDU(180),FE-UI(180),SE-2008T(180),HG-U(28),AS-2008T(180),BA-2008T(180),NA-UI(180),MN-UI(180),SB-2008T(180),TL-2008T(180),CR-2008T(180)
L2524631-03H	Plastic 500ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14),CO2(1)
L2524631-03I	Amber 500ml unpreserved	A	7	7	4.9	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2524631-03J	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-03K	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-03L	Plastic 500ml unpreserved	C	7	7	3.1	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),PH-4500(.01),NO3-353(2)
L2524631-03M	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-03N	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-03Y	Amber 1L unpreserved	C	7	7	3.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-03Z	Amber 1L unpreserved	C	7	7	3.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-04A	Vial Ascorbic Acid/HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-04B	Vial Ascorbic Acid/HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-04C	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-04D	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-04E	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),NO3-353(2),PH-4500(.01)
L2524631-04F	Plastic 120ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),NO3-353(2),PH-4500(.01)

*Values in parentheses indicate holding time in days

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2524631-04G	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		CD-2008T(180),CA-UI(180),NI-2008T(180),BE-2008T(180),K-UI(180),FE-UI(180),HARDU(180),MG-UI(180),SE-2008T(180),HG-U(28),AS-2008T(180),BA-2008T(180),MN-UI(180),NA-UI(180),CR-2008T(180),SB-2008T(180),TL-2008T(180)
L2524631-04H	Plastic 500ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14),CO2(1)
L2524631-04I	Amber 500ml unpreserved	A	7	7	4.9	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2524631-04J	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-04K	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-04L	Plastic 500ml unpreserved	B	7	7	2.1	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),NO3-353(2),PH-4500(.01)
L2524631-04M	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-04N	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-04Y	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-04Z	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-05A	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		PH-4500(.01)
L2524631-06A	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		PH-4500(.01)
L2524631-07A	Plastic 250ml HNO3 preserved	B	<2	<2	2.1	Y	Absent		CD-2008T(180),AG-2008T(180),AS-2008T(180),HG-U(28),SE-2008T(180),BA-2008T(180),CR-2008T(180),PB-2008T(180)
L2524631-07B	Plastic 950ml unpreserved	B	7	7	2.1	Y	Absent		TSS-2540(7)
L2524631-08A	Plastic 60ml unpreserved	B	7	7	2.1	Y	Absent		PH-4500(.01)
L2524631-08B	Plastic 250ml HNO3 preserved	B	<2	<2	2.1	Y	Absent		FE-UI(180),MN-UI(180)
L2524631-08C	Plastic 950ml unpreserved	C	7	7	3.1	Y	Absent		TSS-2540(7)

*Values in parentheses indicate holding time in days

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
PERFLUOROALKYL CARBOXYLIC ACIDS (PFCAs)		
Perfluorooctadecanoic Acid	PFODA	16517-11-6
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5
Perfluorotetradecanoic Acid	PFTA/PFTeDA	376-06-7
Perfluorotridecanoic Acid	PFTrDA	72629-94-8
Perfluorododecanoic Acid	PFDoA	307-55-1
Perfluoroundecanoic Acid	PFUnA	2058-94-8
Perfluorodecanoic Acid	PFDA	335-76-2
Perfluorononanoic Acid	PFNA	375-95-1
Perfluorooctanoic Acid	PFOA	335-67-1
Perfluoroheptanoic Acid	PFHpA	375-85-9
Perfluorohexanoic Acid	PFHxA	307-24-4
Perfluoropentanoic Acid	PFPeA	2706-90-3
Perfluorobutanoic Acid	PFBA	375-22-4
PERFLUOROALKYL SULFONIC ACIDS (PFSAs)		
Perfluorododecanesulfonic Acid	PFDoDS/PFDoS	79780-39-5
Perfluorodecanesulfonic Acid	PFDS	335-77-3
Perfluorononanesulfonic Acid	PFNS	68259-12-1
Perfluorooctanesulfonic Acid	PFOS	1763-23-1
Perfluoroheptanesulfonic Acid	PFHpS	375-92-8
Perfluorohexanesulfonic Acid	PFHxS	355-46-4
Perfluoropentanesulfonic Acid	PFPeS	2706-91-4
Perfluorobutanesulfonic Acid	PFBS	375-73-5
Perfluoropropanesulfonic Acid	PFPrS	423-41-6
FLUOROTELOMERS		
1H,1H,2H,2H-Perfluorododecanesulfonic Acid	10:2FTS	120226-60-0
1H,1H,2H,2H-Perfluorodecanesulfonic Acid	8:2FTS	39108-34-4
1H,1H,2H,2H-Perfluorooctanesulfonic Acid	6:2FTS	27619-97-2
1H,1H,2H,2H-Perfluorohexanesulfonic Acid	4:2FTS	757124-72-4
PERFLUOROALKANE SULFONAMIDES (FASAs)		
Perfluorooctanesulfonamide	FOSA/PFOSA	754-91-6
N-Ethyl Perfluorooctane Sulfonamide	NEtFOSA	4151-50-2
N-Methyl Perfluorooctane Sulfonamide	NMeFOSA	31506-32-8
PERFLUOROALKANE SULFONYL SUBSTANCES		
N-Ethyl Perfluorooctanesulfonamido Ethanol	NEtFOSE	1691-99-2
N-Methyl Perfluorooctanesulfonamido Ethanol	NMeFOSE	24448-09-7
N-Ethyl Perfluorooctanesulfonamidoacetic Acid	NEtFOSAA	2991-50-6
N-Methyl Perfluorooctanesulfonamidoacetic Acid	NMeFOSAA	2355-31-9
PER- and POLYFLUOROALKYL ETHER CARBOXYLIC ACIDS		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid	HFPO-DA	13252-13-6
4,8-Dioxa-3h-Perfluorononanoic Acid	ADONA	919005-14-4
CHLORO-PERFLUOROALKYL SULFONIC ACIDS		
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1
PERFLUOROETHER SULFONIC ACIDS (PFESAs)		
Perfluoro(2-Ethoxyethane)Sulfonic Acid	PFEESA	113507-82-7
PERFLUOROETHER/POLYETHER CARBOXYLIC ACIDS (PFPCAs)		
Perfluoro-3-Methoxypropanoic Acid	PFMPA	377-73-1
Perfluoro-4-Methoxybutanoic Acid	PFMBA	863090-89-5
Nonafluoro-3,6-Dioxaheptanoic Acid	NFDHA	151772-58-6

Project Name: WELL 3&4 PILOT STUDY
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PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
FLUOROTELOMER CARBOXYLIC ACIDS (FTCAs)		
3-Perfluoroheptyl Propanoic Acid	7:3FTCA	812-70-4
2H,2H,3H,3H-Perfluorooctanoic Acid	5:3FTCA	914637-49-3
3-Perfluoropropyl Propanoic Acid	3:3FTCA	356-02-5

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: Data Usability Report

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

Report Format: Data Usability Report

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Data Qualifiers

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Project Name: WELL 3&4 PILOT STUDY **Lab Number:** L2524631

Project Number: 127.25.01 **Report Date:** 05/07/25

REFERENCES

3 Methods for the Determination of Metals in Environmental Samples, Supplement I. EPA/600/R-94/111. May 1994.

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

133 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537.1, EPA/600/R-20/006. Version 2.0, March 2020.

MCL References

The following links provide the most up-to-date Maximum Contaminant Levels (MCL) or Maximum Residual Disinfectant Levels (MRDL) from the EPA's National Primary Drinking Water Regulations (NPDWR) and the MassDEP's Drinking Water Standards and Guidelines.

EPA

https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

MassDEP

https://www.mass.gov/guides/drinking-water-standards-and-guidelines

LIMITATION OF LIABILITIES

Pace Analytical Services performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Pace Analytical Services shall be to re-perform the work at it's own expense. In no event shall Pace Analytical Services be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Pace Analytical Services.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581
EPA 624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625.1: alpha-Terpineol
EPA 8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol, Azobenzene; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
SM 2540D: TSS.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
MADEP-APH.
Nonpotable Water: EPA RSK-175 Dissolved Gases
Biological Tissue Matrix: EPA 3050B

Mansfield Facility – 120 Forbes Blvd. Mansfield, MA 02048
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Nonpotable Water: EPA RSK-175 Dissolved Gases

The following test method is not included in our New Jersey Secondary NELAP Scope of Accreditation:

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (via Alpha SOP 23528)

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 524.2: THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables).
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

Certification IDs:

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581
CT PH-0826, IL 200077, IN C-MA-03, KY JY98045, ME MA00086, MD 348, MA M-MA086, NH 2064, NJ MA935, NY 11148, NC (DW) 25700, NC (NPW/SCM) 666, OR MA-1316, PA 68-03671, RI LAO00065, TX T104704476, VT VT-0935, VA 460195

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
CT PH-0825, ANAB/DoD L2474, IL 200081, IN C-MA-04, KY KY98046, LA 3090, ME MA00030, MI 9110, MN 025-999-495, NH 2062, NJ MA015, NY 11627, NC (NPW/SCM) 685, OR MA-0262, PA 68-02089, RI LAO00299, TX T-104704419, VT VT-0015, VA 460194, WA C954

Mansfield Facility – 120 Forbes Blvd. Mansfield, MA 02048
ANAB/DoD L2474, ME MA01156, MN 025-999-498, NH 2249, NJ MA025, NY 12191, OR 4203, TX T104704583, VA 460311, WA C1104.

For a complete listing of analytes and methods, please contact your Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 2

Date Rec'd in Lab: 4/22/25

ALPHA Job #: L2524631

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: H2Olson Engineering, Inc
Address: 10 Riverside Dr, suite 103, Lakeville, MA 02347
Phone: 508-375-7007
Email: sco@h2olsonengineering.com

Project Information

Project Name: Well 3 & 4 Pilot Study
Project Location: 1680 & Layannough RD Bonstable MA
Project #: 127.25.01
Project Manager: Stephen C. Olson, P.E.
ALPHA Quote #:

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved)
Date Due:

Report Information - Data Deliverables

☐ ADEx ☑ EMAIL

Billing Information

☑ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☑ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☑ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☑ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☑ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Additional Project Information:

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH: ☐ Quant Only ☐ Fingerprint
Turbidity
Alkalinity
Total Metals, Fe, Mn
Color, UV-254
TOC
PH,
CO2

SAMPLE INFO
Filtration ☐ Field ☐ Lab to do
Preservation ☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	Sample Comments	TOTAL # BOTTLES
24631-01	R2-RW	4/22	11:30	DW	RAT		7
02	$R_2 - T_1 - F_1$	4/22	11:30	DW	RAT		7
03	$R_2 - T_2 - F_2$	4/22	11:30	DW	RAT		7
04	$R_2 - T_2 - F_3$	4/22	11:30	DW	RAT		7
05	$R_2 - T_1 - TRT$	4/22	11:30	DW	RAT		1
06	$R_2 - T_2 - TRT$	4/22	11:30	DW	RAT		1

Container Type
Preservative

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	4/22 13:16		4/22/25 13:20
	4/22/25 17:22		4/22/25 1722

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

CHAIN OF CUSTODY

PAGE 2 OF 2

Date Rec'd in Lab: 4/22/25

ALPHA Job #: L2524631

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: Hydrolom Engineering, Inc
Address: 10 Riverside Dr, Suite 103, Lakeville, MA 02347
Phone: 508-375-7007
Email: sue@Hydrolomengineering.com

Additional Project Information:

Project Information

Project Name: Well 3 & 4 pilot study
Project Location: 1680 B Lovanough RD Barnstable MA
Project #: 127.25.01
Project Manager: Stephan C. Olsen, P.E.
ALPHA Quote #:

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved)
Date Due:

Report Information - Data Deliverables

☐ ADEx ☑ EMAIL

Billing Information

☑ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☑ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☑ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☑ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	~~☐ PCB ☐ PEST~~ TSS	~~TPH: ☐ Quant Only ☐ Fingerprint~~ PH	Total Col:Coli	VOCs (EPA 524.2)	PFAS (A2-537.1) sixty group (Ca, Cl, Mg, K, Na, SO4 Hardness)	IOCs (F, Alkalinity, Ag, Ba, Cd, Cr, Hg Ni, Mo, Sb, Se, Be, Cu, Mn, Tl, Cl, SO4)	Total Metals (Fe, Mn)	SAMPLE INFO Filtration ☐ Field ☐ Lab to do Preservation ☐ Lab to do Sample Comments	TOTAL # BOTTLES
24631-01	R2-RW	4/22	11:30	DW	RAT									✓	✓	✓	✓	✓		9
-02	R2-T1-F1	4/22	11:30	DW	RAT									✓	✓	✓	✓	✓		9
-03	R2-T2-F2	4/22	11:30	DW	RAT									✓	✓	✓	✓	✓		9
-04	R2-T2-F3	4/22	11:30	DW	RAT									✓	✓	✓	✓	✓		9
-07	R1-BW-Res	4/22	11:30	DW	RAT			✓			✓									2
-08	R1-BW-Sup	4/22	11:30	DW	RAT						✓	✓						✓		3

Container Type																				
Preservative																				

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H= $Na_2S_2O_3$
I= Ascorbic Acid
J= NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	4/22 13:18		4/22/25 13:20
	4/22/25 17:22		4/22/25 1722

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

Pace

Subcontract Chain of Custody

Pace New England
39 Spruce St
East Longmeadow, MA 01028

Pace Job Number
L2524631

Page 1

Client Information

Client: Pace Analytical Labs
Address: Eight Walkup Drive
Westborough, MA 01581-1019

Report To:west.subreports@pacelabs.com
Bill To:invoices@pacelabs.coupahost.com

Phone: 716.427.5228
Email: Jennifer.Byrnes@pacelabs.com

Project Information

Project Location: MA
Project Manager: Jennifer Byrnes

Turnaround & Deliverables Information

Due Date:
Deliverables:

Regulatory Requirements/Report Limits

State/Federal Program:
Regulatory Criteria:

Report to RL

Project Specific Requirements and/or Report Requirements

Reference following Pace Job Number on final report/deliverables: L2524631 Report to include Method and/or Regulatory required batch QC

Additional Comments:

Lab ID	Pace ID	Client ID	Collection Date/Time	Sample Matrix	Analysis	Sample Level Comments	Sample Specific QC	Container Count
	L2524631-01	R2-RW	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-02	R2-T1-F1	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-03	R2-T2-F2	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-04	R2-T2-F3	04-22-25 11:30	DW	VOCs - EPA 524.2			2

Relinquished By:	Date/Time:	Received By:	Date/Time:
[illegible] 4/28 (4/23)	4/23/25 0508	Robert DAVIS	4-23-25 5:08

Form No: AL_subcoc

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

April 28, 2025

Jennifer Byrnes
Pace Analytical Services - Westborough, MA
8 Walkup Drive
Westborough, MA 01581

Project Location: L2524631
Client Job Number:
Project Number: L2524631
Laboratory Work Order Number: 25D1812

Enclosed are results of analyses for samples as received by the laboratory on April 23, 2025. If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Rebecca Faust
Project Manager

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B403726 14

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Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Pace Analytical Services - Westborough, MA
8 Walkup Drive
Westborough, MA 01581
ATTN: Jennifer Byrnes

REPORT DATE: 4/28/2025

PURCHASE ORDER NUMBER:

PROJECT NUMBER: L2524631

ANALYTICAL SUMMARY

WORK ORDER NUMBER: 25D1812

The results of analyses performed on the following samples submitted to Pace Analytical Services, LLC - East Longmeadow, Ma, are found in this report.

PROJECT LOCATION: L2524631

FIELD SAMPLE #	LAB ID:	MATRIX	SAMPLE DESCRIPTION	TEST	SUB LAB
R2-RW	25D1812-01	Drinking Water		EPA 524.2	
R2-T1-F1	25D1812-02	Drinking Water		EPA 524.2	
R2-T2-F2	25D1812-03	Drinking Water		EPA 524.2	
R2-T2-F3	25D1812-04	Drinking Water		EPA 524.2	

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

CASE NARRATIVE SUMMARY

All reported results are within defined laboratory quality control objectives unless listed below or otherwise qualified in this report.

EPA 524.2

Qualifications:

L-01

Laboratory fortified blank/laboratory control sample recovery outside of control limits. Data validation is not affected since all results are "not detected" for all samples in this batch for this compound and bias is on the high side.

Analyte & Samples(s) Qualified:

1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
B403726-BS1

Dichlorodifluoromethane (Freon 12)
B403726-BS1

Trichlorofluoromethane (Freon 11)
B403726-BS1

PR-08

pH of sample (pH 5) is outside of method specified preservation criteria.

Analyte & Samples(s) Qualified:

25D1812-03[R2-T2-F2], 25D1812-04[R2-T2-F3]

The results of analyses reported only relate to samples submitted to Pace Analytical Services, LLC - East Longmeadow, Ma, for testing.
I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.



Lisa A. Worthington
Technical Representative

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-RW Sampled: 4/22/2025 11:30

Sample ID: 25D1812-01

Sample Matrix: Drinking Water

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Acetone	ND	10	6300	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
tert-Amyl Methyl Ether (TAME)	ND	0.50	90	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Benzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromodichloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromoform	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromomethane	ND	0.50	10	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
2-Butanone (MEK)	ND	5.0	4000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
tert-Butyl Alcohol (TBA)	ND	5.0	120	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
n-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
sec-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
tert-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
tert-Butyl Ethyl Ether (TBEE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Carbon Disulfide	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Carbon Tetrachloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Chlorobenzene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Chloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Chloroform	1.9	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Chloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
2-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
4-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Dibromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dibromoethane (EDB)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Dibromomethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dichlorobenzene	ND	0.50	600	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,3-Dichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,4-Dichlorobenzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Dichlorodifluoromethane (Freon 12)	ND	0.50	1400	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1-Dichloroethane	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1-Dichloroethylene	ND	0.50	7	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
cis-1,2-Dichloroethylene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
trans-1,2-Dichloroethylene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dichloropropane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,3-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
2,2-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
cis-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
trans-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,3-Dichloropropene (total)	ND	1.0	0.4	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Diethyl Ether	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Diisopropyl Ether (DIPE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-RW Sampled: 4/22/2025 11:30

Sample ID: 25D1812-01

Sample Matrix: Drinking Water

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Ethylbenzene	ND	0.50	700	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Hexachlorobutadiene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
2-Hexanone (MBK)	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Isopropylbenzene (Cumene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
p-Isopropyltoluene (p-Cymene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Methyl tert-Butyl Ether (MTBE)	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Methylene Chloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
4-Methyl-2-pentanone (MIBK)	ND	5.0	350	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Naphthalene	ND	1.0	140	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
n-Propylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Styrene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Tetrachloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Tetrahydrofuran	ND	2.0	1300	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Toluene	ND	0.50	1000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2,4-Trichlorobenzene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,1-Trichloroethane	ND	0.50	200	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,2-Trichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Trichloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Trichlorofluoromethane (Freon 11)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2,3-Trichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	210000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Vinyl Chloride	ND	0.50	2	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
m&p-Xylene	ND	1.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
o-Xylene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Xylenes (total)	ND	1.5	10000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
4-Bromofluorobenzene	109	80-120		4/26/25 8:30
1,2-Dichlorobenzene-d4	110	80-120		4/26/25 8:30

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T1-F1 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-02

Sample Matrix: Drinking Water

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Acetone	ND	10	6300	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
tert-Amyl Methyl Ether (TAME)	ND	0.50	90	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Benzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromodichloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromoform	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromomethane	ND	0.50	10	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
2-Butanone (MEK)	ND	5.0	4000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
tert-Butyl Alcohol (TBA)	ND	5.0	120	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
n-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
sec-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
tert-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
tert-Butyl Ethyl Ether (TBEE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Carbon Disulfide	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Carbon Tetrachloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Chlorobenzene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Chloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Chloroform	1.9	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Chloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
2-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
4-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Dibromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dibromoethane (EDB)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Dibromomethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dichlorobenzene	ND	0.50	600	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,3-Dichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,4-Dichlorobenzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Dichlorodifluoromethane (Freon 12)	ND	0.50	1400	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1-Dichloroethane	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1-Dichloroethylene	ND	0.50	7	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
cis-1,2-Dichloroethylene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
trans-1,2-Dichloroethylene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dichloropropane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,3-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
2,2-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
cis-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
trans-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,3-Dichloropropene (total)	ND	1.0	0.4	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Diethyl Ether	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Diisopropyl Ether (DIPE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T1-F1 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-02

Sample Matrix: Drinking Water

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Ethylbenzene	ND	0.50	700	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Hexachlorobutadiene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
2-Hexanone (MBK)	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Isopropylbenzene (Cumene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
p-Isopropyltoluene (p-Cymene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Methyl tert-Butyl Ether (MTBE)	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Methylene Chloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
4-Methyl-2-pentanone (MIBK)	ND	5.0	350	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Naphthalene	ND	1.0	140	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
n-Propylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Styrene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Tetrachloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Tetrahydrofuran	ND	2.0	1300	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Toluene	ND	0.50	1000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2,4-Trichlorobenzene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,1-Trichloroethane	ND	0.50	200	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,2-Trichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Trichloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Trichlorofluoromethane (Freon 11)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2,3-Trichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	210000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Vinyl Chloride	ND	0.50	2	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
m&p-Xylene	ND	1.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
o-Xylene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Xylenes (total)	ND	1.5	10000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
4-Bromofluorobenzene	113	80-120		4/26/25 8:55
1,2-Dichlorobenzene-d4	106	80-120		4/26/25 8:55

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T2-F2 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-03

Sample Matrix: Drinking Water

Sample Flags: PR-08

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Acetone	ND	10	6300	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
tert-Amyl Methyl Ether (TAME)	ND	0.50	90	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Benzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromodichloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromoform	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromomethane	ND	0.50	10	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
2-Butanone (MEK)	ND	5.0	4000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
tert-Butyl Alcohol (TBA)	ND	5.0	120	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
n-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
sec-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
tert-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
tert-Butyl Ethyl Ether (TBEE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Carbon Disulfide	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Carbon Tetrachloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Chlorobenzene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Chloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Chloroform	2.0	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Chloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
2-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
4-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Dibromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dibromoethane (EDB)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Dibromomethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dichlorobenzene	ND	0.50	600	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,3-Dichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,4-Dichlorobenzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Dichlorodifluoromethane (Freon 12)	ND	0.50	1400	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1-Dichloroethane	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1-Dichloroethylene	ND	0.50	7	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
cis-1,2-Dichloroethylene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
trans-1,2-Dichloroethylene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dichloropropane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,3-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
2,2-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
cis-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
trans-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,3-Dichloropropene (total)	ND	1.0	0.4	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Diethyl Ether	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Diisopropyl Ether (DIPE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T2-F2 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-03

Sample Matrix: Drinking Water

Sample Flags: PR-08

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Ethylbenzene	ND	0.50	700	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Hexachlorobutadiene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
2-Hexanone (MBK)	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Isopropylbenzene (Cumene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
p-Isopropyltoluene (p-Cymene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Methyl tert-Butyl Ether (MTBE)	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Methylene Chloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
4-Methyl-2-pentanone (MIBK)	ND	5.0	350	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Naphthalene	ND	1.0	140	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
n-Propylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Styrene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Tetrachloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Tetrahydrofuran	ND	2.0	1300	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Toluene	ND	0.50	1000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2,4-Trichlorobenzene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,1-Trichloroethane	ND	0.50	200	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,2-Trichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Trichloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Trichlorofluoromethane (Freon 11)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2,3-Trichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	210000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Vinyl Chloride	ND	0.50	2	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
m&p-Xylene	ND	1.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
o-Xylene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Xylenes (total)	ND	1.5	10000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH

Surrogates	% Recovery	Recovery Limits	Flag/Qual		
4-Bromofluorobenzene	109	80-120		4/26/25	9:21
1,2-Dichlorobenzene-d4	105	80-120		4/26/25	9:21

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T2-F3 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-04

Sample Matrix: Drinking Water

Sample Flags: PR-08

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Acetone	ND	10	6300	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
tert-Amyl Methyl Ether (TAME)	ND	0.50	90	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Benzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromodichloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromoform	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromomethane	ND	0.50	10	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
2-Butanone (MEK)	ND	5.0	4000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
tert-Butyl Alcohol (TBA)	ND	5.0	120	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
n-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
sec-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
tert-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
tert-Butyl Ethyl Ether (TBEE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Carbon Disulfide	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Carbon Tetrachloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Chlorobenzene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Chloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Chloroform	2.0	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Chloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
2-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
4-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Dibromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dibromoethane (EDB)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Dibromomethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dichlorobenzene	ND	0.50	600	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,3-Dichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,4-Dichlorobenzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Dichlorodifluoromethane (Freon 12)	ND	0.50	1400	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1-Dichloroethane	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1-Dichloroethylene	ND	0.50	7	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
cis-1,2-Dichloroethylene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
trans-1,2-Dichloroethylene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dichloropropane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,3-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
2,2-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
cis-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
trans-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,3-Dichloropropene (total)	ND	1.0	0.4	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Diethyl Ether	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Diisopropyl Ether (DIPE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T2-F3 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-04

Sample Matrix: Drinking Water

Sample Flags: PR-08

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Ethylbenzene	ND	0.50	700	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Hexachlorobutadiene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
2-Hexanone (MBK)	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Isopropylbenzene (Cumene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
p-Isopropyltoluene (p-Cymene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Methyl tert-Butyl Ether (MTBE)	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Methylene Chloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
4-Methyl-2-pentanone (MIBK)	ND	5.0	350	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Naphthalene	ND	1.0	140	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
n-Propylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Styrene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Tetrachloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Tetrahydrofuran	ND	2.0	1300	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Toluene	ND	0.50	1000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2,4-Trichlorobenzene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,1-Trichloroethane	ND	0.50	200	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,2-Trichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Trichloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Trichlorofluoromethane (Freon 11)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2,3-Trichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	210000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Vinyl Chloride	ND	0.50	2	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
m&p-Xylene	ND	1.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
o-Xylene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Xylenes (total)	ND	1.5	10000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH

Surrogates	% Recovery	Recovery Limits	Flag/Qual		
4-Bromofluorobenzene	109	80-120		4/26/25	9:46
1,2-Dichlorobenzene-d4	107	80-120		4/26/25	9:46

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Sample Extraction Data

Prep Method:EPA 524.2 **Analytical Method:EPA 524.2**

Lab Number [Field ID]	Batch	Initial [mL]	Final [mL]	Date
25D1812-01 [R2-RW]	B403726	5	5.00	04/25/25
25D1812-02 [R2-T1-F1]	B403726	5	5.00	04/25/25
25D1812-03 [R2-T2-F2]	B403726	5	5.00	04/25/25
25D1812-04 [R2-T2-F3]	B403726	5	5.00	04/25/25

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

QUALITY CONTROL

Drinking Water Organics EPA 500 Series Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B403726 - EPA 524.2										
Blank (B403726-BLK1)				Prepared: 04/24/25 Analyzed: 04/26/25						
Acetone	ND	10	µg/L							
tert-Amyl Methyl Ether (TAME)	ND	0.50	µg/L							
Benzene	ND	0.50	µg/L							
Bromobenzene	ND	0.50	µg/L							
Bromochloromethane	ND	0.50	µg/L							
Bromodichloromethane	ND	0.50	µg/L							
Bromoform	ND	0.50	µg/L							
Bromomethane	ND	0.50	µg/L							
2-Butanone (MEK)	ND	5.0	µg/L							
tert-Butyl Alcohol (TBA)	ND	5.0	µg/L							
n-Butylbenzene	ND	0.50	µg/L							
sec-Butylbenzene	ND	0.50	µg/L							
tert-Butylbenzene	ND	0.50	µg/L							
tert-Butyl Ethyl Ether (TBEE)	ND	0.50	µg/L							
Carbon Disulfide	ND	5.0	µg/L							
Carbon Tetrachloride	ND	0.50	µg/L							
Chlorobenzene	ND	0.50	µg/L							
Chloroethane	ND	0.50	µg/L							
Chloroform	ND	0.50	µg/L							
Chloromethane	ND	0.50	µg/L							
2-Chlorotoluene	ND	0.50	µg/L							
4-Chlorotoluene	ND	0.50	µg/L							
Dibromochloromethane	ND	0.50	µg/L							
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	µg/L							
1,2-Dibromoethane (EDB)	ND	0.50	µg/L							
Dibromomethane	ND	0.50	µg/L							
1,2-Dichlorobenzene	ND	0.50	µg/L							
1,3-Dichlorobenzene	ND	0.50	µg/L							
1,4-Dichlorobenzene	ND	0.50	µg/L							
Dichlorodifluoromethane (Freon 12)	ND	0.50	µg/L							
1,1-Dichloroethane	ND	0.50	µg/L							
1,2-Dichloroethane	ND	0.50	µg/L							
1,1-Dichloroethylene	ND	0.50	µg/L							
cis-1,2-Dichloroethylene	ND	0.50	µg/L							
trans-1,2-Dichloroethylene	ND	0.50	µg/L							
1,2-Dichloropropane	ND	0.50	µg/L							
1,3-Dichloropropane	ND	0.50	µg/L							
2,2-Dichloropropane	ND	0.50	µg/L							
1,1-Dichloropropene	ND	0.50	µg/L							
cis-1,3-Dichloropropene	ND	0.50	µg/L							
trans-1,3-Dichloropropene	ND	0.50	µg/L							
Diethyl Ether	ND	0.50	µg/L							
Diisopropyl Ether (DIPE)	ND	0.50	µg/L							
Ethylbenzene	ND	0.50	µg/L							
Hexachlorobutadiene	ND	0.50	µg/L							
2-Hexanone (MBK)	ND	5.0	µg/L							
Isopropylbenzene (Cumene)	ND	0.50	µg/L							
p-Isopropyltoluene (p-Cymene)	ND	0.50	µg/L							
Methyl tert-Butyl Ether (MTBE)	ND	0.50	µg/L							
Methylene Chloride	ND	0.50	µg/L							
4-Methyl-2-pentanone (MIBK)	ND	5.0	µg/L							
Naphthalene	ND	1.0	µg/L							

Pace Analytical Services, LLC - East Longmeadow, Ma

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QUALITY CONTROL

Drinking Water Organics EPA 500 Series Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B403726 - EPA 524.2										
Blank (B403726-BLK1)				Prepared: 04/24/25 Analyzed: 04/26/25						
n-Propylbenzene	ND	0.50	µg/L							
Styrene	ND	0.50	µg/L							
1,1,1,2-Tetrachloroethane	ND	0.50	µg/L							
1,1,2,2-Tetrachloroethane	ND	0.50	µg/L							
Tetrachloroethylene	ND	0.50	µg/L							
Tetrahydrofuran	ND	2.0	µg/L							
Toluene	ND	0.50	µg/L							
1,2,3-Trichlorobenzene	ND	0.50	µg/L							
1,2,4-Trichlorobenzene	ND	0.50	µg/L							
1,1,1-Trichloroethane	ND	0.50	µg/L							
1,1,2-Trichloroethane	ND	0.50	µg/L							
Trichloroethylene	ND	0.50	µg/L							
Trichlorofluoromethane (Freon 11)	ND	0.50	µg/L							
1,2,3-Trichloropropane	ND	0.50	µg/L							
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	µg/L							
1,2,4-Trimethylbenzene	ND	0.50	µg/L							
1,3,5-Trimethylbenzene	ND	0.50	µg/L							
Vinyl Chloride	ND	0.50	µg/L							
m&p-Xylene	ND	1.0	µg/L							
o-Xylene	ND	0.50	µg/L							
Surrogate: 4-Bromofluorobenzene	*27.4*		µg/L	25.00		109	80-120			
Surrogate: 1,2-Dichlorobenzene-d4	*26.7*		µg/L	25.00		107	80-120			
LCS (B403726-BS1)				Prepared: 04/24/25 Analyzed: 04/26/25						
Acetone	94	10	µg/L	100.0		94.5	70-130			
tert-Amyl Methyl Ether (TAME)	9.7	0.50	µg/L	10.00		97.2	70-130			
Benzene	11	0.50	µg/L	10.00		109	70-130			
Bromobenzene	10	0.50	µg/L	10.00		104	70-130			
Bromochloromethane	9.1	0.50	µg/L	10.00		91.3	70-130			
Bromodichloromethane	10	0.50	µg/L	10.00		103	70-130			
Bromoform	9.7	0.50	µg/L	10.00		96.6	70-130			
Bromomethane	10	0.50	µg/L	10.00		102	70-130			
2-Butanone (MEK)	78	5.0	µg/L	100.0		78.4	70-130			
tert-Butyl Alcohol (TBA)	90	5.0	µg/L	100.0		89.9	70-130			
n-Butylbenzene	9.9	0.50	µg/L	10.00		99.1	70-130			
sec-Butylbenzene	9.6	0.50	µg/L	10.00		96.2	70-130			
tert-Butylbenzene	10	0.50	µg/L	10.00		100	70-130			
tert-Butyl Ethyl Ether (TBEE)	9.9	0.50	µg/L	10.00		98.8	70-130			
Carbon Disulfide	110	5.0	µg/L	100.0		110	70-130			
Carbon Tetrachloride	13	0.50	µg/L	10.00		130	70-130			
Chlorobenzene	11	0.50	µg/L	10.00		109	70-130			
Chloroethane	11	0.50	µg/L	10.00		105	70-130			
Chloroform	11	0.50	µg/L	10.00		108	70-130			
Chloromethane	9.4	0.50	µg/L	10.00		94.3	70-130			
2-Chlorotoluene	10	0.50	µg/L	10.00		102	70-130			
4-Chlorotoluene	11	0.50	µg/L	10.00		106	70-130			
Dibromochloromethane	11	0.50	µg/L	10.00		107	70-130			
1,2-Dibromo-3-chloropropane (DBCP)	12	2.0	µg/L	10.00		118	70-130			
1,2-Dibromoethane (EDB)	11	0.50	µg/L	10.00		111	70-130			
Dibromomethane	11	0.50	µg/L	10.00		114	70-130			
1,2-Dichlorobenzene	10	0.50	µg/L	10.00		105	70-130			
1,3-Dichlorobenzene	10	0.50	µg/L	10.00		103	70-130			

Pace Analytical Services, LLC - East Longmeadow, Ma

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QUALITY CONTROL

Drinking Water Organics EPA 500 Series Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC		%REC Limits	RPD	RPD Limit	Notes
Batch B403726 - EPA 524.2											
LCS (B403726-BS1)				Prepared: 04/24/25 Analyzed: 04/26/25							
1,4-Dichlorobenzene	10	0.50	µg/L	10.00		103		70-130			
Dichlorodifluoromethane (Freon 12)	15	0.50	µg/L	10.00		**155**	*	70-130			L-01
1,1-Dichloroethane	11	0.50	µg/L	10.00		107		70-130			
1,2-Dichloroethane	12	0.50	µg/L	10.00		116		70-130			
1,1-Dichloroethylene	12	0.50	µg/L	10.00		117		70-130			
cis-1,2-Dichloroethylene	11	0.50	µg/L	10.00		106		70-130			
trans-1,2-Dichloroethylene	10	0.50	µg/L	10.00		104		70-130			
1,2-Dichloropropane	10	0.50	µg/L	10.00		102		70-130			
1,3-Dichloropropane	11	0.50	µg/L	10.00		115		70-130			
2,2-Dichloropropane	9.1	0.50	µg/L	10.00		90.7		70-130			
1,1-Dichloropropene	13	0.50	µg/L	10.00		127		70-130			
cis-1,3-Dichloropropene	11	0.50	µg/L	10.00		106		70-130			
trans-1,3-Dichloropropene	11	0.50	µg/L	10.00		107		70-130			
Diethyl Ether	11	0.50	µg/L	10.00		111		70-130			
Diisopropyl Ether (DIPE)	9.1	0.50	µg/L	10.00		91.2		70-130			
Ethylbenzene	11	0.50	µg/L	10.00		112		70-130			
Hexachlorobutadiene	9.5	0.50	µg/L	10.00		94.8		70-130			
2-Hexanone (MBK)	89	5.0	µg/L	100.0		89.0		70-130			
Isopropylbenzene (Cumene)	11	0.50	µg/L	10.00		108		70-130			
p-Isopropyltoluene (p-Cymene)	9.5	0.50	µg/L	10.00		95.0		70-130			
Methyl tert-Butyl Ether (MTBE)	12	0.50	µg/L	10.00		116		70-130			
Methylene Chloride	9.3	0.50	µg/L	10.00		93.1		70-130			
4-Methyl-2-pentanone (MIBK)	86	5.0	µg/L	100.0		86.5		70-130			
Naphthalene	11	1.0	µg/L	10.00		107		70-130			
n-Propylbenzene	11	0.50	µg/L	10.00		108		70-130			
Styrene	11	0.50	µg/L	10.00		107		70-130			
1,1,1,2-Tetrachloroethane	11	0.50	µg/L	10.00		105		70-130			
1,1,2,2-Tetrachloroethane	10	0.50	µg/L	10.00		103		70-130			
Tetrachloroethylene	11	0.50	µg/L	10.00		113		70-130			
Tetrahydrofuran	7.5	2.0	µg/L	10.00		75.1		70-130			
Toluene	11	0.50	µg/L	10.00		109		70-130			
1,2,3-Trichlorobenzene	9.7	0.50	µg/L	10.00		96.9		70-130			
1,2,4-Trichlorobenzene	9.6	0.50	µg/L	10.00		96.1		70-130			
1,1,1-Trichloroethane	12	0.50	µg/L	10.00		119		70-130			
1,1,2-Trichloroethane	11	0.50	µg/L	10.00		107		70-130			
Trichloroethylene	12	0.50	µg/L	10.00		125		70-130			
Trichlorofluoromethane (Freon 11)	15	0.50	µg/L	10.00		**155**	*	70-130			L-01
1,2,3-Trichloropropane	11	0.50	µg/L	10.00		114		70-130			
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	13	0.50	µg/L	10.00		**132**	*	70-130			L-01
1,2,4-Trimethylbenzene	10	0.50	µg/L	10.00		104		70-130			
1,3,5-Trimethylbenzene	10	0.50	µg/L	10.00		104		70-130			
Vinyl Chloride	12	0.50	µg/L	10.00		123		70-130			
m&p-Xylene	21	1.0	µg/L	20.00		107		70-130			
o-Xylene	11	0.50	µg/L	10.00		114		70-130			
Surrogate: 4-Bromofluorobenzene	*27.7*		µg/L	25.00		111		80-120			
Surrogate: 1,2-Dichlorobenzene-d4	*26.4*		µg/L	25.00		106		80-120			

Pace Analytical Services, LLC - East Longmeadow, Ma

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FLAG/QUALIFIER SUMMARY

*	QC result is outside of established limits.
†	Wide recovery limits established for difficult compound.
‡	Wide RPD limits established for difficult compound.
#	Data exceeded client recommended or regulatory level
ND	Not Detected
RL	Reporting Limit is at the level of quantitation (LOQ)
DL	Detection Limit is the lower limit of detection determined by the MDL study
MCL	Maximum Contaminant Level
	Percent recoveries and relative percent differences (RPDs) are determined by the software using values in the calculation which have not been rounded.
	No results have been blank subtracted unless specified in the case narrative section.
L-01	Laboratory fortified blank/laboratory control sample recovery outside of control limits. Data validation is not affected since all results are "not detected" for all samples in this batch for this compound and bias is on the high side.
PR-08	pH of sample (pH 5) is outside of method specified preservation criteria.

Pace Analytical Services, LLC - East Longmeadow, Ma

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CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications
EPA 524.2 in Drinking Water	
tert-Amyl Methyl Ether (TAME)	NH
Benzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Bromobenzene	CT,MA,NH,NY,RI,VT-DW,NJ
Bromochloromethane	CT,MA,NH,NY,RI,VT-DW,NJ
Bromodichloromethane	MA,NH,NY,RI,ME,VA,VT-DW,NJ
Bromoform	CT,MA,NH,NY,RI,ME,VT-DW,NJ
Bromomethane	CT,MA,NH,NY,RI,VT-DW,NJ
2-Butanone (MEK)	NH
tert-Butyl Alcohol (TBA)	NH
n-Butylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
sec-Butylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
tert-Butylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
tert-Butyl Ethyl Ether (TBEE)	NH
Carbon Disulfide	NH
Carbon Tetrachloride	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Chlorobenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Chloroethane	CT,MA,NH,NY,RI,VT-DW,NJ
Chloroform	MA,NH,NY,RI,ME,VA,VT-DW,NJ
Chloromethane	CT,MA,NH,NY,RI,VT-DW,NJ
2-Chlorotoluene	CT,MA,NH,NY,RI,VT-DW,NJ
4-Chlorotoluene	CT,MA,NH,NY,RI,VT-DW,NJ
Dibromochloromethane	MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,2-Dibromo-3-chloropropane (DBCP)	NH
1,2-Dibromoethane (EDB)	NH
Dibromomethane	CT,MA,NH,NY,RI,VT-DW,NJ
1,2-Dichlorobenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,3-Dichlorobenzene	CT,MA,NH,NY,RI,VT-DW,NJ
1,4-Dichlorobenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Dichlorodifluoromethane (Freon 12)	CT,MA,NH,NY,RI,VT-DW,NJ
1,1-Dichloroethane	CT,MA,NH,NY,RI,VT-DW,NJ
1,2-Dichloroethane	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,1-Dichloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
cis-1,2-Dichloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
trans-1,2-Dichloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,2-Dichloropropane	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,3-Dichloropropane	CT,MA,NH,NY,RI,VT-DW,NJ
2,2-Dichloropropane	CT,MA,NH,NY,RI,VT-DW,NJ
1,1-Dichloropropene	CT,MA,NH,NY,RI,VT-DW,NJ
cis-1,3-Dichloropropene	CT,MA,NH,NY,RI,VT-DW,NJ
trans-1,3-Dichloropropene	CT,MA,NH,NY,RI,VT-DW,NJ
1,3-Dichloropropene (total)	CT,MA
Diethyl Ether	NH
Diisopropyl Ether (DIPE)	NH
Ethylbenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Hexachlorobutadiene	CT,MA,NH,NY,RI,VT-DW,NJ
2-Hexanone (MBK)	NH
Isopropylbenzene (Cumene)	CT,MA,NH,NY,RI,VT-DW,NJ

Pace Analytical Services, LLC - East Longmeadow, Ma

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CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications
EPA 524.2 in Drinking Water	
p-Isopropyltoluene (p-Cymene)	CT,MA,NH,NY,RI,VT-DW,NJ
Methyl tert-Butyl Ether (MTBE)	CT,MA,NH,NY,RI,ME,VT-DW,NJ
Methylene Chloride	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Naphthalene	NY,NJ
n-Propylbenzene	NY,VT-DW,NJ
Styrene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,1,1,2-Tetrachloroethane	CT,MA,NH,NY,RI,VT-DW,NJ
1,1,2,2-Tetrachloroethane	CT,MA,NH,NY,RI,VT-DW,NJ
Tetrachloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Tetrahydrofuran	NJ
Toluene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,2,3-Trichlorobenzene	CT,MA,NH,NY,RI,VT-DW,NJ
1,2,4-Trichlorobenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,1,1-Trichloroethane	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,1,2-Trichloroethane	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Trichloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Trichlorofluoromethane (Freon 11)	CT,MA,NH,NY,RI,VT-DW,NJ
1,2,3-Trichloropropane	CT,MA,NH,NY,RI,VT-DW,NJ
1,2,4-Trimethylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
1,3,5-Trimethylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
Vinyl Chloride	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
m&p-Xylene	NH,VA
o-Xylene	NH,VA
Xylenes (total)	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ

Pace Analytical Services, LLC - East Longmeadow, Ma, operates under the following certifications and accreditations:

Code	Description	Number	Expires
MA	Massachusetts DEP	M-MA100	06/30/2025
CT	Connecticut Department of Public Health	PH-0821	12/31/2026
NY	New York State Department of Health	10899 NELAP	04/1/2026
NH	New Hampshire Environmental Lab	2516 NELAP	02/5/2026
RI	Rhode Island Department of Health	LAO00373	12/30/2025
NJ	New Jersey DEP	MA007 NELAP	06/30/2025
VT-DW	Vermont Department of Health Drinking Water	VT-255716	06/12/2025
ME	State of Maine	MA00100	06/9/2025
VA	Commonwealth of Virginia	460217	12/14/2025

250812

Pace

Subcontract Chain of Custody

Pace New England
39 Spruce St
East Longmeadow, MA 01028

Pace Job Number
L2524631

Page 1

Client Information	Project Information	Regulatory Requirements/Report Limits
Client: Pace Analytical Labs Address: Eight Walkup Drive Westborough, MA 01581-1019 Report To:west.subreports@pacelabs.com Bill To:invoices@pacelabs.coupahost.com Phone: 716.427.5228 Email: Jennifer.Byrnes@pacelabs.com	Project Location: MA Project Manager: Jennifer Byrnes **Turnaround & Deliverables Information** Due Date: Deliverables:	State/Federal Program: Regulatory Criteria: Report to RL

Project Specific Requirements and/or Report Requirements

Reference following Pace Job Number on final report/deliverables: L2524631 Report to include Method and/or Regulatory required batch QC

Additional Comments:

Lab ID	Pace ID	Client ID	Collection Date/Time	Sample Matrix	Analysis	Sample Level Comments	Sample Specific QC	Container Count
AGH	L2524631-01	R2-RW	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-02	R2-T1-F1	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-03	R2-T2-F2	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-04	R2-T2-F3	04-22-25 11:30	DW	VOCs - EPA 524.2			2

	Relinquished By:	Date/Time:	Received By:	Date/Time:
	[illegible] 4128 (4123)		Mark DAVIS 4-23-25	5:08
	4123125	0508	[illegible] 2.9	4123/25 635
	Mark DAVIS	4-23-25 0635		
Form No: AL_subcoc				

Serial_No:05072521:01

Pace	DC#_Title: ENV-FRM-ELON-0001 v08_Sample Receiving Checklist
	Effective Date: 06/11/2024

Log In Back-Sheet

Client PaCE

Project L2524631

MCP/RCP Required MA MA

Deliverable Package Requirement

Location MA

PWSID# (When Applicable) MA

Arrival Method:

Courier ☑ Fed Ex ☐ Walk In ☐ Other ☐

Received By / Date / Time LA 4/23/25 635

Back-Sheet By / Date / Time LA 4-23-25 837

Temperature Method gun # 6

WV samples: Yes (see note*) / (No) (follow normal procedure)

Temp ✓ < 6° C Actual Temperature 2.9

Rush Samples: Yes / (No) Notify

Short Hold: Yes / (No) Notify

Notes regarding Samples/COC outside of SOP:

Login Sample Receipt Checklist – (Rejection Criteria Listing – Using Acceptance Policy) Any False statement will be brought to the attention of the Client – True or False

	True	False
Received on Ice	☑	☐
Received in Cooler	☑	☐
Custody Seal: DATE TIME	☐	☑
COC Relinquished	☑	☐
COC/Samples Labels Agree	☑	☐
All Samples in Good Condition	☑	☐
Samples Received within Holding Time	☑	☐
Is there enough Volume	☑	☐
Proper Media/Container Used	☑	☐
Splitting Samples Required	☐	☑
MS/MSD	☐	☑
Trip Blanks	☐	☑
Lab to Filters	☐	☑
COC Legible	☑	☐

COC Included: (Check all included)

Client	☑	Analysis	☑	Sampler Name	☐
Project	☑	IDs	☑	Collection Date/Time	☑

All Samples Proper pH: (N/A) ☐ ☐

Additional Container Notes

Note: West Virginia requires all samples to have their temperature taken. Note any outliers.

Qualtrax ID: 120836

Pace ANALYTICAL SERVICES	DC#_Title: ENV-FRM-ELON-0001 v08_Sample Receiving Checklist
	Effective Date: 06/11/2024

Sample			
16oz Amb/Clear	Soils Jars (Circle Amb/Clear)		
8oz Amb/Clear			
4oz Amb/Clear			
2oz Amb/Clear			
Unpreserved	Ambers	1 Liter	
HCL			
Sulfuric			
Sulfuric		250mL	
Phosphoric			
HCl			
Unpreserved		100mL	
Unpreserved	Plastics	1 Liter	
Sulfuric			
Unpreserved		500mL	
Sulfuric			
Unpreserved		250mL	
Trizma			
Sulfuric			
Nitric			
NaOH			
Ammonium Acetate			
NaOH/Zinc			
Unpreserved	VOA Vials		
HCl			
MeOH			
D.I. Water			
BiSulfate			
Col/Bact	Other / Fill in		

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Unpreserved			(PV)																	
HCl				X																
Col/Bact			1	2																

2

Qualtrax ID: 120836

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID: 042507675
Customer ID: ALPH55A
Customer PO: I2524631
Project ID:

Attn: Results
Pace Analytical Labs
8 Walkup Drive
Westborough, MA 01581

Phone: (508) 898-9220
Fax: (508) 898-9193
Received: 04/23/2025
Analyzed: 05/07/2025

Proj: L2524631

Test Report: Determination of Asbestos Structures >10µm in Drinking Water Performed by the 100.2 Method (EPA 600/R-94/134)

Sample ID / Client / EMSL	Sample Filtration Date/Time	Original Sample Vol. Filtered (ml)	Effective Filter Area (mm²)	Area Analyzed (mm²)	ASBESTOS: Asbestos Types	Fibers Detected	Analytical Sensitivity	Concentration	Confidence Limits
								MFL (million fibers per liter)	
L2524631-01 042507675-0001	4/23/2025 04:57 PM	100	1336	0.0786	None Detected	ND	0.17	<0.17	0.00 - 0.63
Collection Date/Time:	*04/22/2025 11:30 AM*								
L2524631-02 042507675-0002	4/23/2025 05:03 PM	100	1336	0.0786	None Detected	ND	0.17	<0.17	0.00 - 0.63
Collection Date/Time:	*04/22/2025 11:30 AM*								
L2524631-03 042507675-0003	4/23/2025 05:10 PM	100	1336	0.0786	None Detected	ND	0.17	<0.17	0.00 - 0.63
Collection Date/Time:	*04/22/2025 11:30 AM*								
L2524631-04 042507675-0004	4/23/2025 05:15 PM	100	1336	0.0786	None Detected	ND	0.17	<0.17	0.00 - 0.63
Collection Date/Time:	*04/22/2025 11:30 AM*								

Bottles supplied by client.

Analyst(s)
Sarah Richey (4)

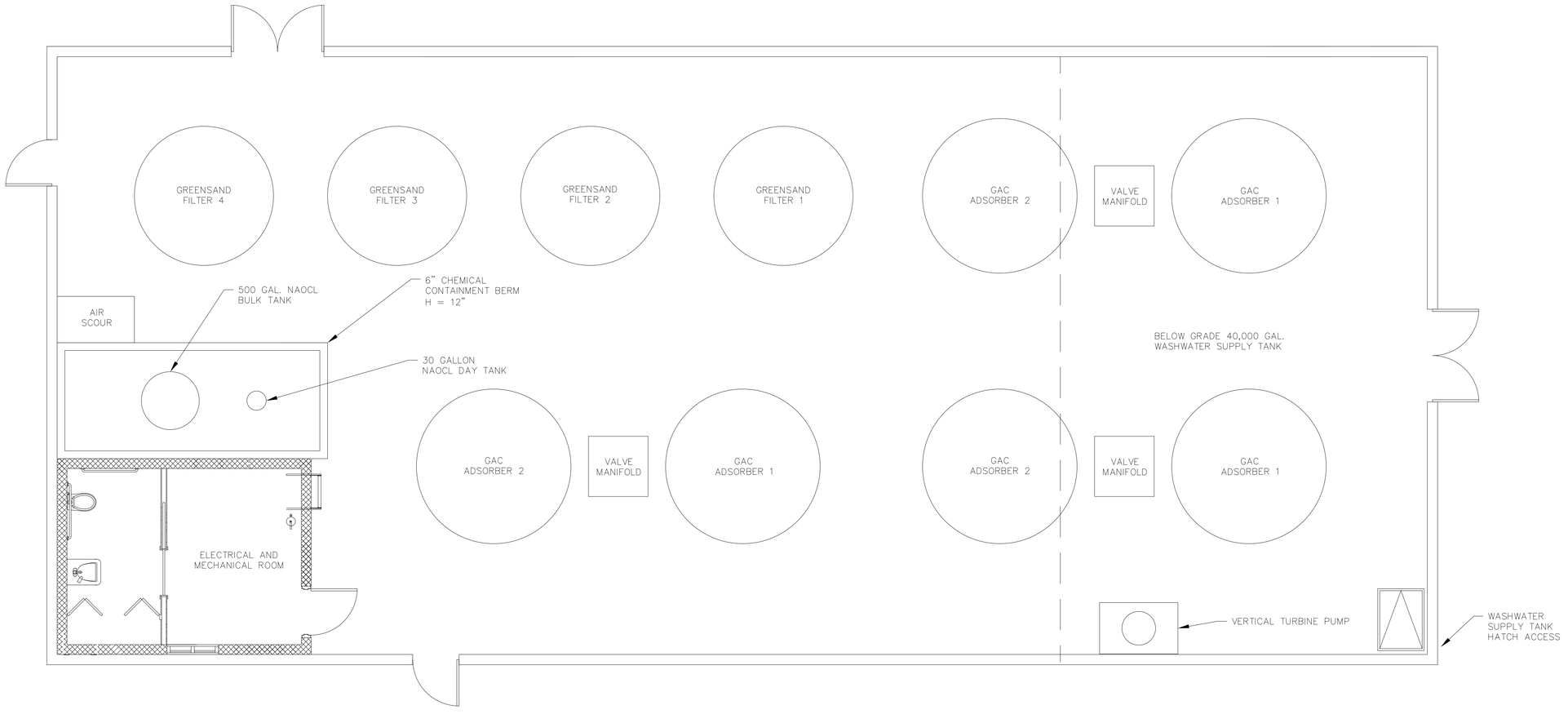
Samantha Rundstrom, Laboratory Manager
or Other Approved Signatory

Any questions please contact Samantha Rundstrom-Cruz.

Initial report from: 05/07/2025 12:44:51

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. Estimation of uncertainty is available on request. Sample collection performed by the client. Pre-cleaned sample containers are available for purchase from EMSL. Note if sample containers are provided by the client, acceptable bottle blank level is defined as ≤0.01MFL for >=10um fibers. ND=None Detected. No Fibers Detected: the value will be reported as less than 369% of the concentration equivalent to one fiber. 1 to 4 fibers: The result will be reported as less than the corresponding upper 95% confidence limit (Poisson),5 to 30 fibers: Mean and 95% confidence intervals will be reported on the basis of the Poisson assumption. When more than 30 fibers are counted, both the Gaussian 95% confidence interval and the Poisson 95% confidence interval will be calculated. The large of these two intervals will be selected for data reporting. When the Gaussian 95% confidence interval is selected for data reporting, the Poisson will also be noted.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAC NYS ELAP 10872, NJ DEP 03036, FL DOH E87975, PA ID# 68-00367



CONCEPTUAL FLOOR PLAN

SCALE: 1/4" = 1'

CONCEPTUAL

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DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JULY 2025
SCALE:	1/4" = 1'
DESIGNED BY:	RAT
CHECKED BY:	RAT
DRAWN BY:	GAC
APPROVED BY:	SCO

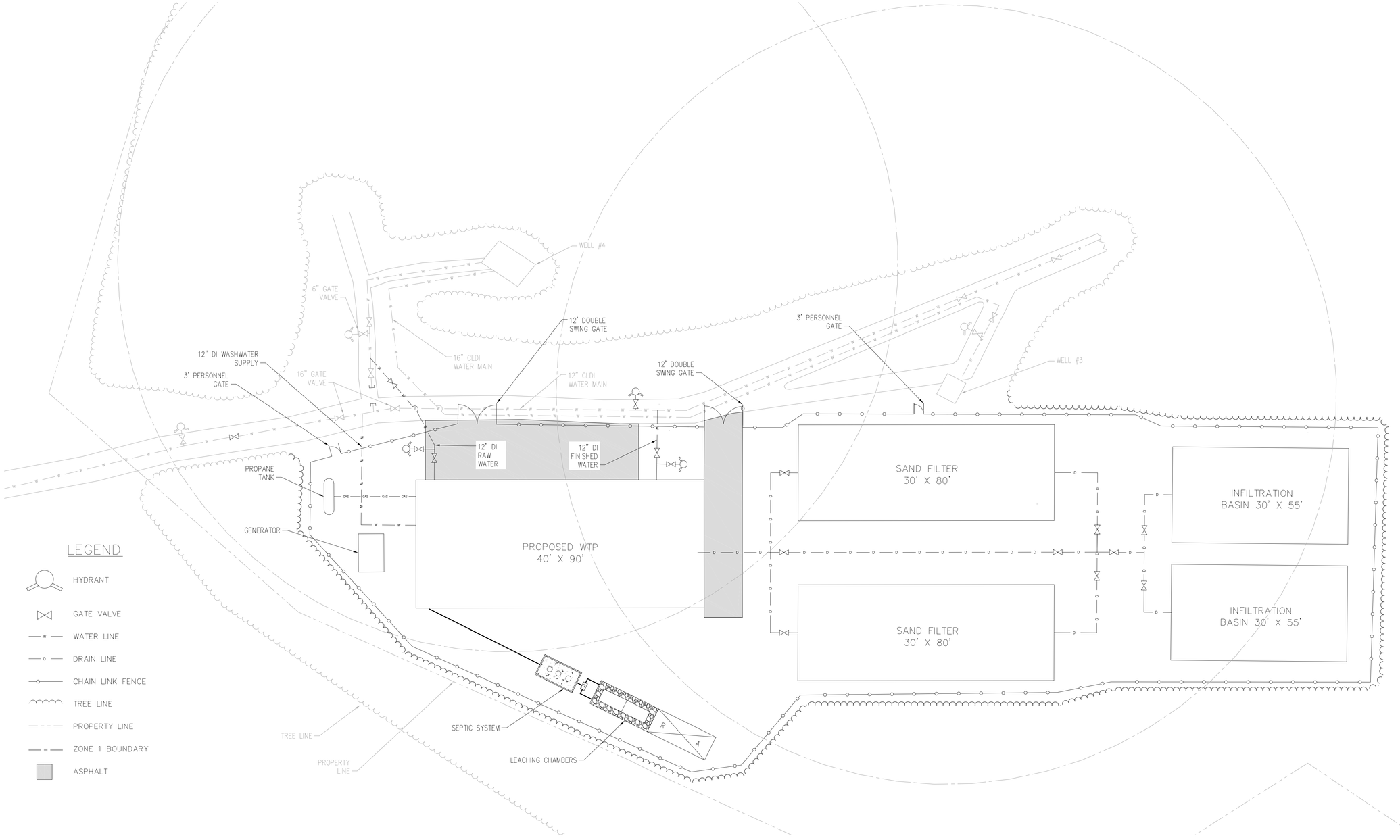
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CONCEPTUAL FLOOR PLAN

DRAWING NO.:
B-1

SHEET NO. ___ OF 1

C:\Users\Ryan\H2Olson Engineering, Inc\H2O - Documents\03 Projects\127 - Barnstable Fire District\127.25.01 - Well 3 & 4 Pilot Study\03 Conceptual Design\M Sheets.dwg



PLAN VIEW

SCALE: 1"=16'

CONCEPTUAL

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(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JULY 2025
SCALE:	1" = 16'
DESIGNED BY:	RAT
CHECKED BY:	RAT
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CONCEPTUAL SITE PLAN

DRAWING NO.:
C-1

SHEET NO. ___ OF 1

C:\Users\Ryan\H2Olson Engineering, Inc\H2O - Documents\03 Projects\127 - Barnstable Fire District\127.25.01 - Well 3 & 4 Pilot Study\03 Conceptual Design\C Sheets.dwg

Barnstable Fire District Well 3 and 4
Well 3 and 4 WTP
Capacity 1,500 gpm
Engineer's Opinion of Probable Construction Costs - Preliminary Design

Work Item Description	Unit of Measure	Quantity	Unit Cost	Estimated Cost
Site Clearing and Preparation	LS	1	$250,000	$250,000
Environmental Protection	LF	1,500	$15	$22,500
Earthwork (excavation and backfill)	LS	1	$200,000	$200,000
Sand Filters	EA	2	$500,000	$1,000,000
Infiltration System	EA	2	$150,000	$300,000
Septic System	LS	1	$50,000	$50,000
Site Yard Piping	LF	500	$150	$75,000
Fencing and Gates	LF	800	$125	$100,000
Bituminous Pavement	Tons	200	$150	$30,000
Stormwater Management	LS	1	$50,000	$50,000
Final Site Restoration	LS	1	$100,000	$100,000
Concrete Slab/Foundation	LS	1	$300,000	$300,000
Pre-engineered Metal Building	SF	3,600	$375	$1,350,000
Process Equipment (Greensand Filter System)	LS	1	$1,500,000	$1,500,000
Process Equipment (GAC System)	LS	1	$2,000,000	$2,000,000
Process Equipment (Chemical Feed Systems)	LS	1	$75,000	$75,000
Interior Process Piping & Valves	LF	300	$500	$150,000
Site Generator and Propane Tanks	EA	1	$150,000	$150,000
Washwater Supply Tank	GAL	40,000	$5	$200,000
Upgrade Well Pumps	EA	2	$75,000	$150,000
Backwash Pump	LS	1	$20,000	$20,000
Bathroom	LS	1	$150,000	$150,000
			Subtotal	$8,222,500
Instrumentation & Controls	ALLOW	5%		$411,125
HVAC & Plumbing	ALLOW	5%		$411,125
Electrical	ALLOW	10%		$822,250
			Subtotal	$1,644,500
			Construction Total	$9,870,000
			20% Contractor (OH/Profit/Bonds/Insurance)	$1,974,000
			5% Escalation, Supply Chain, and Bid Market Conditions	$493,500
			25% Engineering (Design, Permitting, Bidding, & Construction Services)	$2,467,500
			Design & Construction Total	$14,805,000
			20% Project Contingencies	$2,960,000
			Total Project Cost	**$17,770,000**

Date of Estimate: 7/23/2025

H2Olson Engineering, Inc.

ATTACHMENT E

Stormwater Report

STOROMWATER MANAGEMENT REPORT

FOR

WELLS 3&4 WATER TREATMENT BUILDING

JUNE 2026

Prepared For:

BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

255 BREEDS HILL ROAD PO BOX 546

BARNSTABLE, MA 02601

Contact: Sean Anderson

Phone: 508-362-6498

Email: bfdwatersupt@barnstablefiredistrict.com

Prepared By:

Contact: Stephen C. Olson, P.E.

Phone: 508-375-7007

Email: sco@h2olsonengineering.com

Address : 10 Riverside Drive. Suite #103

Lakeville, MA 02347

H2Olson Engineering, Inc.

DRINKING WATER PROFESSIONALS

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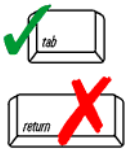
1.0 Stormwater Management Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



6/8/12

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☒ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☒ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☒ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☒ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

2.0 Introduction

H2Olson Engineering Inc. (H2Olson) has completed a drainage analysis for the Barnstable Fire District Wells 3&4 Water Treatment Plant Project (Project), the results of which are contained herein. The purpose of this analysis is to quantitatively understand the impacts of the proposed Project on the existing hydrologic conditions, and to mitigate any impacts through the implementation of a stormwater management system utilizing best management practices (BMPs) supported by both a Construction Period Pollution Prevention and Erosion and Sedimentation Plan and a Long-Term Operations and Maintenance Plan, found in Appendix A and Appendix B, respectively. The Stormwater Management Report herein has been prepared to demonstrate compliance with the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Handbook in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and applicable local regulations and bylaws.

3.0 Existing Conditions

3.1 Site Conditions

The Project area is a portion of District-owned land currently in use for public water supply located at 1650 Iyannough Road/Route 132 Barnstable, Massachusetts. This land consists of a paved access road, Well 3 Pump House, and Well 4 Pump House. The property is located in the Residential RG and RF-1 zoning districts, as well as the Wellhead Protection Overlay District, as seen in the Town of Barnstable Zoning Map shown in Appendix C. Existing utilities include water mains to transport water from Well 3 and Well 4 into distribution, overhead electrical lines to transmit power to the two Pump Houses, and underground fiberoptic lines to transmit SCADA information between Pump Houses, as seen in the Design Drawings shown in Appendix D.

The Project site includes a portion of the existing paved access road, a wooded area to the south of the existing paved access road, and a small wooded area to the south of the Well 4 Pump House. Refer to the Site Locus Map shown in Appendix C for the location and extent of the Project.

The existing property is predominantly woodlands. Land use in the area surrounding the Project includes undeveloped forest to the North, Hathaway's Pond Recreation Area to the East, and the Hyannis Golf Club to the South and West. The existing paved access road runs East to West, connecting the site to Iyannough Road/Route 132. Topography at the Project site varies, as the site contains various depressions, or kettles.

3.1.1 Critical Areas

Critical Areas as defined by Standard 6 of the MassDEP Stormwater Management Handbook are areas where high levels of stormwater treatment are required; typically, the first inch of runoff is treated using distinct BMPs and pre-treatment methods. Specific source control and pollution prevention measures are also required.

The Project site is located within designated groundwater recharge areas for public water supply (310 CMR 22.02), including both Zone I's and Zone II's.

3.2 Soil Description

The Natural Resources Conservation Service (NRCS) lists the on-site soils as Easchop loamy fine sand. Eastchop loamy fine sand is an excessively drained soil consisting of 75% Eastchop and similar soils and of 25% other components. The NRCS also lists the area as 'hilly, rolling, bouldery' and 'pits, sand and gravel'. Refer to the NRCS Soil Map in Appendix E for more information.

Competent Soils Professionals (Pete Newton, P.G., and Genevieve Cordeiro, E.I.T.) separately conducted site visits on 11/7/2025 and 12/24/2025, and together on 5/15/2026 to verify the NRCS classification. Inspection of the site determined that the on-site soils in the area of interest have not been disturbed, filled, or otherwise altered.

Boring logs were prepared by John Turner Consulting on 12/24/2025. These logs indicated that the on-site soil generally consists of a layer of silty sand, underlain by a layer of sand. Groundwater was found at elevations between 30 feet and 34 feet. Refer to the geotechnical engineering report Appendix E for more information.

Test pits were performed by H2Olson on 5/15/2026. These tests confirmed the presence of Class A soils in the locations and soil layer where stormwater infiltration is proposed. Refer to the Soil Evaluation Forms in Appendix E for more information.

No evidence of high groundwater elevation was encountered during the logs or test pits. As such, the Estimation of High Groundwater Levels for Construction and Land Use Planning (revised in 2006) method presented in Cape Cod Commission's Technical Bulletin 92-001 was utilized. Using this method, the depth to the high groundwater level for the site was estimated to be 21 feet, or at an elevation of 39 feet.

Based on the data present in these logs and tests, the soils were modeled as Class A soils for the hydrologic analysis and recharge volume calculation. The proposed stormwater infiltration BMPs have been sited in the identified Class A soil locations.

3.3 Hydrologic Analysis

The existing hydrologic conditions were modeled using HydroCAD™ version 10.20-9a. The analysis utilized precipitation data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the 2-, 10-, 25- and 100-year 24-hour storms, along with the projected 2070 50-year 24-hour storm consistent with the output report from the MA Climate Resilience Design Standards Tool prepared by the Resilient Massachusetts Action Team (RMAT), as seen in Appendix J.

Sub-catchments areas were delineated based on existing runoff patterns and topographic information. This information is shown on the Existing Watershed Plan included in Appendix F. Summaries of each area with respect to Curve Number and Time of Concentration calculations, as well as the site routing diagram, can be found in the Existing Conditions HydroCAD Model Results included in Appendix G.

Six Design Points were used for stormwater runoff analysis. These Design Points, along with the Sub-catchments that fall within each category, are listed in Table 1 below.

Table 1: Existing Conditions Analysis

Design Point	Sub-catchments	Description
1	1.1 through 1.4	Onsite Runoff
2	2.1	Offsite Runoff to the West
3	3.1	Offsite Runoff to the East
4	4.1	Offsite Runoff to the South
5	5.1 and 5.2	Offsite Runoff to the North
6	6.1	Offsite Runoff at the East End of the Access Road

4.0 Proposed Conditions

4.1 Site Conditions

The proposed Project involves the construction of a new water treatment plant for the treatment of water from Well 3 and Well 4. Along with the 4,040 square foot building, the Project consists of a paved driveway to the new building, two (2) sand filters and two (2) infiltration basins for the treatment of water treatment residuals, also known as backwash waste, a septic system for the facility bathroom, best management practices (BMPs) for the treatment and infiltration of stormwater, new yard piping to deliver water to and from the building, new underground electrical lines to deliver power to the building, new underground fiberoptic lines to transmit SCADA information, two (2) new generators, two (2) new propane tanks, yard fencing, and three (3) new water hydrants, one located at the end of the paved access road. Refer to the Design Drawings included in Appendix D for exact locations.

There will be no changes to the existing easements, zoning, or land use at the site.

4.2 Stormwater Management System Overview

The proposed stormwater management system consists of a closed drainage system including deep sump hooded catch basins, a drain manhole, an oil/grit separator, a filtering rain garden, a sediment forebay, an infiltration basin, infiltration trenches, roof leaders, underground piping, and dry wells, which will work in combination to collect, control, and treat runoff discharging from the site. The closed drainage system has been designed to accommodate the 25-year 24-hour storm. Offsite impervious areas draining to the proposed drainage system have been identified, as seen in the Proposed Offsite Contribution Plan included in Appendix F.

Stormwater runoff from portions of the new paved driveway and two (2) down spouts from the proposed building's roof will be directed to one of four (4) catch basins. Catch basins will include fifty-four-inch-deep sumps and oil/gas separator hoods. The deep sumps are intended to remove sediment, and the hoods are intended to remove oil and gas from the stormwater prior to release. Stormwater will then travel through pipes and the drain manhole to the oil/grit separator, which acts as a second line of defense in separating oil and sediment from the runoff. From this BMP, stormwater travels through pipes to the sediment forebay, which then spills into the infiltration basin. The deep sump hooded catch basins, oil/grit separator, sediment forebay, and infiltration basin make up Treatment Train 1.

Stormwater runoff from the remainder of the new paved driveway and portions of the existing paved access road will be directed to the filtering rain garden. This device is composed of shrubs and herbaceous perennials planted in mulch and soil media underlaid by an underdrain as described in the Design Drawings located in Appendix D. From this BMP, stormwater travels through pipes to the sediment forebay, which then spills into the infiltration basin. The filtering rain garden, sediment forebay, and infiltration basin make up Treatment Train 2.

Stormwater runoff from the remaining six (6) down spouts from the proposed building's roof will be directed to one of six (6) dry wells for treatment and infiltration. These dry wells make up Treatment Train 3.

The catch basins, oil/grit separator, rain garden, and sediment forebay have been designed to facilitate Total Suspended Solids (TSS) removal. All have been sized to provide adequate water quality treatment. The oil/grit separator has been designed to accommodate the 2-year 24-hour storm without interference. For larger storms, the drain manhole acts as a flow separator, diverting some of the flow away from the oil/grit separator and directly to the sediment forebay, as per Volume 2, Chapter 2 of the Stormwater Management Handbook.

The infiltration basin and dry wells have been designed to provide water quality treatment, groundwater recharge, and attenuation of the proposed peak flow rates and volumes to that of the existing conditions or less for both the 2- and 10-year 24-hour storms. These recharge BMPs have been equipped with overflow spillways to facilitate the discharge of stormwater during a high magnitude storm event.

The site will be vegetated with grass and shrubbery, as shown on the Design Drawings provided in Appendix D. The site will also be equipped with two infiltration trenches to assist in providing attenuation of the proposed peak flow rates and volumes for the 2-, 10-, 25-, 100-, and projected 2070 50-year 24-hour storms. As the two infiltration trenches are not components of treatment trains, and only provide assistance in attenuating peak runoff, the two devices are not considered infiltration nor treatment BMPs and thus are not included in the proposed volumes to meet the requirements of Standard 3 and Standard 4.

The areas that drain to the infiltration trenches include portions of the existing access road and proposed lawn. The Project is constrained by the need to meet existing grades at the existing paved access road, and the goal to minimize the disturbance to existing trees and shrubs, thus this portion of the site's impervious area does not drain to the proposed infiltration BMPs. Due to this constraint, the infiltration BMPs are sized based on the procedure set forth in Standard 3 of the MassDEP Stormwater Management Handbook. Refer to Standard 3 in Section 5.0 below and the Supplemental Calculations in Appendix J for more information.

4.3 Hydrologic Analysis

The proposed hydrologic conditions were modeled in the same manner as the existing conditions: using HydroCAD™ version 10.20-9a and precipitation data from NOAA and the RMAT output.

Sub-catchment areas and flow paths were modified to reflect proposed conditions. This information is shown on the Proposed Watershed Plan included in Appendix F. Summaries of each area with respect to

Curve Number and Time of Concentration calculations, as well as the site routing diagram, can be found in the Proposed Conditions HydroCAD Model Results included in Appendix H.

The established design points used in the existing conditions analysis were used in the proposed conditions analysis for direct comparison. The proposed conditions analysis considers both runoff from sub-catchments not captured by BMPs, as well as overflow from BMPs during high magnitude storm events. See Table 2 below for a summary of the sub-catchments and BMPs accounted for within each Design Point.

Table 2: Proposed Conditions Analysis

Design Point	Sub-catchments	BMP	Description
1	-	-	Onsite Runoff
2	-	14P	Offsite Runoff to the West
3	3.1	12P and 13P	Offsite Runoff to the East
4	4.1 and 4.2	7P and 15P	Offsite Runoff to the South
5	5.1 and 5.2	-	Offsite Runoff to the North
6	6.1	-	Offsite Runoff at the end of the Access Road

5.0 Compliance with the Stormwater Management Standards

As part of this drainage analysis, H2Olson has performed an in-depth review of the Project site for conformance with the ten standards outlined in the MassDEP Stormwater Management Handbook. This Project is not considered a redevelopment project (as defined in Standard 7) and is therefore required to meet all the Stormwater Management Standards. The following narrative discusses the Project as it relates to the Ten Stormwater Management Standards.

LID Measures:

Low Impact Development (LID) techniques utilized along portions of the Project include:

- No disturbance to any wetland resource area.
- Minimizing disturbance to existing trees and shrubs.
- Use of country drainage.
- Rain Gardens.

Standard 1: No New Untreated Discharges

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

There will be no direct discharge of untreated stormwater to nearby wetlands or waters of the Commonwealth. Runoff from a majority of the impervious areas on the site will be conveyed to BMPs for water quality treatment, infiltration, and runoff rate attenuation prior to discharge. Untreated runoff from impervious areas onsite will not be directed to adjacent wetlands. There are no wetlands located within a

500-foot radius of the Project site, as seen on the MassGIS Environmental Constraints Map shown in Appendix C.

Standard 2: Peak Rate Attenuation

Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.

As stated above in Section 3.3 and Section 4.3, the hydrologic conditions of the existing and proposed site were modeled using HydroCAD™ for the 2-, 10-, 25-, 100-, and projected 2070 50-year 24-hour storms to demonstrate that post-development stormwater runoff rates will be less than or equal to the pre-development runoff rates. The results of this analysis can be seen below in Table 3 and Table 4.

Table 3: Stormwater Runoff Peak Discharge Summary

Peak Discharge	Flow (cfs)									
	2-Year Storm		10-Year Storm		25-Year Storm		100-Year Storm		RMAT Projected 50-Year Storm	
Analysis Area	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.
Design Point 1	0.00	0.00	0.01	0.00	0.07	0.00	0.35	0.00	0.93	0.00
Design Point 2	0.26	0.00	0.41	0.00	0.51	0.00	0.65	0.45	0.77	1.47
Design Point 3	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.34	0.05	0.25
Design Point 4	0.00	0.00	0.01	0.01	0.07	0.05	0.44	0.43	0.97	1.47
Design Point 5	0.08	0.08	0.17	0.15	0.24	0.21	0.33	0.30	0.43	0.39
Design Point 6	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07
Total	**0.37**	**0.11**	**0.64**	**0.20**	**0.94**	**0.32**	**1.84**	**1.58**	**3.22**	**3.65**

Table 4: Stormwater Runoff Volume Summary

Runoff Volume	Volume (af)									
	2-Year Storm		10-Year Storm		25-Year Storm		100-Year Storm		RMAT Projected 50-Year Storm	
Analysis Area	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.
Design Point 1	0.000	0.000	0.006	0.000	0.017	0.000	0.048	0.000	0.086	0.000
Design Point 2	0.014	0.000	0.022	0.000	0.027	0.000	0.034	0.002	0.041	0.009
Design Point 3	0.000	0.000	0.000	0.001	0.001	0.003	0.002	0.007	0.005	0.012
Design Point 4	0.000	0.000	0.008	0.005	0.020	0.013	0.046	0.036	0.076	0.073
Design Point 5	0.004	0.004	0.010	0.008	0.012	0.011	0.017	0.016	0.022	0.021
Design Point 6	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.004
Total	**0.019**	**0.005**	**0.048**	**0.016**	**0.079**	**0.029**	**0.150**	**0.064**	**0.233**	**0.119**

As shown in Table 3 above, the post-development peak discharge rates are equal to or less than the pre-development peak discharge rates for both the 2- and 10-year 24-hour storms, as required by Standard 2 of the MassDEP Stormwater Management Handbook. Similarly, in Table 4 above, the post-development

runoff volumes are equal to or less than the pre-development runoff volumes for both the 2- and 10-year 24-hour storms. Both statements hold true for all six Design Points.

During the 100-year 24-hour storm, only Design Point 3 shows a greater post-development peak discharge rate and volume, even though the total runoff rate and volume of the Project site as a whole are lower in the post-development conditions. The runoff in Design Point 3 drains to a low point east of the site, which was modeled as a two-foot-deep basin in HydroCAD according to the existing contours of the area. The peak elevation in this low point 'basin' rose 0.26 feet in the post-development conditions compared to the pre-development conditions. As this off-site sub-catchment consists of woodlands in a mapped area of Class A soils by NRCS, the off-site sub-catchment is thought to have rapid infiltration similar to the Project site. Because of these favorable estimated soil conditions, and the minimal increase in depth of the modeled 'basin', it was determined that the rise in peak elevation is not subject to flooding areas downstream in the watershed and that this drainage analysis indicates this area is not subject to increased off-site flooding. Refer to Appendix I for the Existing and Proposed Offsite Sub-Catchment Plans, along with the 100-year 24-hour storm offsite HydroCAD Model results.

During the RMAT projected 2070 50-year 24-hour storm, Design Point 2, 3, and 4 all show greater post-development peak discharge rates, even though the post-development runoff volumes for Design Points 2 and 4 are lower. Although the current design does not attenuate peak discharge rates from this high magnitude storm, the proposed design allows for various future upgrades to adapt to this projected scenario due to climate change. Opportunities for future upgrades are as follows:

- Design Point 2: There is space to the west of the existing access road to upgrade the existing infiltration trench and/or install an additional stormwater BMP for treatment and recharge. The topography is supportive of this future design, as there is an existing depression in the area that could be utilized.
- Design Point 3: There is space to the east of the site to increase the capacity of the building's roof infiltration devices and/or add an additional stormwater BMP. The existing contours shown in the Existing Watershed Plan in Appendix F are supportive of this future design.
- Design Point 4: There is space to the South of the site to increase the capacity of the current infiltration basin and/or add additional stormwater BMPs. The existing contours shown in the Existing Watershed Plan in Appendix F are supportive of this future design.

The Project site is not located within any flood zones, as seen in the FEMA FIRMette Flood Zone Map located in Appendix C.

Standard 3: Recharge

Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The stormwater management system includes multiple infiltration BMPs that will effectively recharge groundwater on-site. These infiltration BMPs include an infiltration basin and six (6) dry wells. The total

provided recharge volume through these BMPs is 1,214 cubic feet, in excess of what is required, see Table 5 below. Refer to Appendix J for required and provided sizes of individual infiltration BMPs.

Table 5: Recharge Volume Summary

Total Proposed Impervious Area On-Site (sf)	13,630
Impervious Area Draining to Proposed Recharge BMPs (sf)	9,651
Adjusted Total Recharge Volume Required (cf)	962
Total Recharge Volume Provided (cf)	1,214
Percentage of Site's Impervious Area Directed to Infiltration BMPs	71%

As stated above in Section 4.2, not all impervious areas within the site limits are to drain to the proposed infiltration BMPs. As such, the total recharge volume was adjusted to reflect this, as per the procedure set forth in Standard 3 of the MassDEP Stormwater Management Handbook. Although the proposed design does not account for all impervious areas on site, the percentage of impervious areas treated is above the required 65%, as defined in Standard 3 of the MassDEP Stormwater Management Handbook.

Additionally, all infiltration BMPs have been designed to drawdown within 72 hours. Refer to Appendix J for drawdown calculations.

Standard 4: Water Quality

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids.

The stormwater management system includes multiple treatment BMPs that will effectively treat stormwater on-site. These treatment BMPs include four (4) deep sump hooded catch basins, an oil/grit separator, a sediment forebay, an infiltration basin, and six (6) dry wells. The total provided water quality volume through these BMPs is 2,282 cubic feet, in excess of what is required, see Table 6 below.

Table 6: Water Quality Volume Summary

Total Water Quality Volume Required (cf)	1,136
Total Water Quality Volume Provided (cf)	2,282

The proposed stormwater management system contains three treatment trains that will meet the 80% TSS removal requirement. Please see the TSS Removal Calculation Worksheets in Appendix J for more information. These treatment trains are as follows:

1. Deep sump hooded catch basins, oil/grit separator, sediment forebay, infiltration basin
2. Filtering rain garden, sediment forebay, infiltration basin
3. Dry wells

Treatment Train 1 contains runoff from the new pavement and roof runoff from two building down spouts. This train achieves 89% TSS removal in total and 44% TSS removal in pre-treatment, as required due to the site's location in an area of rapid infiltration rate and a Zone I Wellhead Protection Zone.

Treatment Train 2 contains runoff from the remainder of the new paved driveway and portions of the existing paved access road. Rain gardens achieve 90% TSS removal with adequate pre-treatment, and are approved as a pre-treatment device for areas with the potential to generate high concentration of oil and grease, as per Volume 2, Chapter 2 of the Stormwater Management Handbook. Since runoff from pavement has the potential to generate high concentration of oil and grease, and filtering rain gardens have been used as a pre-treatment to sediment forebays and infiltration basins in previous applications within a Zone 1 Critical Zone, it is of the understanding that this train achieves the required 44% TSS removal in pre-treatment. This train achieves at least 80% TSS removal in total.

Treatment Train 3 contains roof runoff from the remaining 6 building down spouts. This train achieves 80% TSS removal. Since the proposed roof will not be made of metal, as defined in Standard 3 of the MassDEP Stormwater Management Handbook, pre-treatment of roof runoff is not required. As such, no pre-treatment device is proposed for this treatment train.

The proposed Project is located within the Barnstable Harbor embayment within the Wequaquet Lake Watershed, which has a final Total Maximum Daily Load (TMDL) issued for fecal coliform, as seen in the MassDEP TMDL Map shown in Appendix C. The most likely runoff to contribute to this TMDL is from the pavement. As such, the treatment BMP for this infiltration area, the infiltration basin, was chosen as it has a 90% removal efficiency for pathogens. The roof runoff is considered clean and will not contribute to the TMDL for pathogens. As such, the treatment BMP for this infiltration area, the dry well, was chosen as this BMP does not need to meet removal efficiencies for pathogens.

There are additional TMDLs identified for the Wequaquet Lake Watershed. However, since this Project is not subject to wetlands regulation, as there are no wetlands located within a 500-foot radius of the site, these additional TMDLs were not considered, as set forth in Volume 1, Chapter 2 of the MassDEP Stormwater Management Standards.

All proposed stormwater management BMPs will be operated and maintained according to the Long-Term Operation and Maintenance Plan, located in Appendix B.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

Land use with high potential pollutant loads must have source control and pollution prevention measures implemented in accordance with the Massachusetts Stormwater Handbook.

The Project site is not a land use with higher potential pollutant loads, per the MassDEP Stormwater Management Handbook.

Standard 6: Critical Areas

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

The Project site discharges to a Zone I and a Zone II Wellhead Protection Area. Although Standard 6 generally prohibits stormwater discharges to a Zone I, an exception is made when essential to the operation of the public water supply. The proposed stormwater management system will treat stormwater runoff from a water treatment plant site and therefore is considered essential.

The treatment BMPs has been designed to treat the first 1-inch of runoff from all post-construction impervious areas. Treatment trains have been designed to provide 44% pretreatment prior to discharge to an infiltration BMP. The proposed stormwater BMPs listed above in Standard 3 and Standard 4 are considered suitable for Zone Is.

A source control and pollution prevention plan is provided in Appendix B.

Standard 7: Redevelopment

A redevelopment project is required to meet certain Stormwater Management Standards only to the maximum extent practicable. However, if it is not practicable to meet all the Standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.

Although a portion of the site was previously developed, this Project is considered new development as the proposed Project includes a net increase in impervious area. As such, the Project is required to fully meet all the Massachusetts Stormwater Management Standards.

Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control

A plan to control construction related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The Project will disturb more than one acre of land and will therefore be required to obtain coverage under the NPDES Construction General Permit. A Stormwater Pollution Prevention Plan (SWPPP) will be provided before the start of construction; however, erosion and sediment controls are identified in the Design Drawings, provided in Appendix D, and a Construction Period Pollution Prevention and Erosion and Sediment Control Plan is provided in Appendix A.

Standard 9: Long Term Operation and Maintenance Plan

A Long-Term Operation and Maintenance Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

Please refer to Appendix B for the Long-Term Operation and Maintenance Plan for the proposed Stormwater Management System.

Standard 10: Prohibition of Illicit Discharges

All illicit discharges to the stormwater management system are prohibited.

There will be no illicit discharges to the proposed stormwater management system associated with the proposed Project. An Illicit Discharge Compliance Statement is included below in Section 8.0.

6.0 Compliance with Town Bylaws

This Project is subject to the Town of Barnstable Stormwater Management Rules and Regulations (Chapter 903) and Stormwater Management Illicit Discharge Ordinance (Chapter 185). All information and calculations required by this regulation have been provided in this report.

The Project is required to meet the 90% TSS and 60% total phosphorus treatment requirements outlined in §903-7 B.(4). The Project proposes to meet this requirement by retaining the volume of runoff equivalent to 1.0 inch multiplied by the total post-construction impervious area on the new development site, as outlined in §903-7 B.(4)(a) ii. Refer to Appendix J for calculations related to water quality volume. Refer to Appendix F for the Proposed Offsite Contribution Plan, which identifies off-site areas contributing to the proposed drainage system, as required per §903-7 A.(14).

7.0 Conclusion

Based on the stormwater report herein, stormwater runoff will be captured, peak flows will be controlled, and TSS will be reduced. The proposed stormwater management system has been designed to meet MassDEP's Stormwater Management Handbook Policy and that of the local bylaws.

8.0 Illicit Discharge Compliance Statement

Standard 10 of the Massachusetts Stormwater Regulations prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, surface water, or municipal storm sewer system (MS4).

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater, discharges from fire-fighting activities, and certain non-stormwater discharges as specified in §185-12 of the Town Of Barnstable Bylaws.

I, Sean Anderson (print name), certify that, to the best of my knowledge, there are no illicit discharges located within the Project limits.

Signature

6/9/26
Date

Appendix A – Construction Period Pollution Prevention and Erosion and Sediment Control Plan

1.0 General Information

Project Name:	Barnstable Fire District Wells 3&4 Water Treatment Plant
Project Type:	Public Health
Address:	1650 Iyannough Road/Route 132 Barnstable, MA
Stormwater Management System Owner & Responsible Party:	Barnstable Fire District Water Department 255 Breeds Hill Road PO Box 546 Barnstable, MA 02630
Owner:	Sean Anderson O: 508-362-6498 bfdwatersupt@barnstablefiredistrict.com
Preparer:	Stephen C. Olson, P.E. O: 508-375-7007 sco@h2olsonengineering.com 10 Riverside Drive. Suite #103 Lakeville, MA 02347

2.0 Narrative

2.1 Introduction

This Project is anticipated to disturb greater than one acre of land; therefore, filing a Notice of Intent with EPA and preparing a Stormwater Pollution Prevention Plan (SWPPP) is required. The SWPPP will be provided as part of the construction documents and will be submitted to the Town of Barnstable Conversation Commission prior to the commencement of construction. The following plan provides general guidance for the prevention of pollution, erosion, and sedimentation during construction.

This Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan has been prepared in accordance with the Department of Environmental Protection's Massachusetts Erosion and Sedimentation Guidelines for Urban and Suburban Areas, the standards set forth in Standard 8 of MassDEP's Stormwater Management Handbook, and the Town of Barnstable Stormwater Management Rules and Regulations (Chapter 903).

It shall be the responsibility of the awarded contractor at the time of construction to ensure compliance with all erosion control measures.

2.2 Potential Erosion and Sedimentation

Portions of the Project involve soil disturbance in areas upgradient of stormwater collection systems. Site preparation, scheduling, and construction practices need to be carefully planned to prevent construction debris and erosion caused by stormwater runoff over exposed soils from causing degradation of downstream stormwater collection systems. Although it is not always possible to avoid impacts from storm events, the following guidelines shall be followed:

- Minimize land disturbance area and soil exposure to stormwater and wind erosion.
- Minimize time that area is disturbed.
- Avoid routing uncontaminated water (stormwater runoff or dewatering flows) through disturbed areas.
- Inspect and maintain erosion controls until all soils are stabilized.
- Maintain good housekeeping practices.
- Stabilize disturbed soils as soon as practical to limit exposure.

2.3 Extent of Disturbance

The total area of disturbance is approximately 2.10 acres. The existing site will be impacted by tree clearing, re-grading, building construction, paving, construction of a water treatment residuals handling system, septic system construction, and implementation of stormwater control measures. Refer to the Design Plans located in Appendix D for locations of the proposed structures, post-construction stormwater management best management practices (BMPs), and construction period erosion and sedimentation controls.

Off-site areas are not proposed to be directly altered but may be impacted by erosion and sedimentation if the controls described in this plan are not followed. No off-site land disturbance is proposed. Refer to the Locus Map located in Appendix C for the proposed area of disturbance.

The proposed Project is not located on a floodplain, nor will it disturb any wetlands, Areas of Critical Environmental Concern, or the Massachusetts Natural Heritage & Endangered Species Program (NHESP) certified vernal pools, as seen in the FEMA Flood Zone Map and the MassGIS Environmental Constraints Map, both located in Appendix C. Additionally, the Project will not disturb any Priority Habitats of Rare Species, as seen in the negative determination by NHESP included in Attachment A. Included in Attachment B is a list of abutters within 300 feet of the subject parcel in which the proposed site is located. Refer to the Watershed Plans located in Appendix F for existing vegetation and ground covers.

2.4 Pre-Construction and Site Preparation

- Install erosion control barriers in accordance with the Design Plans prior to commencing any land disturbance activity.
- Inspect and maintain erosion controls until soils are stabilized.
- Monitor weather reports daily and stabilize/prepare site if storm event in excess of the 2-year storm is expected.
- Maintain an inspection logbook on-site at all times. The specific location of the logbook shall be conveyed to the Town.

3.0 Erosion and Sedimentation Control Practices

Inspect erosion controls weekly and after every storm event until such time as soils are stabilized.

3.1 Catch Basin Inlet Protection

Inlet protection is proposed at proposed drain inlets within the Project area. Inlet protection shall also be provided at off-site drain inlets located immediately downgradient of the area of disturbance.

The purpose of inlet protection is to intercept and capture sediment that would otherwise enter the proposed drainage system for post-construction stormwater management. Inlet protection shall consist of manufactured filter fabric consistent with the construction details.

Inspection and maintenance shall consist of checking for sediment accumulation and removing accumulated sediment when the protection device is at least one-half full.

3.2 Erosion Control Barriers

Erosion control barriers are proposed along the downgradient limit of work, as depicted in the Design Plans. Additional erosion control barriers may be required at other locations as needed.

The purpose of erosion control barriers is to intercept and capture sediment that would otherwise migrate off-site. Erosion control barriers shall consist of compost filter tubes, straw wattles, and silt fences, or such other barriers as may be needed.

Inspection and maintenance:

- Check for sedimentation accumulation and remove sediments when they reach excessive volumes (approximately 1/3 the height of the barrier).
- Remove sediments when runoff ponds for 24 or more hours to prevent potential mosquito breeding habitat. Restake/replace controls as necessary to maintain their effectiveness.

3.3 Stabilized Construction Entrance

A stabilized construction entrance is proposed at the construction-period site entrance. Additional stabilized construction entrances shall be constructed if different means of access/egress are required.

The purpose of the stabilized construction entrance is to prevent sediment track out via construction vehicles. Stabilized construction entrance shall consist of coarse aggregate consistent with the construction plans and details.

Inspection and maintenance:

- Check the entrance to observe overall integrity and effectiveness of crushed stone entrance.
- Reshape the pad as needed for drainage and runoff control, and top dress with clean stone if needed.
- Remove tracked-out sediment by the end of each workday.

3.4 Tree Protection

Tree protection is proposed at trees that are to remain near to the area of disturbance, as noted on the Design Plans.

The purpose of tree protection is to minimize risk of damage to trees designated to remain. Tree protection shall consist of armoring, pruning, and/or fencing.

3.5 Construction Period Sedimentation Basin

Construction period sediment basins may be proposed if warranted during construction. A riprap spillway shall be provided at each basin to control outflow. The purpose of sediment basins is to detain sediment-laden stormwater runoff and collect construction-period sediment.

Inspection and maintenance:

- Remove sediment from the basins when the accumulated height exceeds one-half the height of the basin or swale.
- Check basin berm for signs of failure.
- Maintain integrity of overflow spillway.
- Check for signs of erosion in the vicinity of the basin and restore as needed.

3.6 Temporary Seeding

Temporary seeding is proposed for disturbed areas which have remained or are anticipated to remain exposed for more than 7 days. The purpose of temporary seeding is to provide vegetative stabilization of loose soil to mitigate risk of erosion. Temporary seeding shall consist of perennial rye grass.

Inspection and maintenance:

- Confirm that vegetation has been established
- Provide additional seeding as needed

3.7 Street Sweeping

Street sweeping is proposed at the existing paved access road periodically during construction. The purpose of street sweeping is to collect and dispose of any tracked-out sediment originating from the Project. All street sweepings shall be disposed of in a legal manner.

4.0 Additional Control Measures

4.1 Good Housekeeping

Minimize hazardous materials stored on site. All materials stored on site shall be stored in weatherproof enclosures in original containers and sealed. Refuel construction equipment off-site at a designated location. Any spills of hazardous materials shall be reported, contained, and removed in accordance with local, State, and Federal regulations.

Project shall also comply with all applicable local, State, and Federal regulations regarding air quality requirements and construction of the septic system onsite.

4.2 Material Stockpiling

Construction materials shall be stored in designated stockpile areas. Soil stockpiles shall be surrounded with silt fence, straw wattles, and/or compost filter tubes to mitigate erosion potential. All waste materials shall be removed from the site or placed in approved receptacles at the conclusion of each workday. Disposal of waste materials shall be in accordance with relevant local, state, and federal regulations. No excavated soil material shall be stockpiled within one hundred (100) feet of rivers, streams, ponds, or reservoirs.

4.3 Protection of Infiltration Areas

To maximize post-construction groundwater recharge and protect the infiltrative capacity of proposed basin areas, basins shall be excavated as late as practicable in the construction sequence; this includes the sediment forebay, two (2) infiltration trenches, and infiltration basin. During site restoration, all construction-period sediment shall be removed from basins, and the basins shall be re-seeded as necessary.

4.4 Uncontaminated Water

Appropriate erosion controls, construction-period grass swales, and construction-period infiltration basins will be implemented as necessary to divert uncontaminated water around disturbed areas, to the maximum extent practicable.

4.5 Potential Construction Site Pollutants

Pollutant-Generating Activity	Pollutant(s) Constituents	Location on Site
Equipment Re-fueling	Diesel Fuel, Gasoline	Laydown Area Off Site
Leaking or Broken Hydraulic Lines	Hydraulic Oil	Building Work Areas and Laydown Area
Minor Equipment Maintenance	Diesel Fuel, Gasoline, Hydraulic Oil, Motor Oil, Anti-Freeze	Laydown Area
Portable Sanitary Toilets	Bacteria, Parasites, Viruses	Laydown Area
Vehicle Accidental Spill	Diesel Fuel, Gasoline	Entire Site
Trash Containers/Dumpters	Paper, Plastic, Food Waste	Laydown Area

Refer to the Long-Term Pollution Prevention Plan, included as part of Appendix B, for measures to be implemented to minimize pollutant discharges.

4.6 General Construction Sequence

The proposed Project is not anticipated to be executed in a phased manor. The following represents a general construction sequence to be followed by the awarding contractor.

1. Obtain plan approval and other applicable permits.
2. Flag the work limits and applicable resource areas. Mark the tree area for protection.
3. Hold a pre-construction conference at least one week prior to starting construction.
4. Install stabilized construction entrance, perimeter erosion controls, and inlet protection.
5. Establish the location of stockpile and staging areas.
6. Install sediment basin if needed.
7. Conduct site clearing.
8. Rough grade site and stockpile topsoil.
9. Install drainage pipes and other utilities.
10. Install site features including building, treatment facilities, pavement, etc.
11. Install infiltration basin, sediment forebay, oil/grit separator, deep sump hooded catch basins, dry wells, and infiltration trenches.
12. Complete final grading.
13. Restore drainage BMPs impacted by construction-period sediment.
14. Complete final stabilization and site restoration.
15. Remove temporary erosion control measures pending approval by the responsible party.

Construction Period BMP Inspection and Maintenance Documentation Form

Inspection No.:_____ Date:_____ Weather:_____

Date & Amount of Last Precipitation Event:_____

Inspector Name:_____ Inspector Signature:_____

BMP	Condition	Recommendations	Date Corrected
Catch Basin Inlet Protection			
Erosion Control Barrier			
Stabilized Construction Entrance			
Street Sweepings			
Other			
Additional Comments			

Attachment A: NHESP Determination

MASSWILDLIFE

DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

January 14, 2026

Sean Anderson
Barnstable Fire District Water Department
255 Breeds Hill Road
PO Box 546
Barnstable, Massachusetts 02630

RE: Project Location: 1650 Iyannough Road
Project Description: Construction of a new water treatment plant for the treatment of water from Well 3 and Well 4
Heritage Hub Form ID: RC-97409

Dear Applicant:

Thank you for submitting the MESA Project Review Checklist, site plans (dated December 2025 (3 sheets, C-1, C-2, C-3; H2Olson Engineering, Inc.) prepared by) and other required materials to the Natural Heritage and Endangered Species Program of the MA Division of Fisheries & Wildlife (the "Division") for review pursuant to the Massachusetts Endangered Species Act (MESA) (MGL c.131A) and its implementing regulations (321 CMR 10.00).

PROJECT DESCRIPTION

The existing site includes a paved access road, Well 3 Pump House, and Well 4 Pump House. Water from Well 3 and Well 4 is treated at the Well 4 Pump House, which consists of potassium hydroxide (KOH) and sodium hypochlorite (NAOCl) storage, feed, and handling facilities. Water is then pumped to distribution. The proposed project involves the construction of a new water treatment plant for the treatment of water from Well 3 and Well 4. The proposed facility will be equipped with three (3) 10.5-foot GreensandPlusTM media filters and associated process mechanical valves and piping, six (6) 10-foot GAC pressure vessels and associated process mechanical valves and piping, and NaOCl storage, feed, and handling facilities. This project also involves the construction of two (2) sand filters and two (2) infiltration basins for the treatment of water treatment residuals, a septic system for the facility bathroom, the installation of new yard piping to deliver water to the treatment building, new finished water piping to deliver water to the distribution system, a new generator next to the existing Well 4 Pump House, and a new water hydrant located at the end of the paved access roadway.

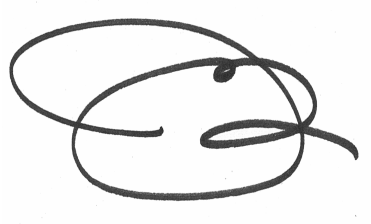
MA ENDANGERED SPECIES ACT

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries & Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if

there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Emily Holt, Endangered Species Review Assistant, at Emily.Holt@mass.gov, (508) 389-6385.

Sincerely,



Jesse Leddick
Assistant Director

cc: Stephen C Olson, H2Olson Engineering, Inc.

Attachment B: Abutters Within 300 feet of Project Parcel

Formal Site Plan Review GIZ Abutter List for Subject Parcel 254018

Abutters within 300 feet of subject parcel

Parcel ID	Owner 1	Owner 2	Address Line 1	Address Line 2	City	State	Zip
253020B00	CAPE COD 5 CENTS SAVINGS BANK		1500 IYANNOUGH RD		HYANNIS	MA	02601
254016	BARNSTABLE, TOWN OF (LB)		367 MAIN STREET		HYANNIS	MA	02601
254018	BARNSTABLE FIRE DISTRICT		PO BOX 546		BARNSTABLE	MA	02630
275001	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
275002	BARNSTABLE, TOWN OF (REC)		367 MAIN STREET		HYANNIS	MA	02601
275005	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
275008	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
275009	BARNSTABLE, TOWN OF (CON)	CONSERVATION COMMISSION	230 SOUTH STREET		HYANNIS	MA	02601
275013	ALWARDT, MARY ELLEN ET ALS		25 ALWARDT WAY		EAST FALMOUTH	MA	02536
275058	LEBEL, CAROL		114 ATTUCKS LANE		HYANNIS	MA	02601
275058001	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
276002	BARNSTABLE, TOWN OF (CON)	CONSERVATION COMMISSION	230 SOUTH STREET		HYANNIS	MA	02601

Total Number of Abutters: 12

Report Generated On: 11/14/2025 12:20 PM

This list by itself does NOT constitute a "Certified List of Abutters" and is provided only as an aid to the determination of abutters. If a Certified Abutter List is required, you must contact the Assessing Division to have this list certified.

Appendix B – Long-Term Operation and Maintenance Plan

1.0 General Information

Project Name:	Barnstable Fire District Wells 3&4 Water Treatment Plant
Project Type:	Municipal
Address:	1650 Iyannough Road/Route 132 Barnstable, MA
Stormwater Management System Owner & Responsible Party:	Barnstable Fire District Water Department 255 Breeds Hill Road PO Box 546 Barnstable, MA 02630
Owner:	Sean Anderson O: 508-362-6498 bfdwatersupt@barnstablefiredistrict.com

It shall be the responsibility of the Owner to provide a revised plan to the Conservation Commission indicating any change of ownership or assignment of financial responsibility of the site and shall comply with §903-9 B.(3)(b) regarding amendments to the maintenance schedule provided herein.. The responsible party shall also be responsible for financing maintenance and emergency repairs at the site.

This stormwater management system (SWMS) operations and maintenance plan has been prepared in accordance with the Massachusetts Department of Environmental Protection's Stormwater Management Standards.

Applicant Certification

I, Sean Anderson (print name), being the applicant, certify that the Operation and Maintenance Manual provided herein abides by the applicable local, state, and federal regulations to the best of my knowledge.

SC 6/9/20

Signature Date

Owner Certification

I, Sean Anderson ✓ (print name), being the owner and person responsible for operation and maintenance, financing, and emergency repairs at the site, certify that I am familiar with the requirements of this Operation and Maintenance Plan and shall maintain the proposed Stormwater Management System in accordance with this Maintenance Agreement.

SC 6/9/20

Signature Date

2.0 Operation and Maintenance Introduction

In compliance with Standard 9 of the 2008 MassDEP Stormwater Management handbook and Town of Barnstable Stormwater Management Rules and Regulations (Chapter 903), this section outlines the stormwater best management practices (BMPs) associated with the proposed stormwater management system and identifies the long-term inspection and maintenance requirements for each BMP.

Inspection and maintenance personnel shall be provided with a copy of this Operation and Maintenance (O&M) Plan and required to review the specific inspection and maintenance procedures outlined below. A copy of the O&M Plan must be kept on-site at all times.

Inspection and Maintenance logs including inspections, repair, replacement, type of material removed, and disposal locations must be kept in this on-site plan and must be submitted to the Town of Barnstable Department of Public Works (Department), Reviewing Agent, or the Commonwealth of Massachusetts (Commonwealth) for review upon request. The owner shall provide Inspection and Maintenance logs to the Department on a yearly basis by June 30th, and an annual report prepared and stamped by Professional Engineer as per §903-9 D to the Department or Reviewing Agent. Owner shall keep the past seven (7) years of records on-site and allow the Department, Reviewing Agent, or Commonwealth access to inspect each BMP to ensure compliance with this O&M Plan.

2.1 Stormwater Management System Components

The following table outlines the type and quantity of the BMPs and their general location. Please refer to the site plans provided in Figure AB-1 for exact locations.

BMP Type	Quantity	General Location
Deep Sump Hooded Catch Basin	4	Within the new paved driveway.
Oil/Grit Separator	1	North of the infiltration basins for the WTP residuals.
Filtering Rain Garden	1	South of the existing paved access road and west of the new paved driveway.
Sediment Forebay	1	West of the infiltration basins for the WTP residuals.
Infiltration Basin	1	South of the sediment forebay.
Dry Well	6	North and south of the water treatment building.
Infiltration Trench	2	South of the water treatment building. West of the existing paved access road.

2.2 Inspection and Maintenance Measures

Effectiveness of BMPs is maximized when properly maintained. The inspections schedule and maintenance procedures for each BMP included in this Project are defined below, along with general guidance procedures.

For the purposes of the requirements below, a "rainfall event" is defined as the occurrence of greater than 0.25 inches of precipitation within 24 hours. A "major storm" is defined as a rainfall event resulting in greater than 2.87 inches of precipitation within 24 hours, reflecting the 1-year storm.

2.2.1 Deep Sump Hooded Catch Basin

Catch basins shall be inspected four times per year, including after the foliage and snow removal season. Other inspection and maintenance requirements include:

- Cleaning the units (organic material, sediment and hydrocarbons removed) four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.
    - Cleanout shall always occur after street sweeping.
- Removing hydrocarbons using absorbent pads or other suitable measures and disposing of it legally if any evidence of the material is found during inspection.
- Removing other accumulated debris as necessary.
- Transporting and disposing accumulated sediment off-site in accordance with applicable local, state and federal guidelines and regulations.

2.2.2 Oil/Grit Separator

Inspect after the first several rainfall events, after all major storms, and at least once every month. Inspection shall include:

- Cleaning the units twice a year to remove accumulated oil, grease, and sediment.
- Inspecting the inlets to ensure proper function.
- Transporting and disposing accumulated sediment off-site in accordance with applicable local, state and federal guidelines and regulations.

Refer to Manufacturer's Operation and Maintenance procedures for additional information.

2.2.3 Filtering Rain Garden

Inspect after the first several rainfall events, after all major storms, and at least once every month. Inspection shall include:

- Inspecting the soil and repairing eroded areas.
- Removing trash, litter, and debris monthly.
- Monitoring for ponding within the basin.
- Mulching annually in the spring season.
- Pruning annually in the spring or fall.
- Removing and replacing dead vegetation annually in the spring season.
- Removing invasive species within or near the basin.

- Replacing the entire media and all vegetation in the late spring or early summer as needed.

2.2.4 Sediment Forebay

Inspect after the first several rainfall events, after all major storms, and at least once every month. Inspection shall include:

- Cleaning at least four times per year and when sediment depth is between 3-6 inches.
- Removing accumulated sediment, trash, debris, leaves, and grass clippings.
- Replacing any vegetation damaged during the clean-out by re-seeding or re-sodding.
- Mowing the buffer area. The grass height shall be between 3-6 inches.
- Raking the stone side slopes, and basin bottom.
- Checking for ponding within forebay.
- Checking for erosion or sedimentation along the trapezoidal weir.
- Inspecting to ensure proper functioning.

2.2.5 Infiltration Basin

Inspect after the first several rainfall events, after all major storms, every time discharge drains through the emergency spillway, and at least once every six months. Inspection shall include:

- Removing the accumulated sediment, trash, debris, leaves, grass clippings, and organic matter.
- Removing tree or other plant seedlings before they become established.
- Replacing any vegetation damaged during the clean-out by re-seeding or re-sodding.
- Mowing the buffer area twice a year.
- Raking the stone side slopes and basin bottom twice a year.
- Checking for erosion along basin slopes.
- Checking for ponding within the basin.
- Inspecting to ensure proper functioning.
- Checking for erosion or sedimentation along downgradient slopes of the emergency spillway.

2.2.6 Dry Well

Inspect after the first several rainfall events, after all major storms, and at least once every year. Inspection shall include:

- Measuring the water depth in the observation well at 24- and 48-hour intervals after a storm. Clearance rates shall be calculated by dividing the drop in water level (inches) by the time elapsed (hour).
- Repairing damage to dry well. Replace gravel as needed.
- Removing accumulated sediment, trash, debris, leaves, and grass clippings.
- Checking for erosion or sedimentation along downgradient slopes.

2.2.7 Infiltration Trench

Inspect after the first several rainfall events, after all major storms, and at least once every 6 months. Inspection shall include:

- Repairing damage to trench, replacing gravel as needed.
- Removing accumulated sediment, trach, debris, leaves, and grass clippings.
- Removing tree or other plant seedlings before they become established.
- Checking for erosion along downgradient slopes.
- Checking for ponding within the trench.

2.2.8 Vegetation

Monitor establishment and health of all vegetation on site at least once a month for the first year, then at least once a month. Inspection shall include:

- Checking vegetation growth rate, health, and stability.
- Noting presence of any failing vegetation.
- Reseeding low-growth areas as necessary.

2.2.9 Street Sweeping

Paved areas shall be swept annually to remove excess sediments and trash, and always prior to catch basin cleanout. Once removed from paved surfaces, the sweepings shall be handled and disposed of properly in compliance with applicable local, state and federal regulations. Use of salt for de-icing purposes will not be used.

2.2.10 Public Safety Features

All excavations and entry into closed structures will be completed in accordance with OSHA requirements.

2.3 Erosion and Sediment Control Measures During Maintenance Activities

For maintenance activities that could result in discharges of sediments or other contaminants into wetlands, waterways, or other resource areas regulated under 310 CMR 10.00, the responsible maintenance personnel will employ measures to prevent migration of these sediments/contaminants. Such temporary measures may include, but are not necessarily limited to, the use of siltation barriers, catch basin silt sacks/filter bags, pipe plugs, cofferdams deployed within the stormwater structure, turbidity curtains, or other practices designed to prevent such discharges.

Where maintenance occurs in areas that are confined, with no risk of discharge to adjacent water bodies, no special measures may be needed. Examples include, but are not limited to: (1) cleaning of a forebay under dry conditions when the work can be completed and exposed surfaces stabilized prior to placing it back into service; and (2) catch basin cleaning where the activity is limited to removing material from a sump below the elevation of the outlet pipe.

2.4 Estimated Operation and Maintenance Budget

An operations and maintenance budget was prepared to approximate the annual cost of the inspections required in compliance with the MassDEP Stormwater Management Regulations. The table below estimates the annual cost to inspect and maintain each proposed BMP, based on the requirements in Section 2.2 above.

BMP Type	Quantity	Average Annual O&M Cost per BMP	Average Annual Cost
Catch Basin	4	$1,000	$4,000
Oil/Grit Separator	1	$1,000	$1,000
Rain Garden	1	$500	$500
Sediment Forebay	1	$250	$250
Infiltration Basin	1	$500	$500
Dry Well	6	$1,000	$6,000
Infiltration Trench	2	$1,000	$2,000
Street Sweeping	1 hour (14,000 sf)	$350/hour	$350
Total Average Annual Maintenance Cost			**$14,600**

BMP Inspection and Maintenance Documentation Form

Inspection No.:_____ Date:_____ Weather:_____

Date & Amount of Last Precipitation Event:_____

Inspector Name:_____ Inspector Signature:_____

BMP	Condition	Recommendations	Date Corrected
Catch Basin			
Oil/Grit Separator			
Rain Garden			
Sediment Forebay			
Infiltration Basin			
Dry Well			
Infiltration Trench			
Additional Comments			

3.0 Pollution Prevention Introduction

This Project is anticipated to disturb greater than one acre of land; therefore, filing a Notice of Intent with EPA and preparing a Stormwater Pollution Prevention Plan (SWPPP) is required. The SWPPP will be provided as part of the construction documents and will be provided to the Town of Barnstable Conversation Commission prior to the commencement of construction. The following section provides general guidance for source control and pollution prevention after construction concludes.

This section has been prepared in accordance with Standard 4, 5, 6, and 10 of the 2008 MassDEP Stormwater Management handbook and the Town of Barnstable Stormwater Management Rules and Regulations (Chapter 903).

3.1 Good Housekeeping

- Periodically inspect the stormwater management system to ensure all portions of the system are in good working order in conformance with Section 2.2.
- Conduct litter pick-up from the stormwater management facilities in conjunction with routine maintenance activities.
- Inspect Project area for signs of inadequate drainage.

3.2 Storage of Materials and Waste

- Avoid stockpiling of soil or materials within Wellhead protection areas. Avoid Zone I Wellhead Protection areas to extent practicable. If necessary, provide sufficient erosion controls to prevent migration of sediments.
- All materials shall be stored or disposed in accordance with all local, state, and federal regulations.
- All sand piles shall be removed from the site to prevent the discharge of sand to wetlands or water bodies.
- Minimize hazardous materials stored on site. All materials stored on site shall be stored in original containers and sealed.
- Solid waste, if encountered, shall be handled and disposed of in accordance with all local, state, and federal regulations.
- Store all materials and/or waste products inside or under cover whenever feasible.
- No snow shall be stored within waterbodies, resource areas, Zone I wellhead protection areas, or associated buffer zones.

3.3 Vehicle Washing

- No vehicle washing shall be performed on site.

3.4 Routine Inspections and Maintenance of Stormwater BMPs

- See Section 2.2 above for routine inspection and maintenance requirements for all proposed stormwater BMPs.

3.5 Spill Prevention and Response

The purpose of this spill prevention and response plan is to outline the source control and pollution prevention measures to minimize the risk of pollution to stormwater runoff. The following measures shall be implemented at the site:

- Maintain spill response supplies on site, include sorbent pads booms, granular material, shovel, and similar.
- Refuel construction equipment off-site.
- Any spills of hazardous materials shall be contained, removed, and reported in accordance with local, State, and Federal regulations.
- Review on-site equipment and activities to ensure no illicit discharges are created.
- Inspect and maintain the emergency generator and its spill containment system.
- Activities prone to spills include damage to construction equipment and materials. Construction vehicles and materials shall be inspected for leaks prior to their arrival at the site.
- Contractor shall keep a record of any waste or spill at the site as well as the associated response procedures implemented.
- In the event of a significant spill, contact the MassDEP 24-Hour emergency response notification line: (888) 304-1133 and immediately contact the 24-hour emergency contact.

3.6 Maintenance of Lawns, Gardens, and other Landscaped Areas

- Lawns, gardens, and other landscaped areas shall be maintained regularly by the site owner.
- See Section 2.2 above for instruction on how to maintain vegetated and landscaped BMPs.

3.7 Storage and Use of Fertilizers, Herbicides, and Pesticides

- No fertilizers, pesticides, and/or herbicides shall be used at the site.

3.8 Pet Waste Management

- No pets are anticipated to regularly be present at the site.
- Dispose of any pet waste encountered during routine inspection and maintenance activities.

3.9 Operation and Management of Septic Systems

- Inspect and pump out septic system once a year.
- Routinely mow the grass around the site to maintain clear access to the system.
- Remove tree or other plant seedlings in the area before they become established.

3.10 Snow and Deicing Chemical Management

- No road salt or sand for ice management or deicing chemicals shall be used or stored at the site.
- Plowed snow shall not be placed within the stormwater management system nor block flow paths to the system.

3.11 Prohibition of Illicit Discharges

The MassDEP Stormwater Management Standard 10 prohibits illicit discharges to the stormwater management system. Illicit discharges are discharges that do not consist entirely of stormwater, except for certain specified non-stormwater discharges. Examples of discharges from the following sources are not considered illicit discharges:

- Firefighting activities*
- Flows from riparian habitats/wetlands
- Foundation drains
- Potable water sources
- Water line flushing
- Dechlorinated swimming pool water
- Footing drains
- Street wash waters
- Landscape irrigation
- Wash water from residential buildings (no detergents)
- Individual residential car washing
- Condensation from air conditioning units
- Uncontaminated groundwater
- Run-on from private driveways caused by precipitation
- Rising groundwater
- Lawn watering
- Diverted stream flows
- Water from crawl space pumps

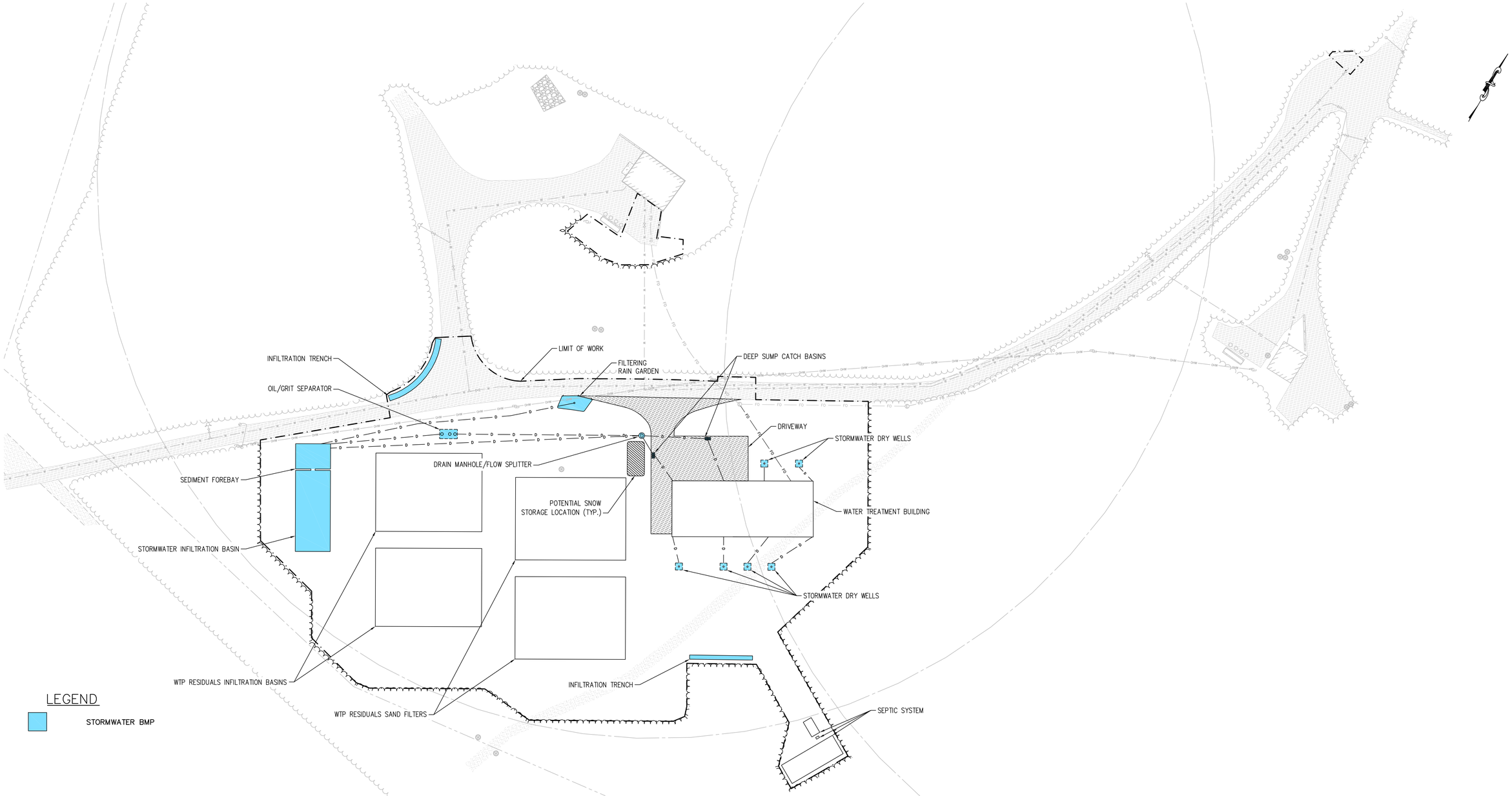
*Water from firefighting activities is allowed and need only be addressed where they are identified as significant sources of pollutants to waters of the United States.

Based on plan review and confirmation in the field, there are no known or proposed illicit connections associated with the Project within the Project limits. Should an interconnection to the stormwater management system be identified, the Owner shall confirm if the connections are authorized. For unauthorized connections, the Owner will investigate the connections and, if they are determined to be illicit, the connections will be managed through the appropriate authorities.

3.12 Nutrient Management Plan

The proposed Project is located within the Barnstable Harbor Embayment within the Wequaquet Lake Watershed, which has a final TMDL issued for fecal coliform. As a Public Water System, fertilizers, herbicides, and pesticides will not be permitted to be used on site. Additionally, the site will be secured from public access, including dog walkers. Although fecal coliform from anthropogenic sources is not anticipated, the proposed design incorporates measures to reduce this pollutant.

The selected BMP that will remove fecal coliform from contaminated runoff is the infiltration basin, as it has a 90% removal efficiency for pathogens. Nutrient management will include inspection and maintenance of the infiltration basin as described above in Section 2.2.



PLAN VIEW

SCALE: 1" = 35'

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SCALE ADJUSTMENT GUIDE
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NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
OPERATION AND MAINTENANCE PLAN

DRAWING NO.:
AB-1

SHEET NO. 1 OF 1

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C Sheets.dwg

Appendix C – Site Figures

ZONING MAP

of the

TOWN OF BARNSTABLE MASSACHUSETTS

INDEX MAP

SEPTEMBER 1, 1998

APPROVED SEPTEMBER 17, 1998
AMENDED NOVEMBER 12, 1998
AMENDED JULY 15, 1999
AMENDED OCTOBER 26, 2000
AMENDED FEBRUARY 1, 2001
AMENDED JUNE 28, 2001
AMENDED JULY 19, 2001
AMENDED AUGUST 16, 2001
AMENDED NOVEMBER 15, 2001
AMENDED SEPTEMBER 19, 2002
AMENDED APRIL 15, 2004
AMENDED SEPT. 2, 2004
AMENDED NOV. 18, 2004
AMENDED JULY 14, 2005
AMENDED JUNE 1, 2006
AMENDED MAY 3, 2007
AMENDED FEBRUARY 28, 2008
AMENDED APRIL 3, 2008
AMENDED JULY 16, 2009
AMENDED MARCH 4, 2010
AMENDED JUNE 17, 2010
AMENDED OCTOBER 7, 2010
AMENDED JANUARY 19, 2011
AMENDED SEPTEMBER 8, 2011
AMENDED FEBRUARY 16, 2012
AMENDED FEBRUARY 6, 2014
AMENDED MARCH 19, 2015
AMENDED MAY 7, 2015
AMENDED MAY 19, 2016
AMENDED JULY 21, 2016
AMENDED APRIL 27, 2017
AMENDED JUNE 1, 2017
AMENDED FEBRUARY 28, 2019
AMENDED FEBRUARY 4, 2021
AMENDED OCTOBER 21, 2021
AMENDED SEPTEMBER 1, 2023
AMENDED FEBRUARY 2, 2023

SEAL OF THE TOWN OF BARNSTABLE, MASS. 1639. ADOPTED MAY 4, 1889

TOWN OF SANDWICH

TOWN OF MASHPEE

TOWN OF YARMOUTH

Cape Cod Bay

Barnstable Harbor

Centerville Harbor

Hyannis Harbor

Lewis Bay

Nantucket Sound

Great Marshes

Mystic Lake

Middle Pond

Hamblin Pond

Wequaquet Lake

North Bay

East Bay

West Bay

Cotuit Bay

Popponesset Bay

RF

RF-1

RF-2

RG

RD-1

RC

RC-1

RC-2

RB

RB-1

RB-2

CBD

B

IND

IND Ltd

HB

HC

TC

MB-A

MB-B

R-2C

AP

WP

GP

S&D

WBWBD

BA

Map Legend

- HB — Zoning District
- WP — Wellhead Protection Overlay District
- GP — Groundwater Protection Overlay District
- AP — Aquifer Protection Overlay District
  All other areas not identified as Wellhead or Groundwater Protection Overlay Districts
- Adult Use Overlay District
- Dock and Pier Overlay District
- Former Grade 5 School Planned Unit Development Overlay District
- Medical Services Overlay District
- Mixed-Use Sub Zone of the Medical Services Overlay District
- Resource Protection Overlay District
- Shopping Center Redevelopment Overlay District
- Drive Through Restaurant Sub Zone of the Shopping Center Redevelopment Overlay Dist.
- Senior Continuing Care Retirement Community - SCCRCOD 2008-1
- Recreational Shellfish Area and Shellfish Relay Area Dock & Pier Overlay District
- Ground Mounted Solar Photovoltaic Overlay District
- Medical Marijuana Overlay District
- Registered Recreational Marijuana Cultivators, Research Facilities, and Testing Laboratories Overlay
- Craigville Village Neighborhood Overlay
- Long / Short Beach Neighborhood Overlay
- Craigville Beach Neighborhood Overlay
- Centerville River North Bank Neighborhood Overlay
- ★ C-O #12 — Existing Public Well Site
- ★ C-O #18 — Proven Future Public Well Site
- ★ C-O #20 — Proposed Future Public Well Site
- Paved Road
- Unimproved Road
- Railroad Track
- Town Boundary Line
- Marsh Area
- Stream / Edge of Water

SEE TEXT OF ZONING ORDINANCE FOR COMPLETE INFORMATION ON BULK REGULATIONS.

Where a zoning district boundary is located at the edge of a water body, that zone that applies to the land shall apply to structures and uses such as piers and commercial boating operations to the extent of the territorial jurisdiction of the town.

Where zoning district boundaries are located along the edge of a roadway and a distance is shown from such point to another zoning boundary, such distance and points shall be from the edge of the road layout. The ultimate location of such point shall be determined by survey as the line shown on this map is considered an approximation.

Sheet Index Grid



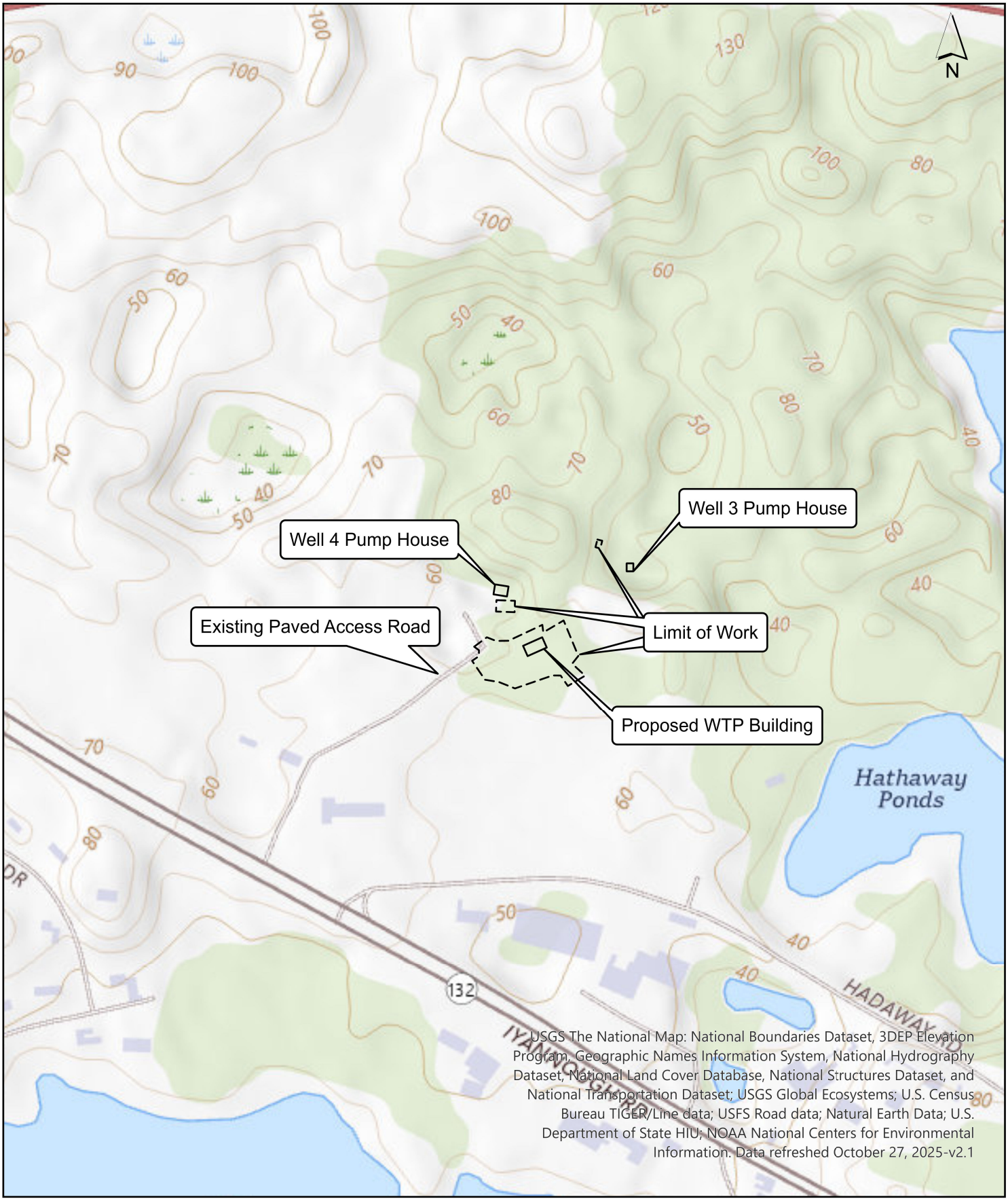
N W E S

SCALE 1"=1800'

feet 3000 2000 1000 0 1/4 1/2 1 mile

1" = 0.34 miles 1:21,600

TOWN OF BARNSTABLE G.I.S. UNIT FILE: townzone.dgn A.N.M. 3-21-2023



0 320 640 1,280 Feet

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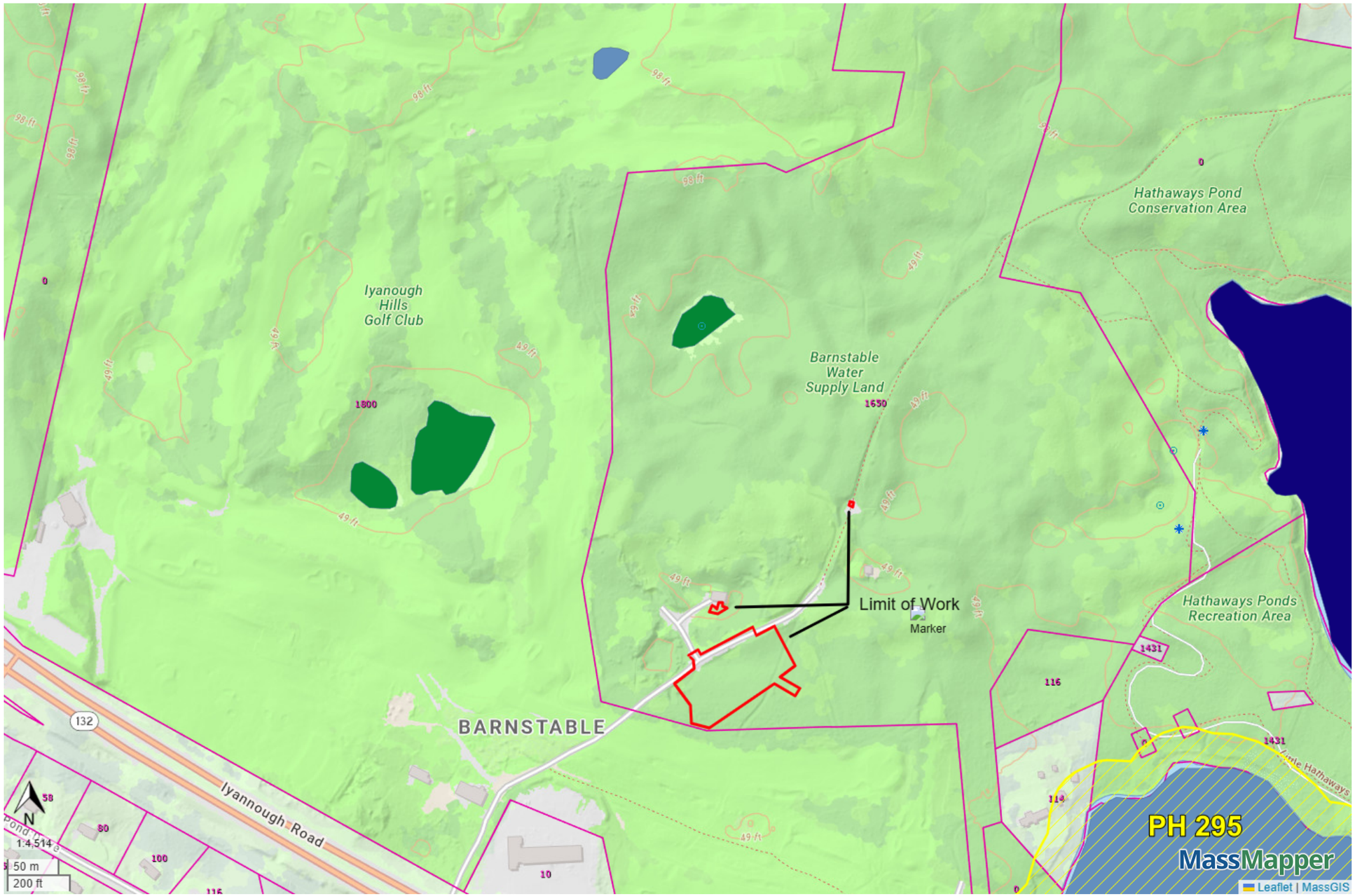
Site Locus Map
Barnstable Fire District Wells 3&4 WTP
Barnstable, Massachusetts
June 2026

MassGIS Environmental Constraints Map



NHESP Priority Habitats of Rare Species

Potential Vernal Pools

NHESP Certified Vernal Pools

Areas of Critical Environmental Concern
ACECs Transparent Green

NWI Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Other

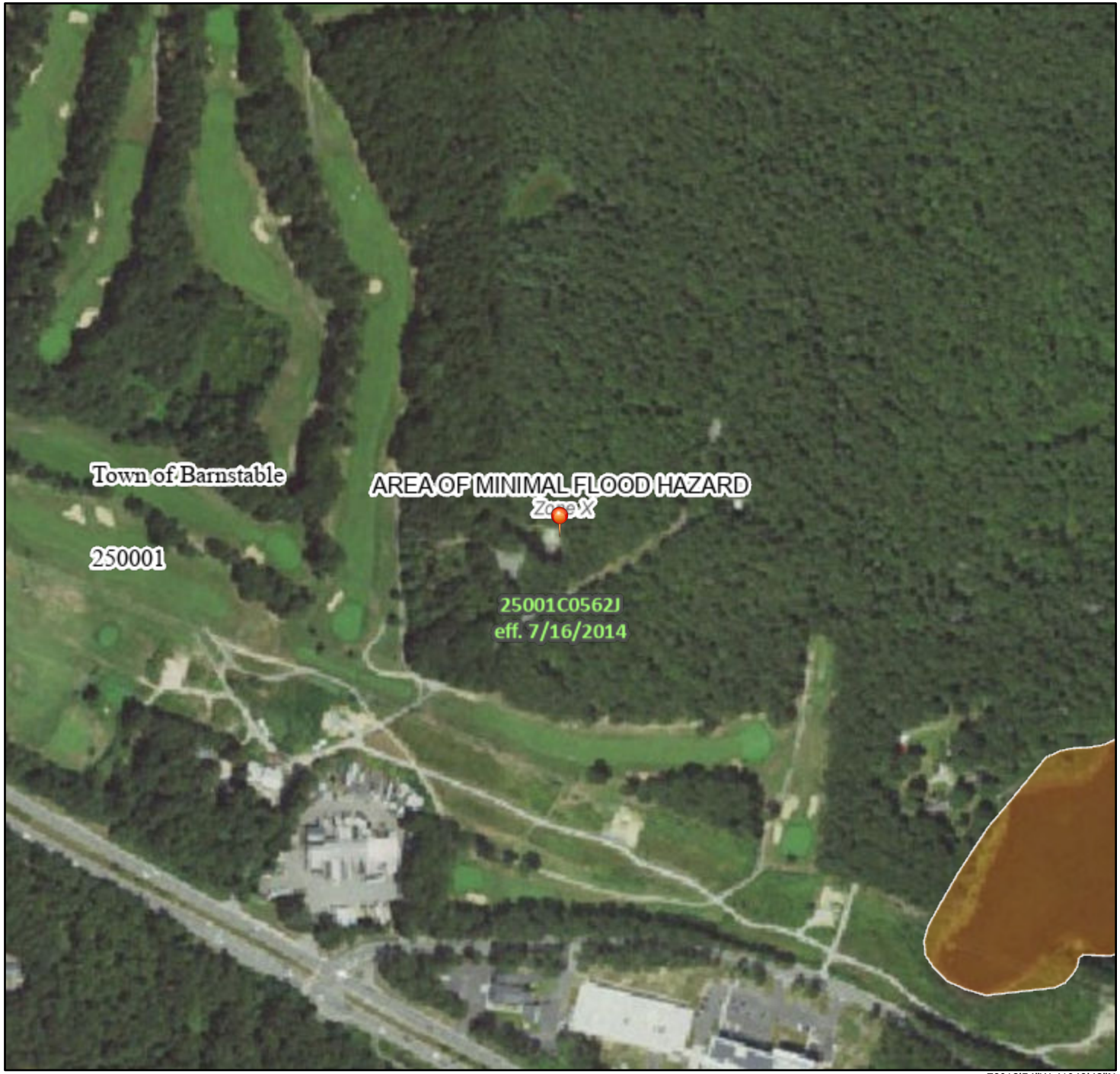
Property Tax Parcels

Printed May 4, 2026

National Flood Hazard Layer FIRMette

FEMA

70°19'32"W 41°41'15"N



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Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

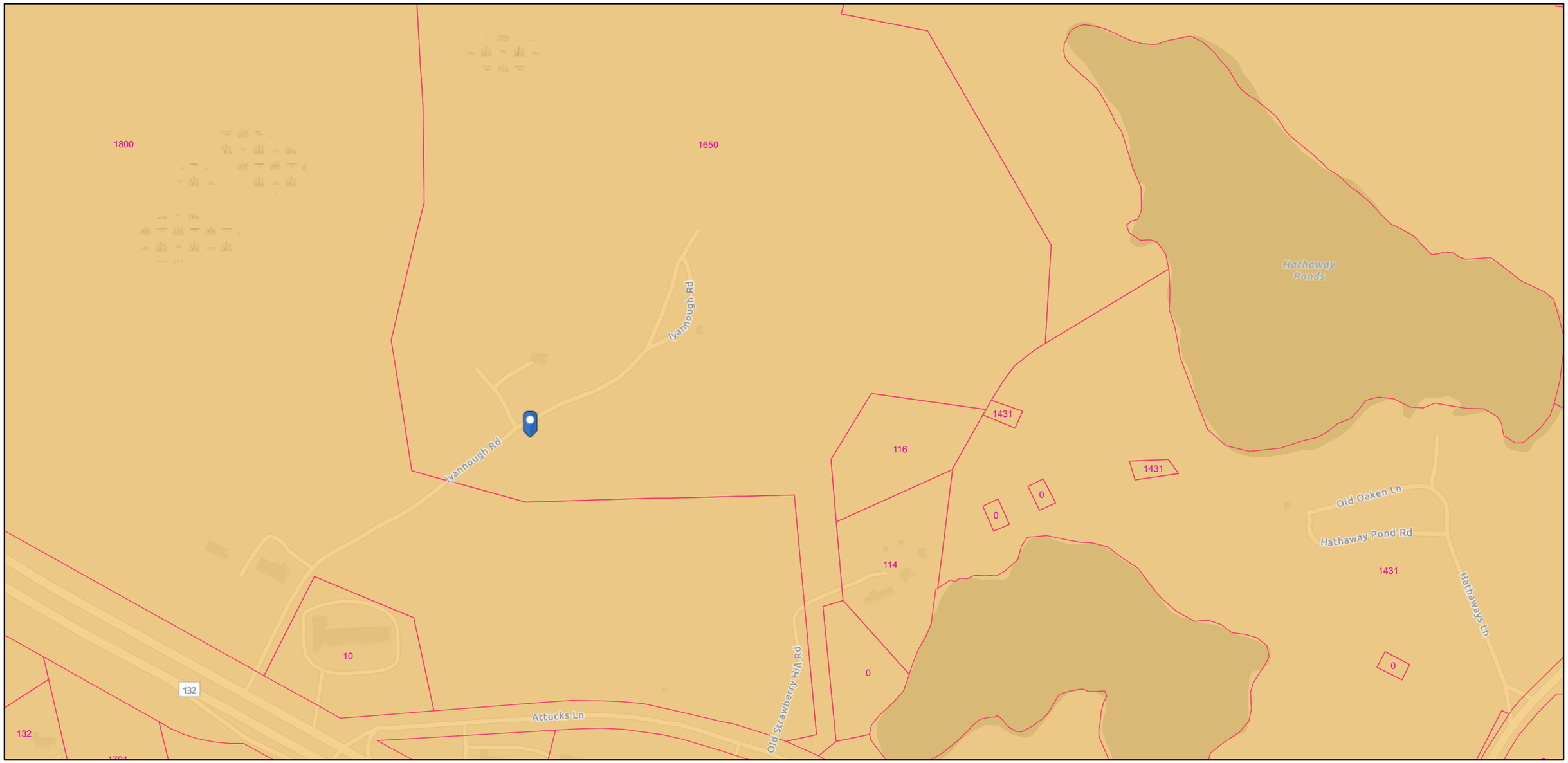
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/6/2026 at 3:26 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Barnstable Fire District Wells 3&4 WTP



4/28/2026, 9:24:33 AM

MassachusettsTMDL_DrainageEstimates

Pathogens

Massachusetts Parcels Feature Layer

1:4,514

0 0.04 0.07 0.15 mi

0 0.05 0.1 0.2 km

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

This map is for planning purposes and represents only the approximate relative location of property, boundaries, or regulated areas and do not take the place of a legal survey or other primary source documentation.

Appendix D – Design Drawings

BARNSTABLE WATER DEPARTMENT
WELLS 3 & 4 WTP

Hyannis Golf Course, Barnstable, Massachusetts

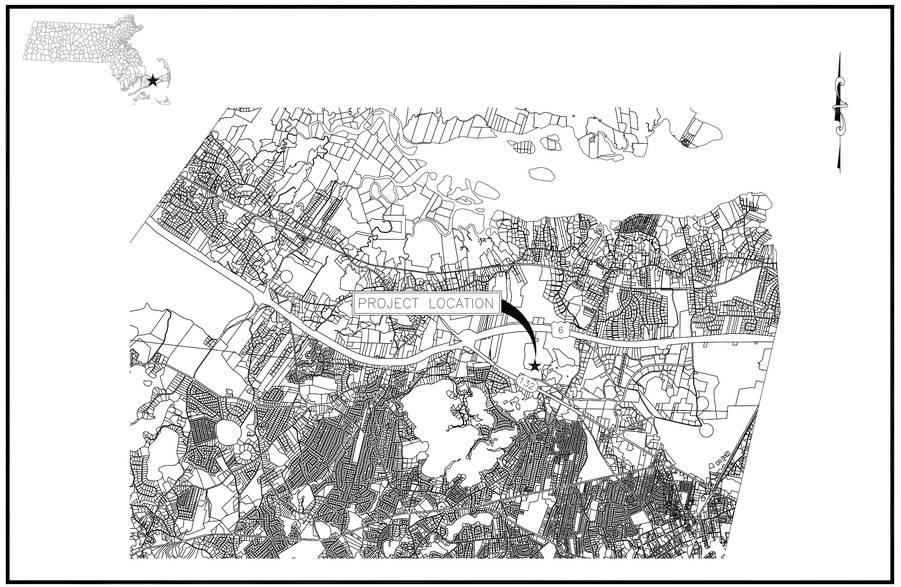
Prepared For:

BARNSTABLE FIRE DISTRICT, WATER DEPARTMENT

P.O. Box 546
Barnstable, Massachusetts
Sean Anderson, Superintendent

Index of Drawings

Sheet No.	Dwg. No.	Description
1	-	COVER SHEET
		CIVIL SHEETS
2	C-1	EXISTING CONDITIONS
3	C-2	SITE LAYOUT
4	C-3	SITE PREPARATION PLAN
5	C-4	UTILITY PLAN
6	C-5	STORMWATER MANAGEMENT PLAN
7	C-6	GRADING AND PAVEMENT PLAN
8	C-7	WELL #4 SITE PLAN
9	C-8	END OF ACCESS ROAD SITE PLAN
10	C-9	LANDSCAPING PLAN
11	C-10	STORMWATER BASIN SECTIONS
12	C-11	RINSEWATER INFILTRATION BASIN SECTIONS
13	C-12	CIVIL DETAILS I
14	C-23	CIVIL DETAILS II
15	C-24	CIVIL DETAILS III
16	C-15	CIVIL DETAILS IV
17	C-16	CIVIL DETAILS V
18	C-17	CIVIL DETAILS VI



Locus Plan
SCALE: 1"=5000'

Contract No. 127.25.01
FOR PERMITTING
JUNE 2026

STEPHEN C. OLSON
6/4/26

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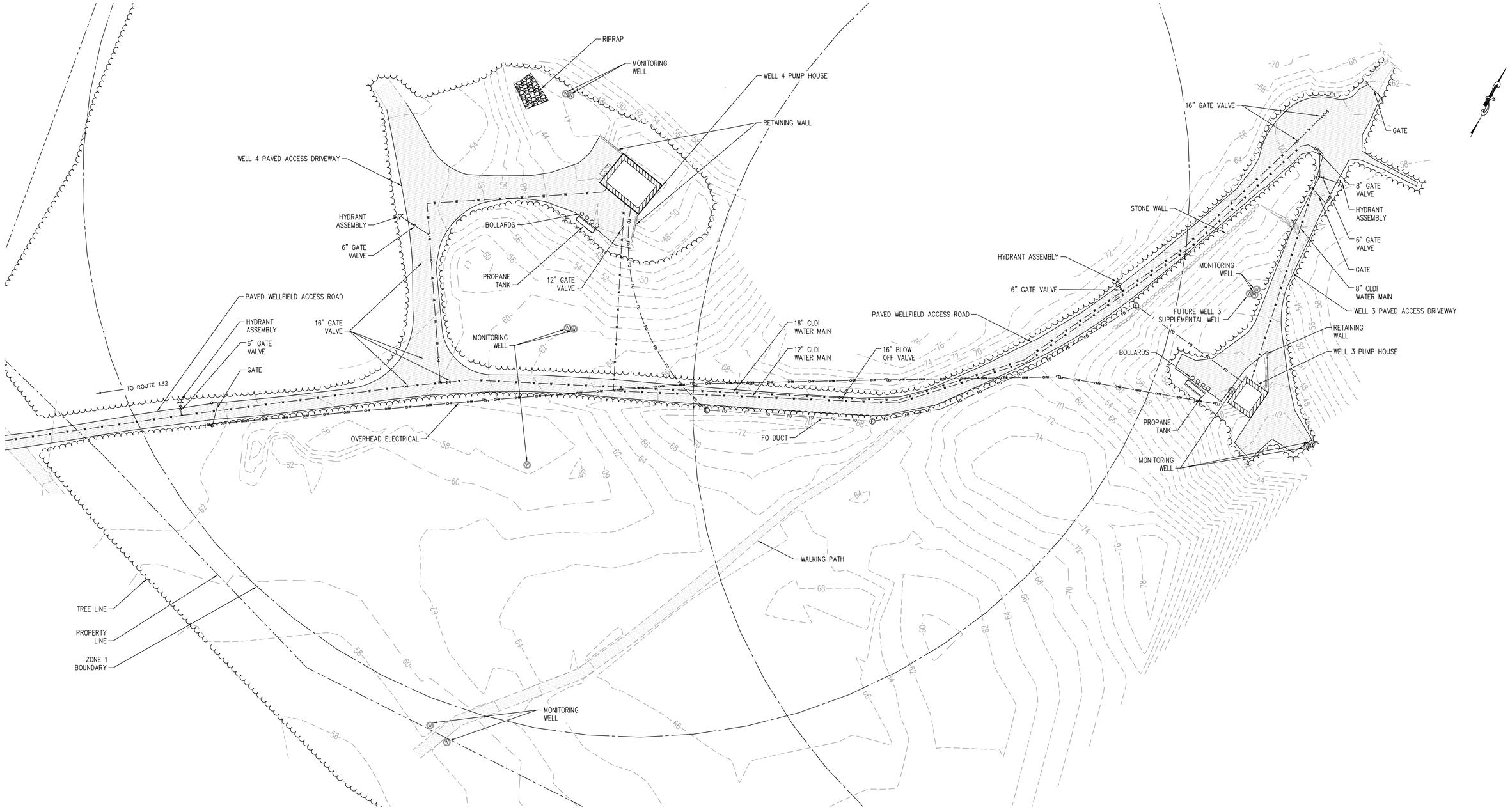

PLAN VIEW

SCALE: 1" = 35'

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SCALE ADJUSTMENT GUIDE
0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

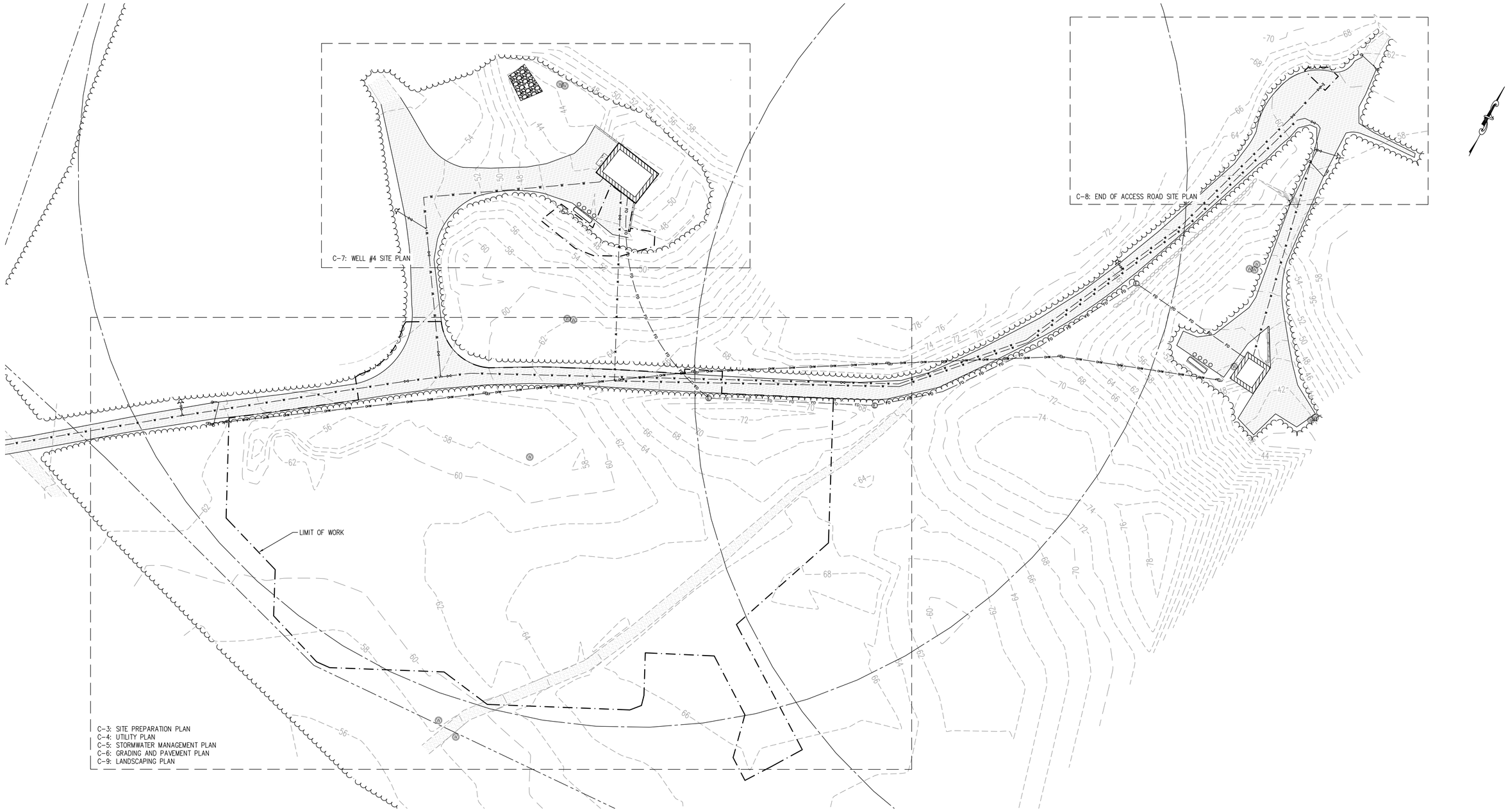
BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
EXISTING CONDITIONS

DRAWING NO.:
C-1

SHEET NO. 2 OF 18

C:\Users\GenevieveH\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire Distrtch\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\XRefs\XR_Existing.dwg



PLAN VIEW

SCALE: 1" = 35'

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REGISTERED PROFESSIONAL ENGINEER
6/4/26

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DATE:	JUNE 2026
SCALE:	1" = 35'
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BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: SITE LAYOUT

DRAWING NO.: C-2

SHEET NO. 3 OF 18

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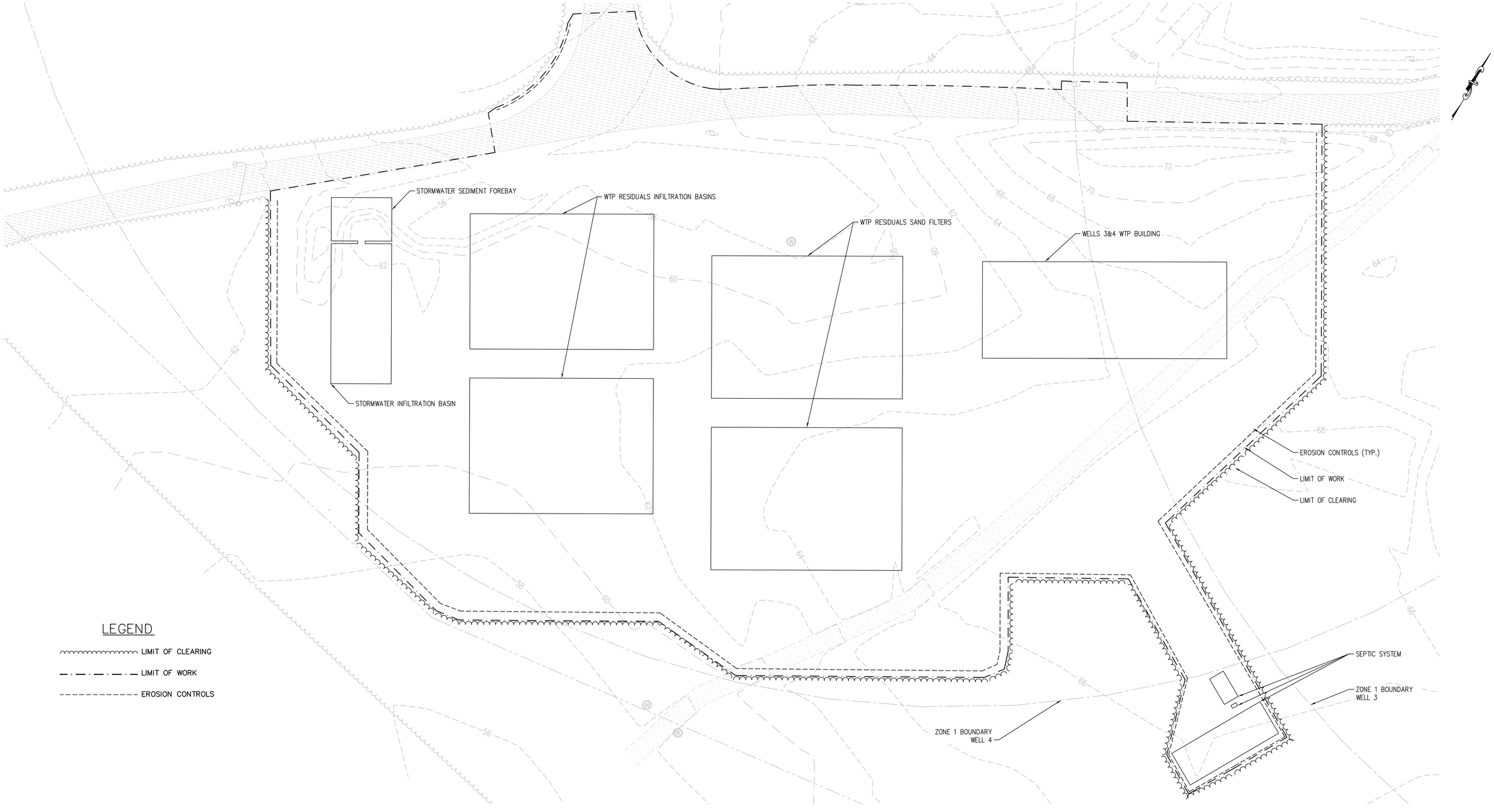

PLAN VIEW

SCALE: 1" = 20'

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NO. 46,176
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6/4/26

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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SITE PREPARATION PLAN

DRAWING NO.:
C-3

SHEET NO. 4 OF 18

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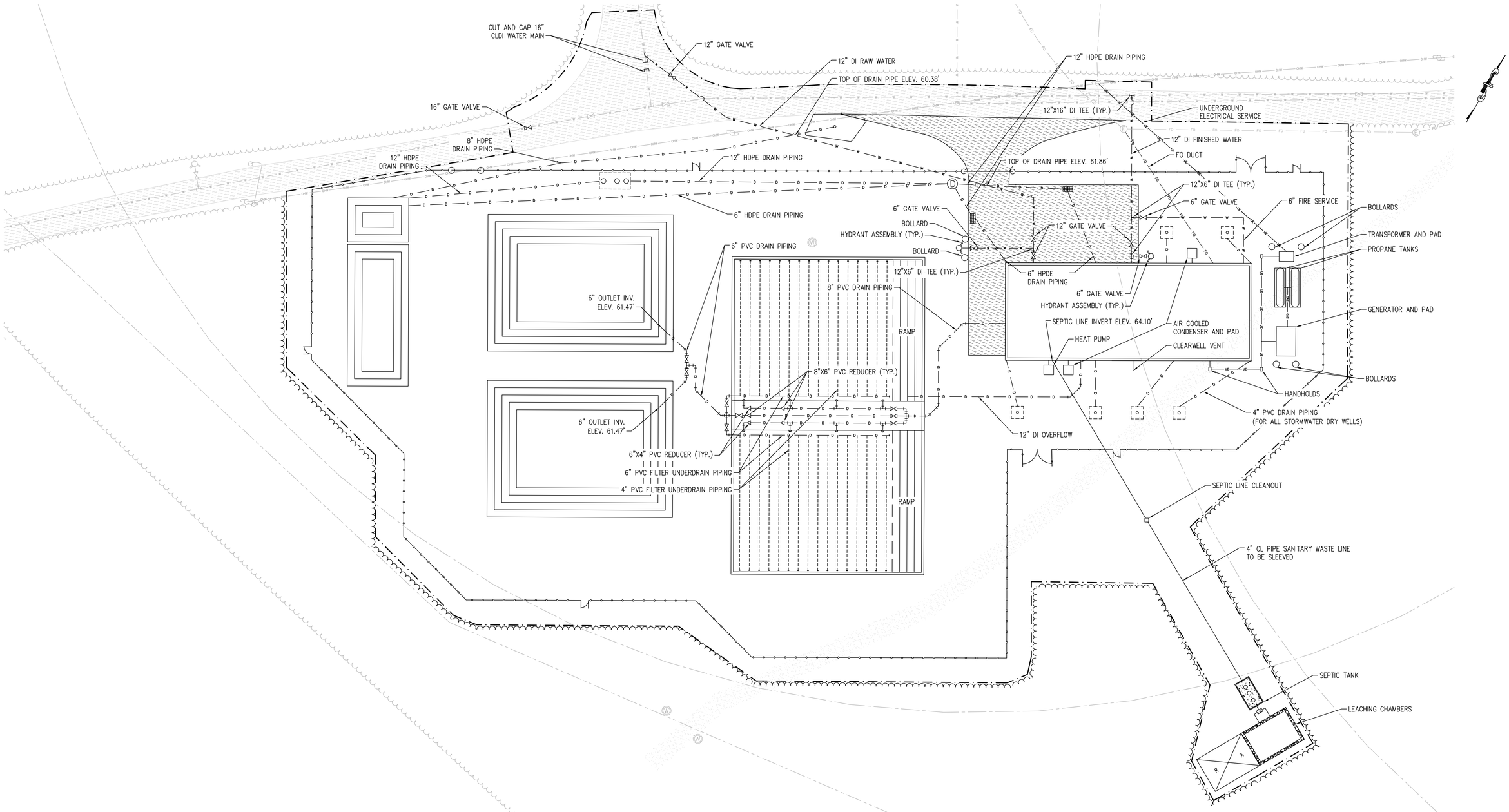

PLAN VIEW

SCALE: 1" = 20'

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BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: UTILITY PLAN

DRAWING NO.: C-4

SHEET NO. 5 OF 18

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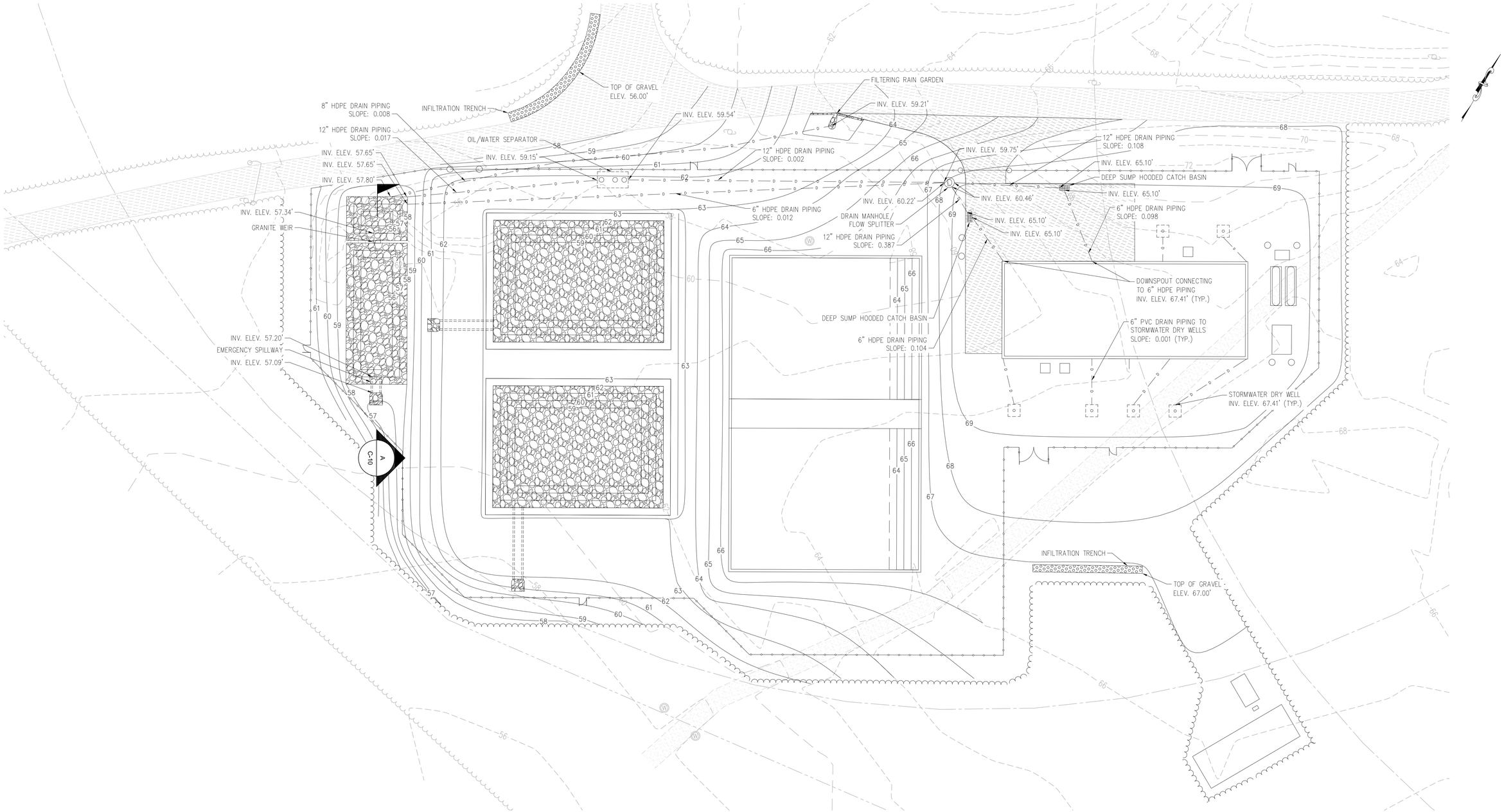

PLAN VIEW

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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
STORMWATER MANAGEMENT PLAN

DRAWING NO.:
C-5

SHEET NO. 6 OF 18

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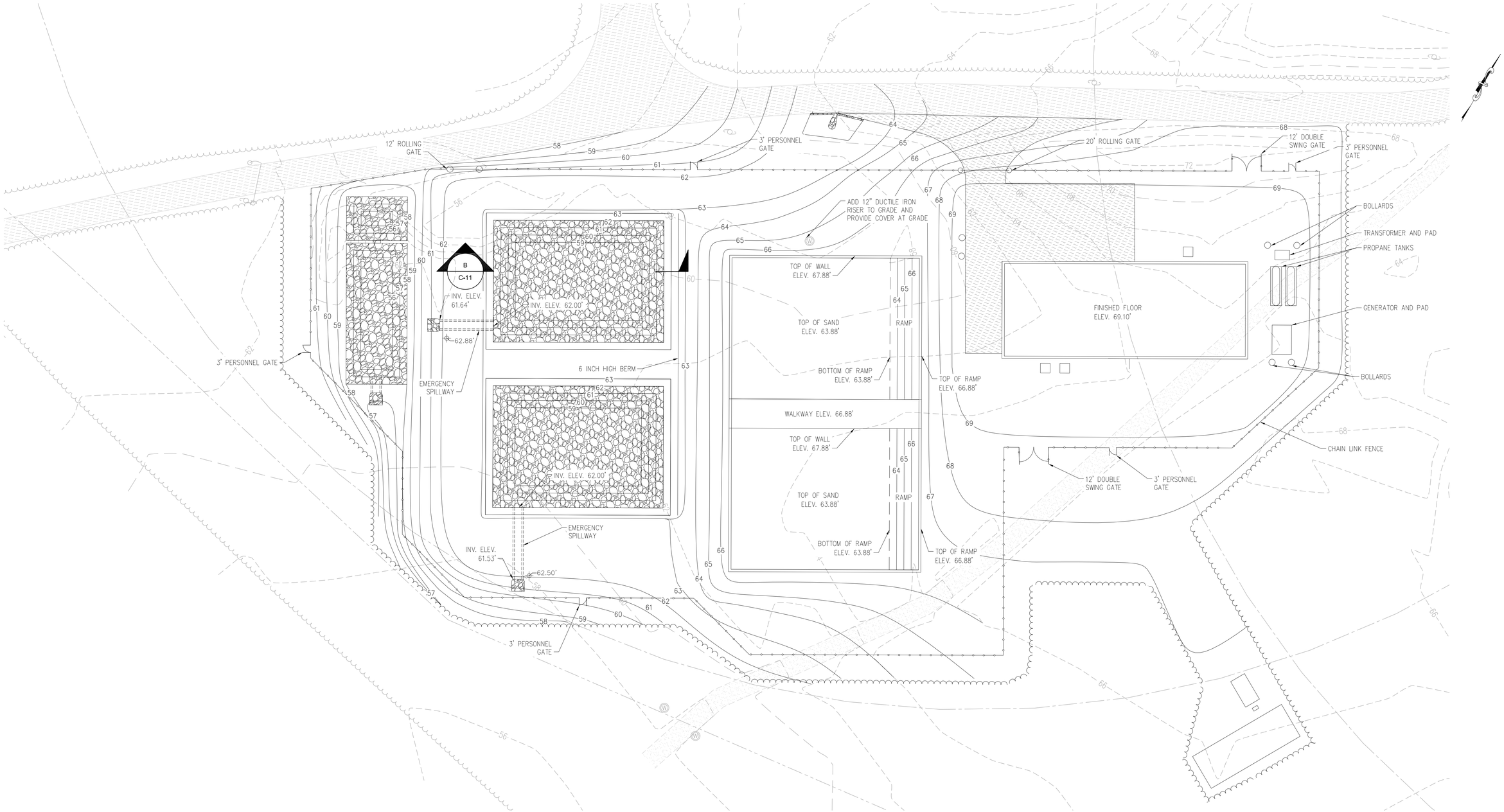

PLAN VIEW

SCALE: 1" = 20'

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DATE:	JUNE 2026
SCALE:	1" = 20'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
GRADING AND PAVEMENT PLAN

DRAWING NO.:
C-6

SHEET NO. 7 OF 18

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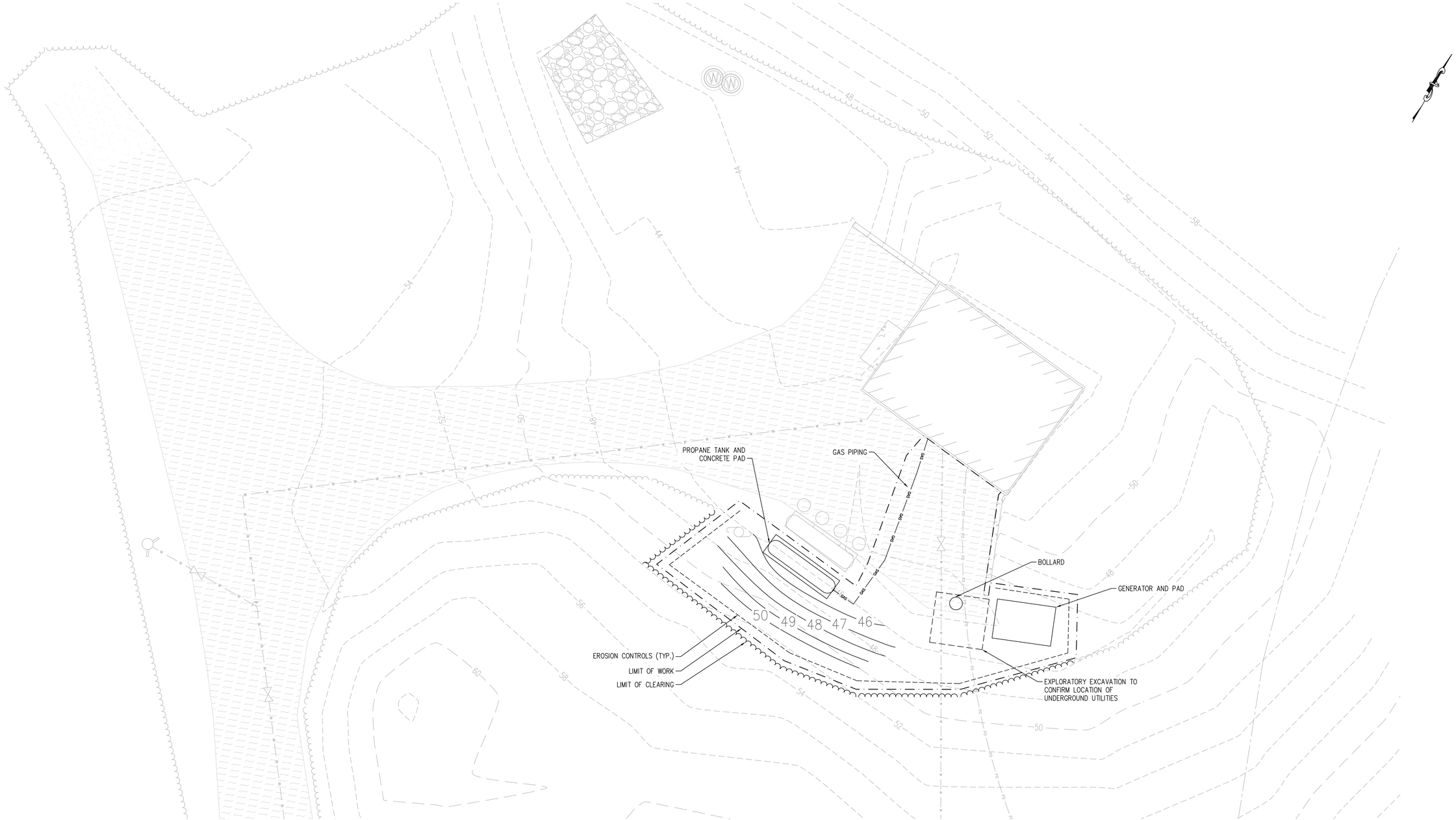

PLAN VIEW

SCALE: 1" = 10'

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DATE:	JUNE 2026
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CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
WELL #4
SITE PLAN

DRAWING NO.:
C-7

SHEET NO. 8 OF 18

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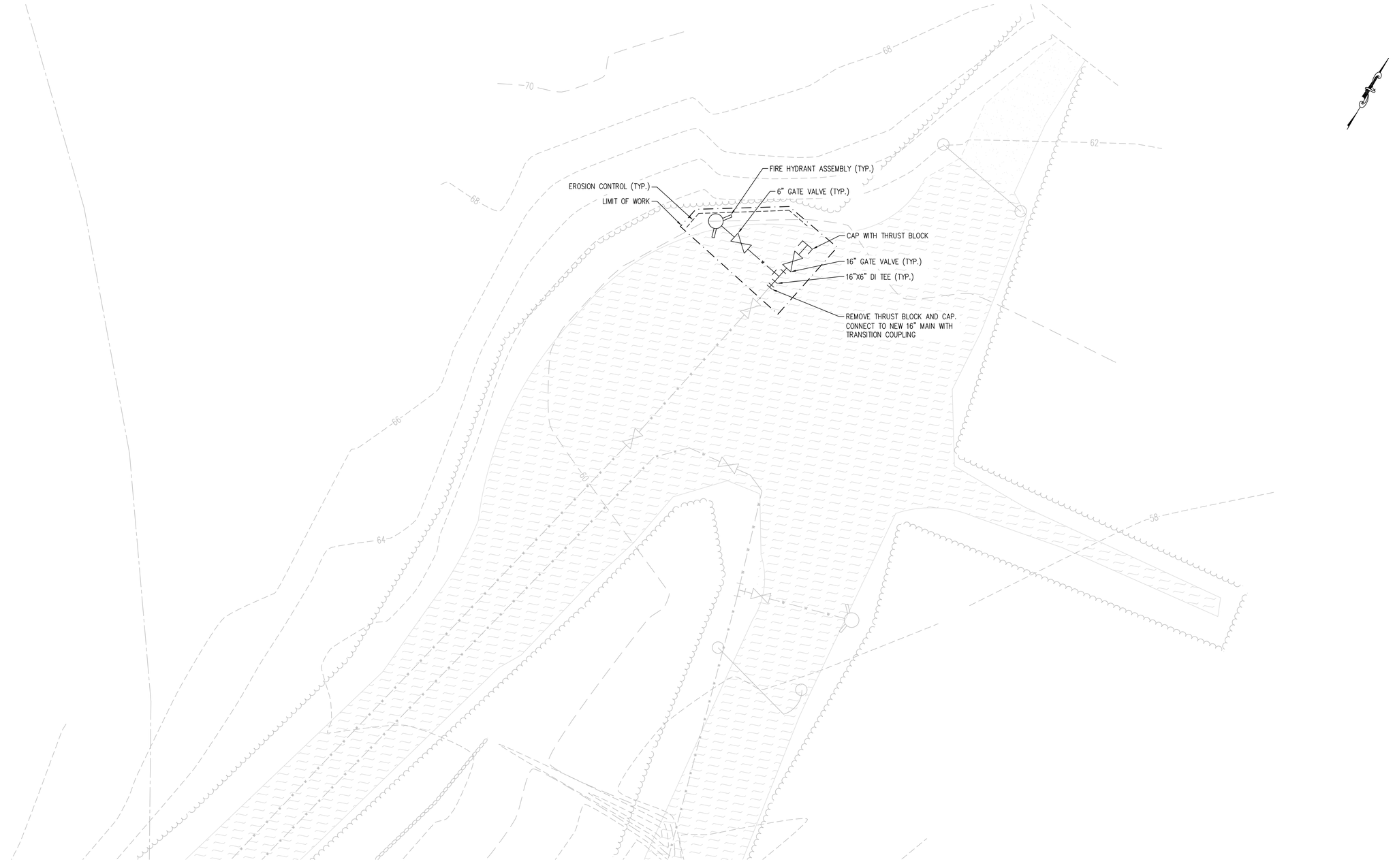

PLAN VIEW

SCALE: 1" = 8'

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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 49386
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 8'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
END OF ACCESS ROAD SITE PLAN

DRAWING NO.:
C-8

SHEET NO. 9 OF 18

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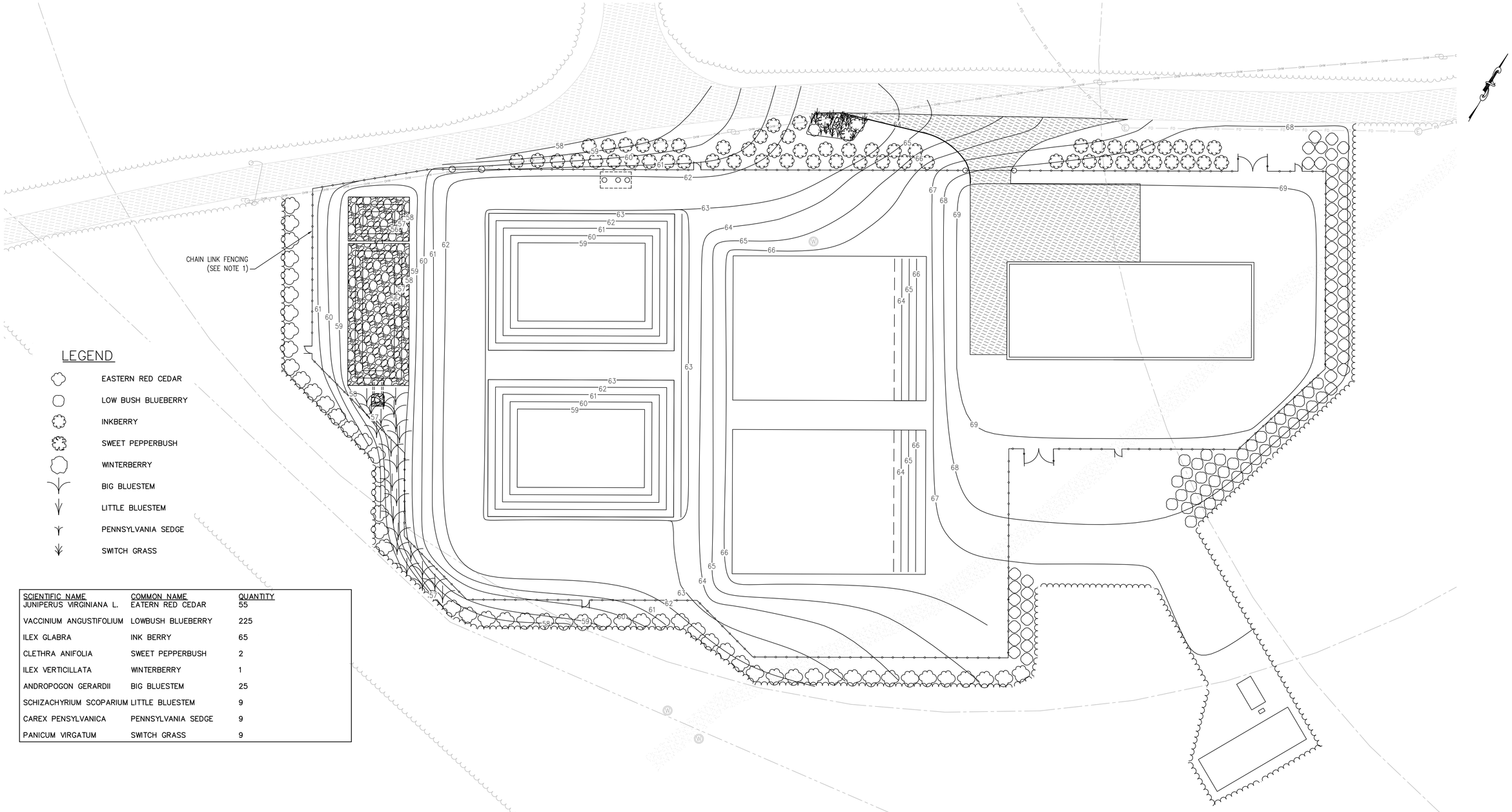

SCIENTIFIC NAME	COMMON NAME	QUANTITY
JUNIPERUS VIRGINIANA L.	EATERN RED CEDAR	55
VACCINIUM ANGUSTIFOLIUM	LOWBUSH BLUEBERRY	225
ILEX GLABRA	INK BERRY	65
CLETHRA ANIFOLIA	SWEET PEPPERBUSH	2
ILEX VERTICILLATA	WINTERBERRY	1
ANDROPOGON GERARDII	BIG BLUESTEM	25
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	9
CAREX PENSYLVANICA	PENNSYLVANIA SEDGE	9
PANICUM VIRGATUM	SWITCH GRASS	9

NOTES:

1. CHAIN LINK FENCING SHALL BE SEVEN FEET TALL.

PLAN VIEW

SCALE: 1" = 20'

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SCALE ADJUSTMENT GUIDE
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REVISIONS		
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PROJECT NO.:	127.25.01
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SCALE:	1" = 20'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
LANDSCAPING PLAN

DRAWING NO.:
C-9

SHEET NO. 10 OF 18

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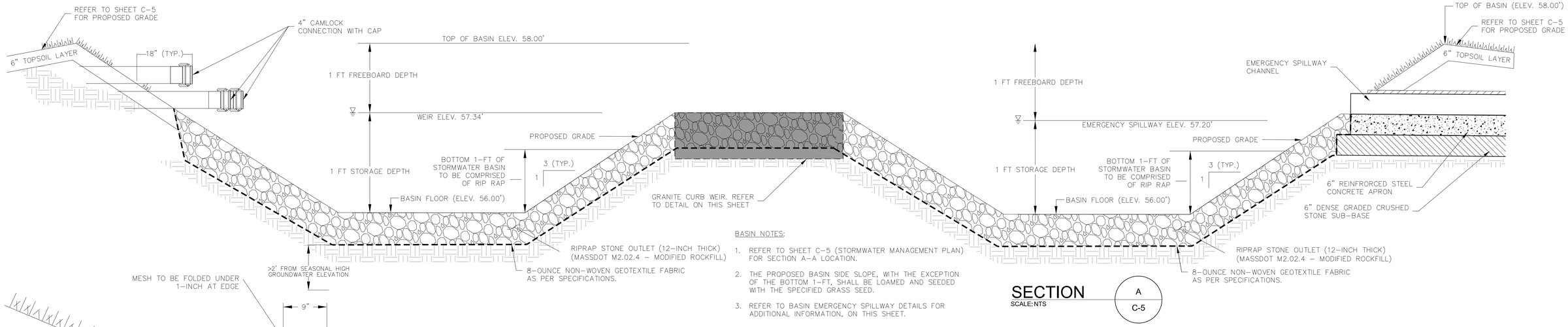


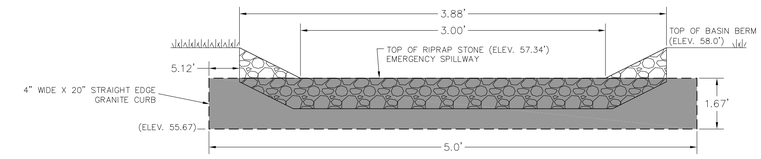
BASIN NOTES:

1. REFER TO SHEET C-5 (STORMWATER MANAGEMENT PLAN) FOR SECTION A-A LOCATION.
2. THE PROPOSED BASIN SIDE SLOPE, WITH THE EXCEPTION OF THE BOTTOM 1-FT, SHALL BE LOAMED AND SEEDED WITH THE SPECIFIED GRASS SEED.
3. REFER TO BASIN EMERGENCY SPILLWAY DETAILS FOR ADDITIONAL INFORMATION, ON THIS SHEET.

SECTION A

SCALE: NTS

A / C-5

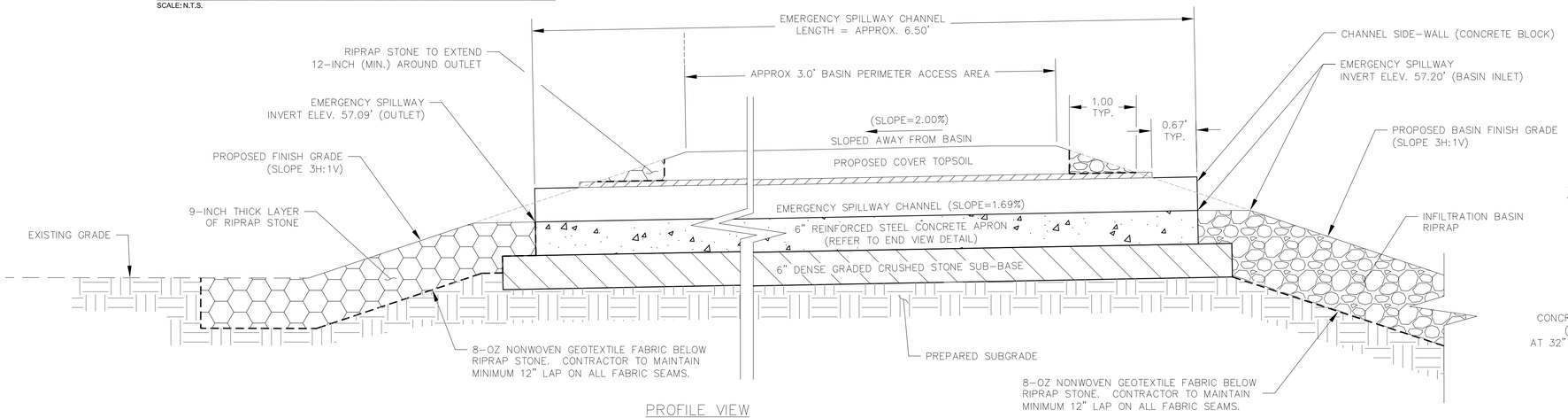


GRANITE CURB WEIR DETIAL

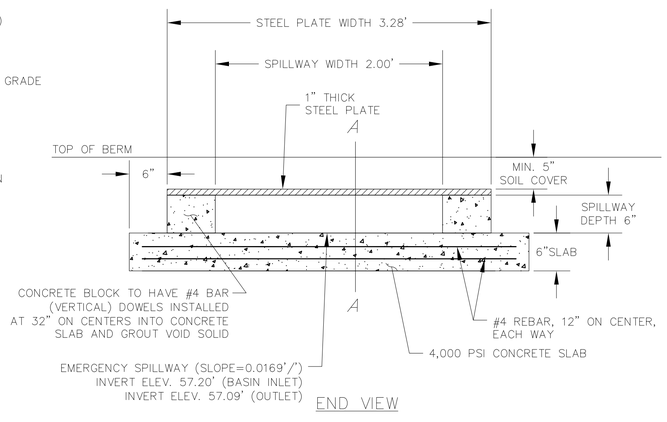
SCALE: N.T.S.

STORMWATER OUTLET DETIAL

SCALE: N.T.S.



PROFILE VIEW



END VIEW

EMERGENCY SPILLWAY DETAIL

SCALE: N.T.S.

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CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: STORMWATER BASIN SECTIONS

DRAWING NO.: C-10

SHEET NO. 11 OF 18

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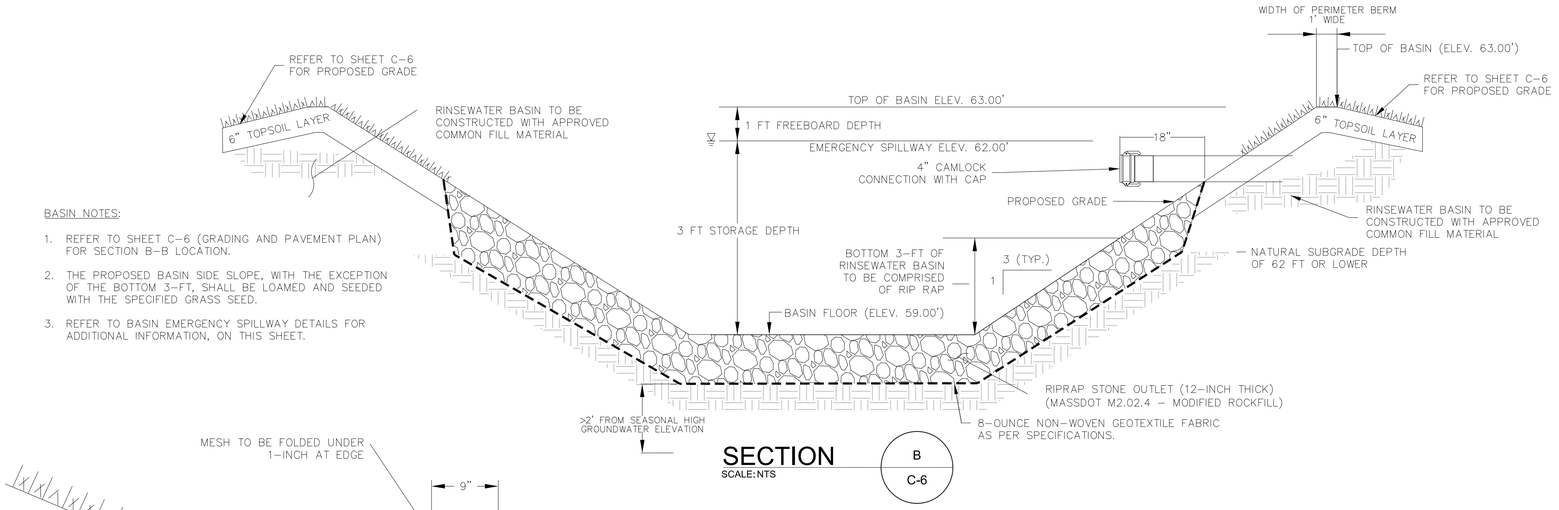


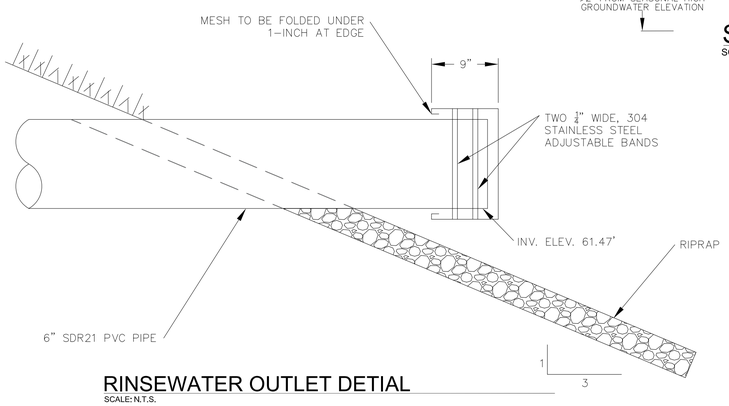
BASIN NOTES:

1. REFER TO SHEET C-6 (GRADING AND PAVEMENT PLAN) FOR SECTION B-B LOCATION.
2. THE PROPOSED BASIN SIDE SLOPE, WITH THE EXCEPTION OF THE BOTTOM 3-FT, SHALL BE LOAMED AND SEEDED WITH THE SPECIFIED GRASS SEED.
3. REFER TO BASIN EMERGENCY SPILLWAY DETAILS FOR ADDITIONAL INFORMATION, ON THIS SHEET.

SECTION

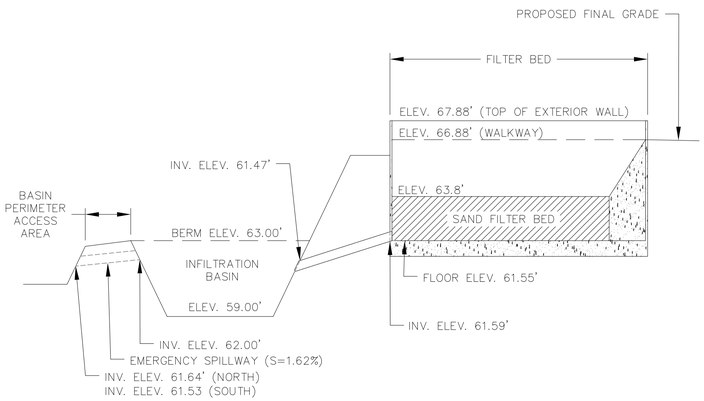
SCALE: NTS

B / C-6



RINSEWATER OUTLET DETIAL

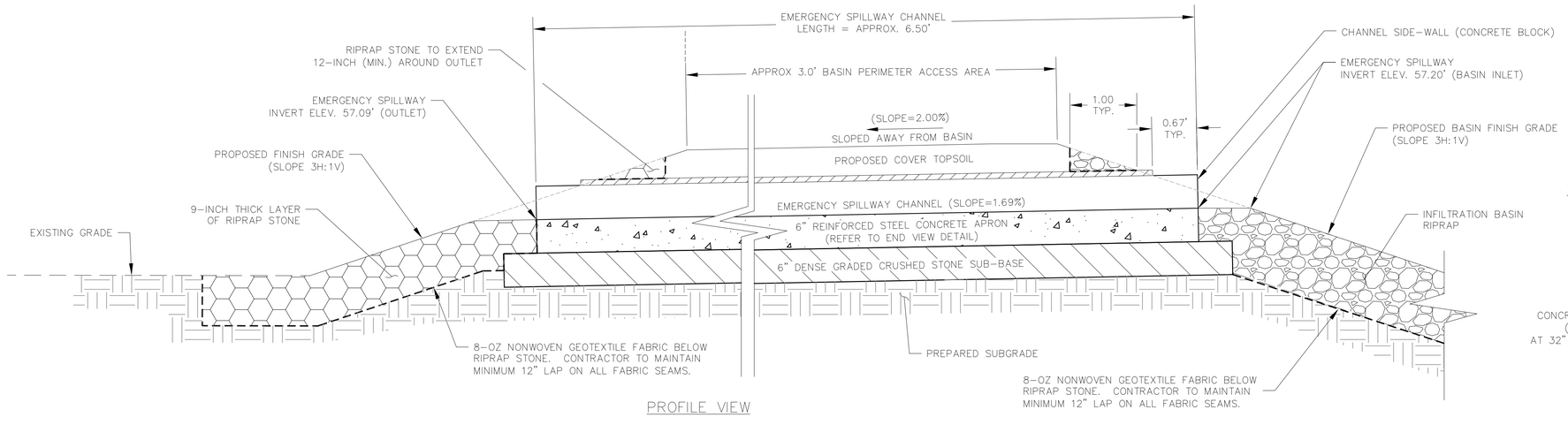
SCALE: N.T.S.



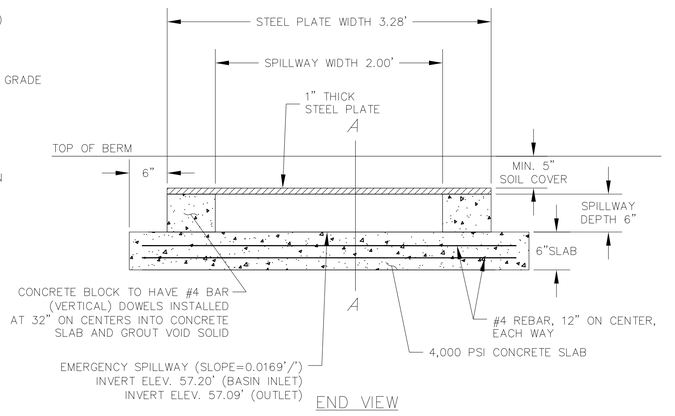
NOTE:
1. PROPOSED SYSTEM IS COMPRISED OF 2 SAND FILTER BEDS AND TWO INFILTRATION BASINS. SECTION SHOWN IS REPRESENTATIVE OF TYPICAL SYSTEM ELEVATIONS.

FILTER BED & INFILTRATION BASIN SYSTEM SECTION

SCALE: N.T.S.



PROFILE VIEW



END VIEW

EMERGENCY SPILLWAY DETAIL

SCALE: N.T.S.

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COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 37886
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
RINSEWATER INFILTRATION BASIN SECTIONS

DRAWING NO.:
C-11

SHEET NO. 12 OF 18

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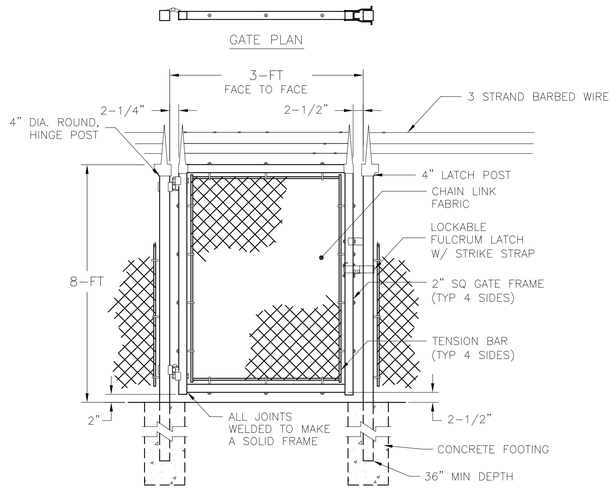
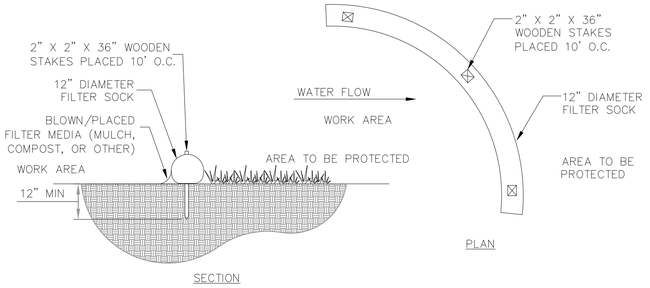


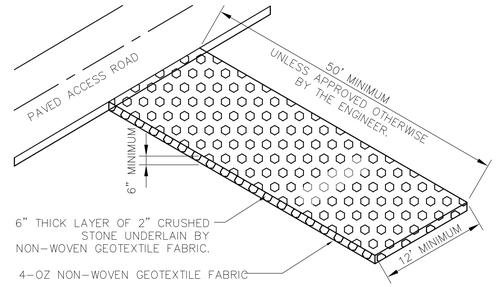
PERSONEL GATE DETAIL

SCALE: N.T.S.



SEDIMENTATION CONTROL BARRIER

SCALE: NOT TO SCALE

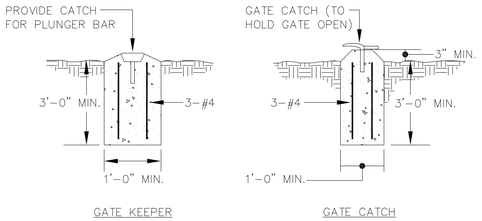


ENTRANCE PAD NOTES:

1. NON–WOVEN GEOTEXTILE FABRIC SHALL BE PLACED OVER THE ENTIRE AREA OF THE CONSTRUCTION ENTRANCE PRIOR TO PLACING STONE.
2. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING SEDIMENT ONTO PUBLIC RIGHT–OF WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, WASHED, OR TRACKED ONTO PUBLIC RIGHT–OF–WAY MUST BE REMOVED PROMPTLY.
3. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR SHALL REMOVE THE CONSTRUCTION ENTRANCE PAD AND RESTORE THE SURFACE TO ORIGINAL CONDITION.

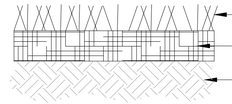
CONSTRUCTION ENTANCE PAD

SCALE: NOT TO SCALE



TYPICAL GATE KEEPER & CATCH DETAIL

SCALE: N.T.S.

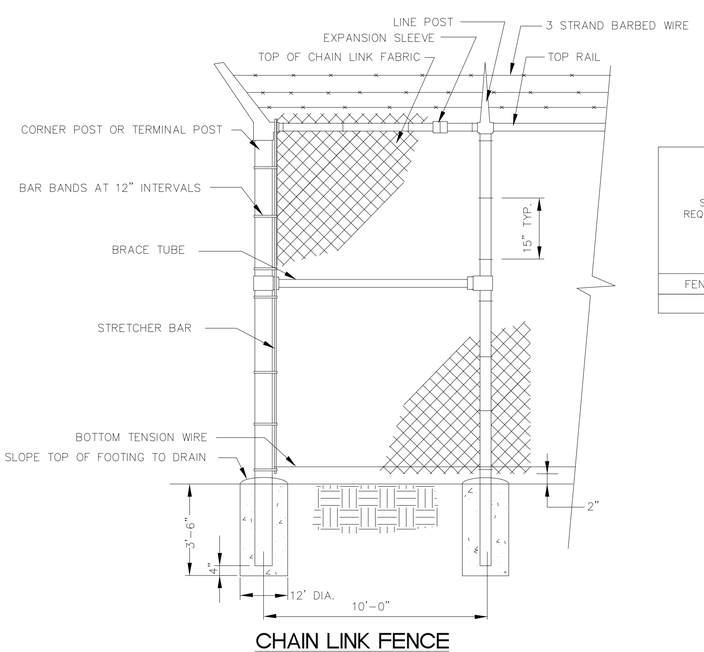


NOTES

1. ALL GRASSED SURFACE SLOPES STEEPER THAN 7H:1V SLOPE SHALL INCLUDE THE INSTALLATION OF EROSION CONTROL BLANKET AFTER THE LOAM, SEED AND FERTILIZER HAVE BEEN PLACE.
2. MATERIAL SPECIFICATIONS FOR THE EROSION CONTROL BLANKET SHALL MEET CURLEX II EROSION CONTROL BLANKET AS MANUFACTURED BY AMERICAN EXCELSIOR COMPANY, OR EQUAL.

GRASSED VEGETATED SURFACE

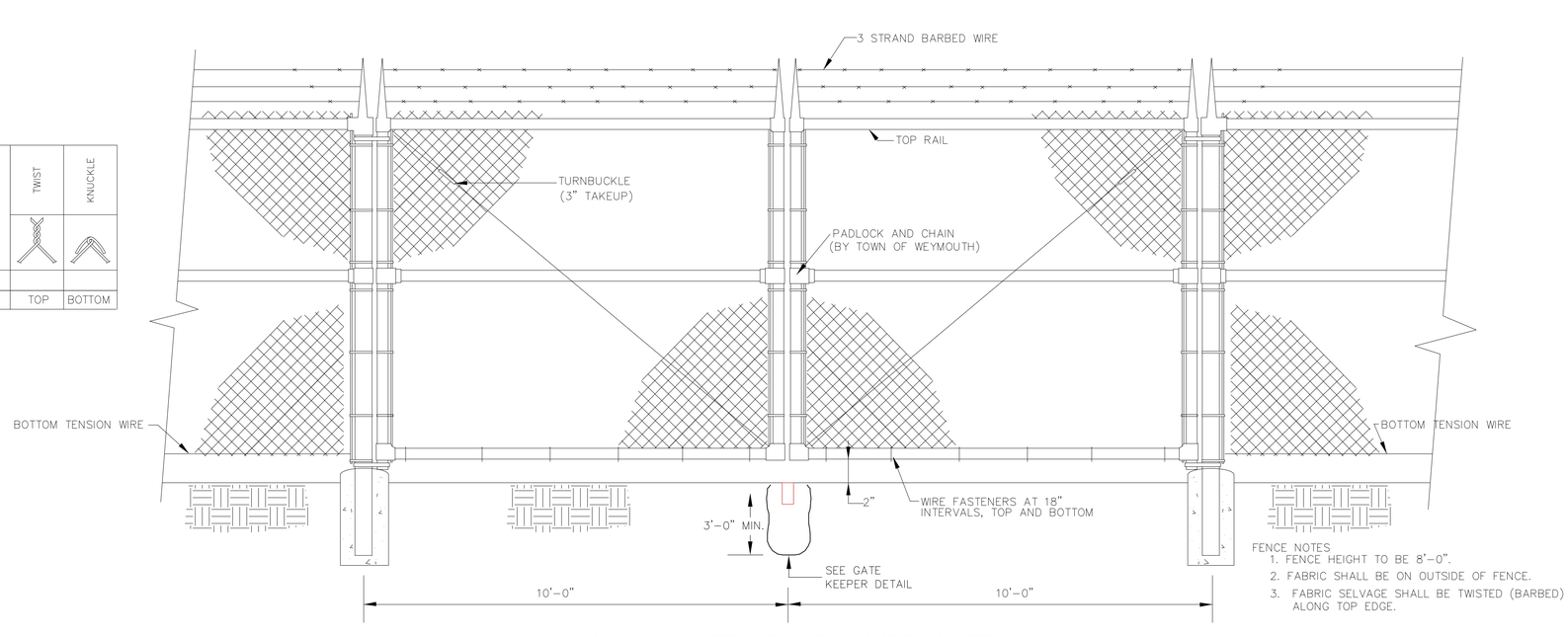
SCALE: NOT TO SCALE



SELVAGE REQUIREMENTS	TWIST	KNUCKLE
FENCE HEIGHT		
8'–0"	TOP	BOTTOM

CHAIN LINK FENCE

N.T.S.



FENCE NOTES

1. FENCE HEIGHT TO BE 8'–0".
2. FABRIC SHALL BE ON OUTSIDE OF FENCE.
3. FABRIC SELVAGE SHALL BE TWISTED (BARBED) ALONG TOP EDGE.

CHAIN LINK FENCE AND ACCESS GATE

N.T.S.

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DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS I

DRAWING NO.:
C-12

SHEET NO. 13 OF 18

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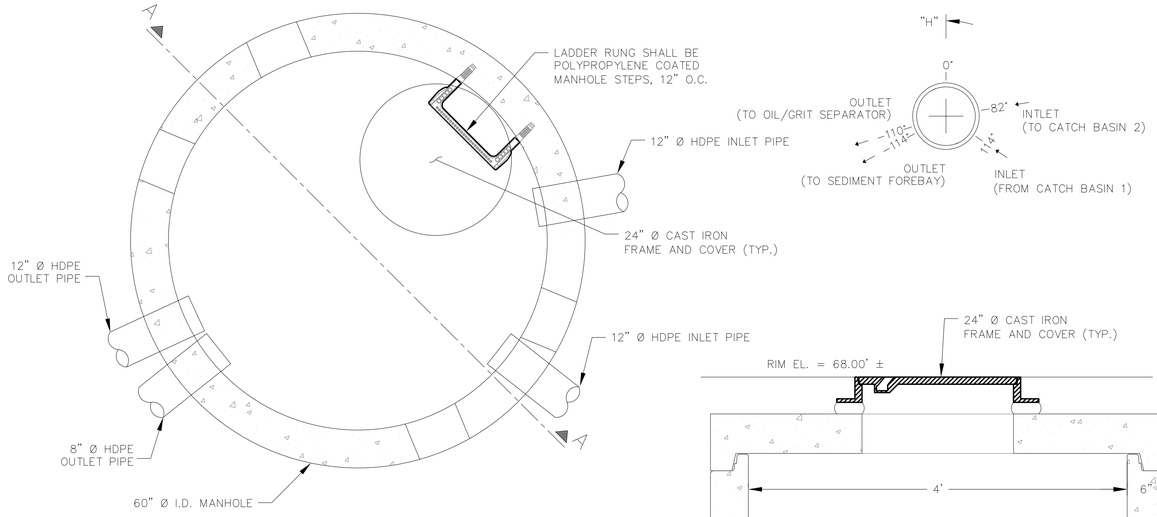
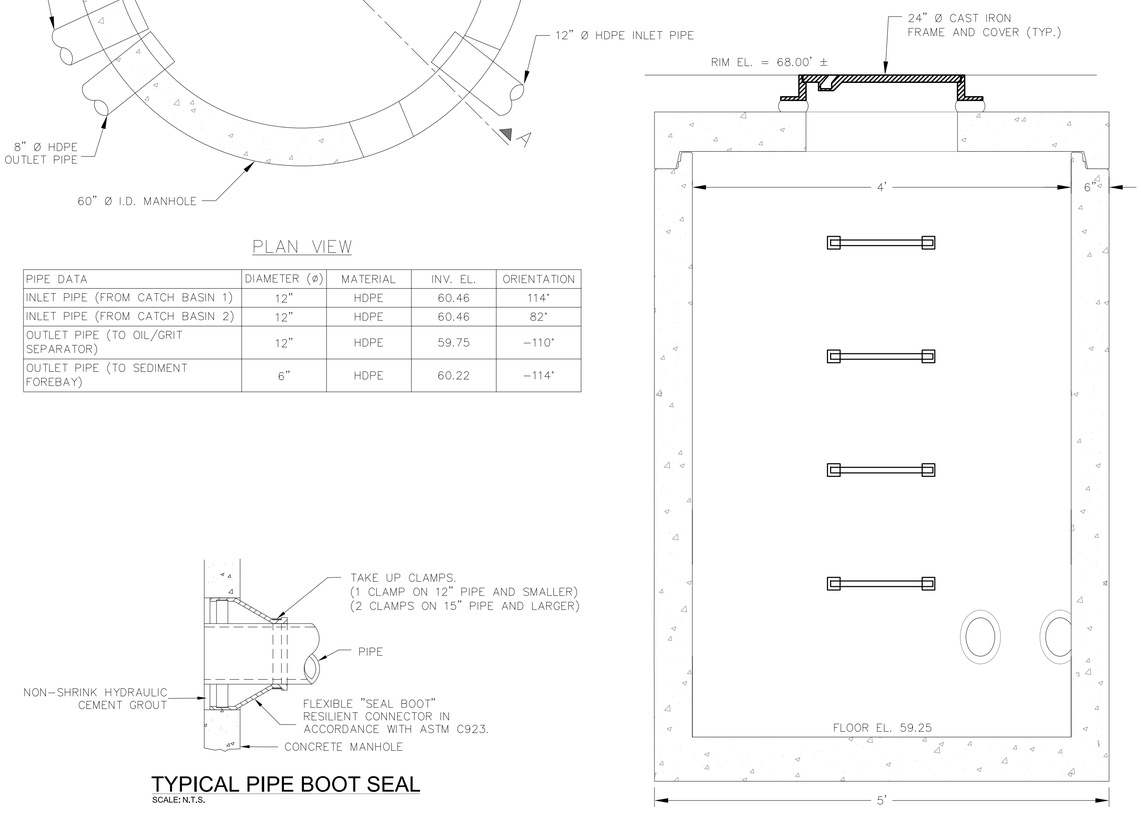


PLAN VIEW

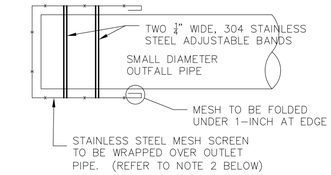
PIPE DATA	DIAMETER (ø)	MATERIAL	INV. EL.	ORIENTATION
INLET PIPE (FROM CATCH BASIN 1)	12"	HDPE	60.46	114°
INLET PIPE (FROM CATCH BASIN 2)	12"	HDPE	60.46	82°
OUTLET PIPE (TO OIL/GRIT SEPARATOR)	12"	HDPE	59.75	-110°
OUTLET PIPE (TO SEDIMENT FOREBAY)	6"	HDPE	60.22	-114°



SECTION A-A

OUTLET CONTROL STRUCTURE DETAIL
SCALE: N.T.S.

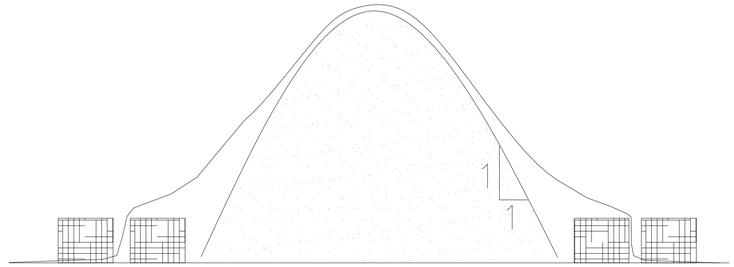
TYPICAL PIPE BOOT SEAL
SCALE: N.T.S.



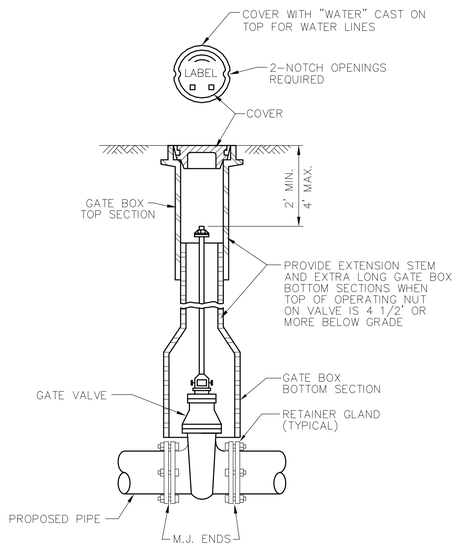
OUTLET SCREEN NOTE:

1. OUTLET SCREEN TO BE INSTALL ON SMALL DIAMETER OUTFALL PIPING, AS CALLED OUT ON THE PLANS.
2. MESH SCREEN SHALL BE SQUARE, STAINLESS STEEL, TYPE 304, WELDED 2 X 2 MESH (SQUARE), 0.4370" X 0.4370" OPENING, 0.063" THICK (16 GAUGE) WIRE DIAMETER, 76% OPEN AREA.

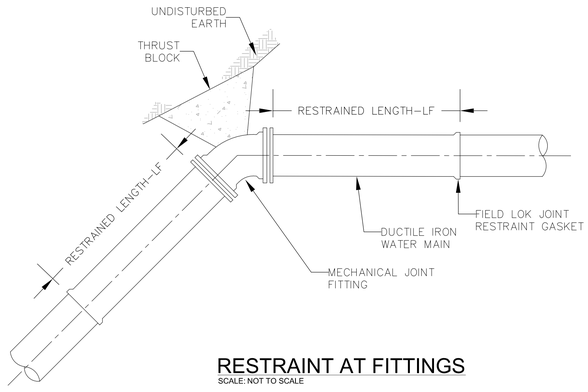
OUTLET SCREEN DETAIL
SCALE: N.T.S.



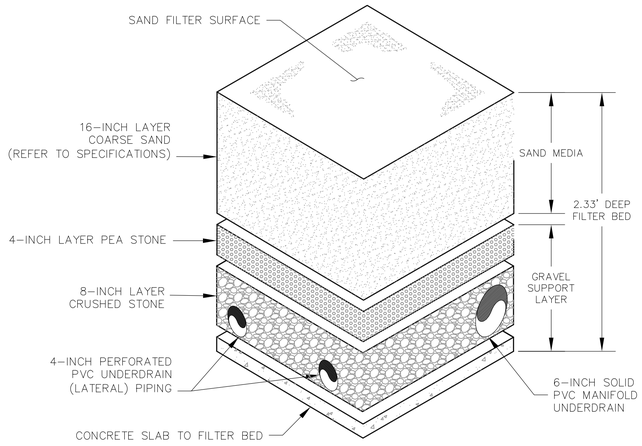
STOCKPILE DETAIL
SCALE: N.T.S.



GATE VALVE AND VALVE BOX DETAIL
SCALE: N.T.S.



RESTRAINT AT FITTINGS
SCALE: NOT TO SCALE



SAND MEDIA NOTES:

1. PERFORATED LATERAL UNDERDRAIN PIPING SHALL BE SPACED AT 4-FT (ON CENTER). PERFORATIONS SHALL BE 1/4-INCH DIA., 6 HOLES PER FOOT LOCATED ON THE BOTTOM. REFER TO PERFORATION DETAIL ON SHEET C-11.

SAND FILTER - MEDIA BED
SCALE: N.T.S.

PIPE SIZE	PLUG SF	PLUG LF	TEE SF	TEE LF	90° BEND SF	90° BEND LF	45° BEND SF	45° BEND LF	22 1/2° BEND SF	22 1/2° BEND LF	11 1/4° BEND SF	11 1/4° BEND LF
6"	2.8	37	2.8	32	4.0	18	2.1	7	1.1	4	1.0	2
8"	4.8	48	4.8	43	6.8	23	3.7	10	1.9	5	1.0	2
10"	7.3	58	7.3	53	10.3	28	5.6	12	2.8	6	1.4	3
12"	10.3	69	10.3	63	14.5	33	7.9	14	4.0	6	2.0	3
16"	17.8	89	17.8	83	25.2	42	13.6	17	7.0	8	3.5	4
20"	27.5	108	27.5	102	38.9	51	21.0	21	10.7	10	5.4	5
24"	39.2	127	39.2	121	55.4	59	30.0	25	15.3	12	7.7	6

RESTRAINT NOTES:

1. MINIMUM SURFACE AREA OF CONCRETE THRUST BLOCK AGAINST UNDISTURBED EARTH – SF (SQUARE FEET)
2. MINIMUM RESTRAINED LENGTH OF PIPE ON EITHER SIDE OF FITTING – LF (LINEAR FEET)
3. THE "SF" VALUES IN THE ABOVE TABLE ARE BASED ON 3,000 P.S.F. SOIL BEARING CAPACITY, 150 P.S.I. TEST PRESSURE AND A 1.5 FACTOR OF SAFETY.
4. THE "LF" VALUES IN THE ABOVE TABLE ARE BASED ON A TYPE 3 LAYING CONDITION, A SAND SILT SOIL DESIGNATION, A 5 FOOT RUN LENGTH, 150 P.S.I. TEST PRESSURE AND A 1.5 FACTOR OF SAFETY.

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REVISIONS

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DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: CIVIL DETAILS II

DRAWING NO.: C-13

SHEET NO. 14 OF 18

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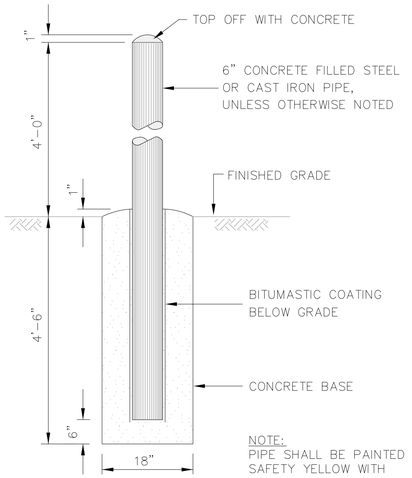
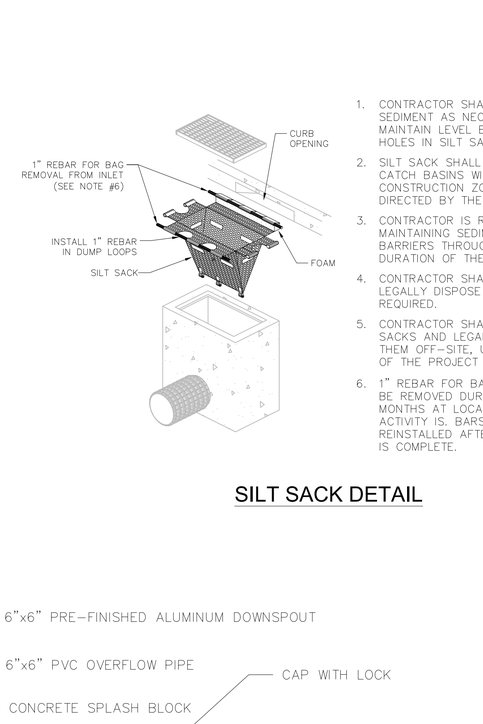


NOTE:
PIPE SHALL BE PAINTED SAFETY YELLOW WITH CATALIZED EPOXY PAINT

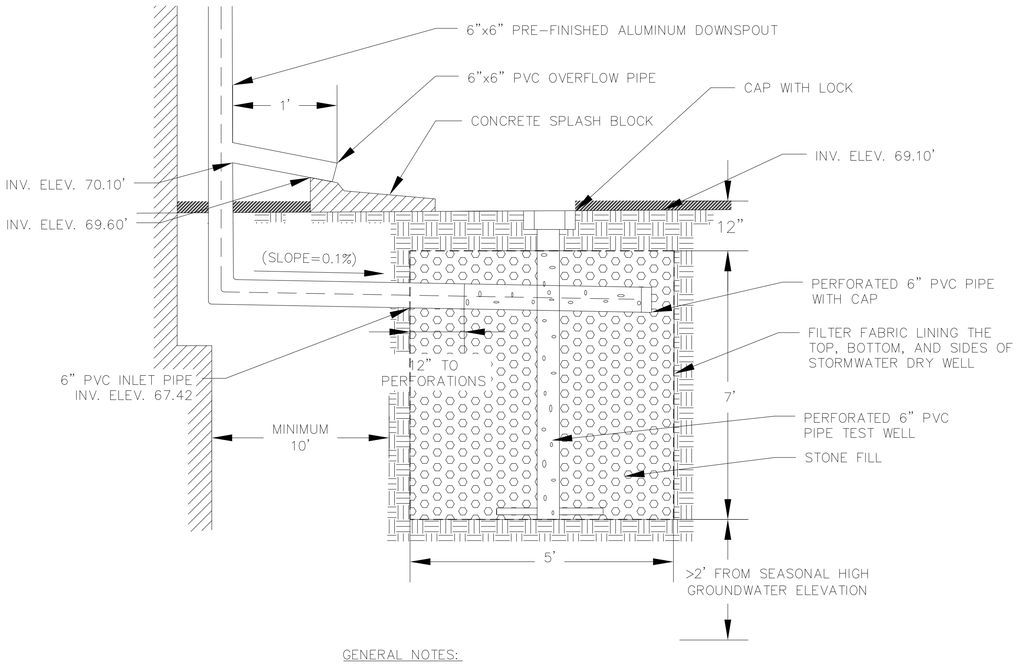
BOLLARD DETAIL

N.T.S.



1. CONTRACTOR SHALL REMOVE SEDIMENT AS NECESSARY TO MAINTAIN LEVEL BELOW OVERFLOW HOLES IN SILT SACK.
2. SILT SACK SHALL BE USED ON ALL CATCH BASINS WITHIN CONSTRUCTION ZONE OR AS DIRECTED BY THE AUTHORITY.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SEDIMENTATION BARRIERS THROUGHOUT THE DURATION OF THE PROJECT.
4. CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF SEDIMENT AS REQUIRED.
5. CONTRACTOR SHALL REMOVE SILT SACKS AND LEGALLY DISPOSE OF THEM OFF-SITE, UPON COMPLETION OF THE PROJECT AND AS REQUIRED.
6. 1" REBAR FOR BAG REMOVAL SHALL BE REMOVED DURING WINTER MONTHS AT LOCATIONS WHERE PLOW ACTIVITY IS. BARS SHALL BE REINSTALLED AFTER SNOW SEASON IS COMPLETE.

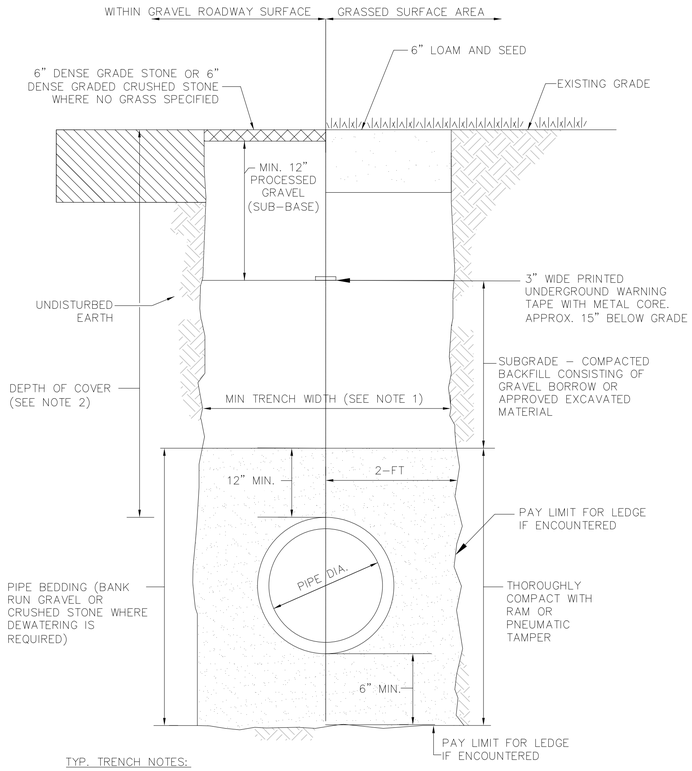
SILT SACK DETAIL



GENERAL NOTES:
1. TEST WELL SHALL BE ANCHORED WITH REBAR.
2. SEE SHEET C-5 FOR STORMWATER DRY WELL LOCATIONS.
3. STONE FILL SHALL BE 1.5"-3.0" IN DIAMETER.

STORMWATER DRY WELL

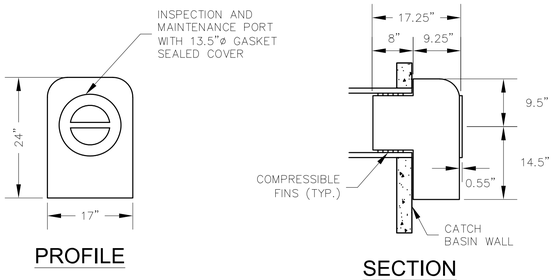
SCALE: N.T.S.



TYP. TRENCH NOTES:
1. MIN. COVER 5' COVER FOR WATER MAIN
2. MIN. 3' COVER FOR STORM DRAIN

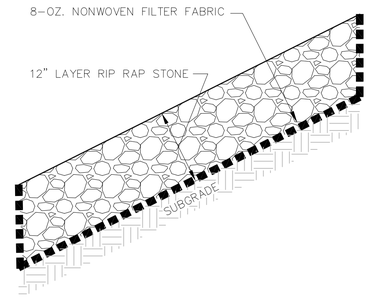
TYPICAL TRENCH DETAIL

SCALE: N.T.S.



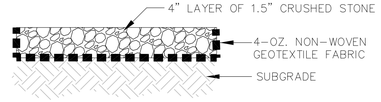
HDPE CATCHBASIN HOOD

SCALE: N.T.S.



RIPRAP SLOPE PROTECTION DETAIL

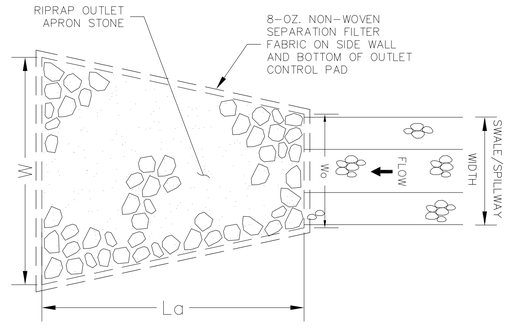
SCALE: N.T.S.



NOTE:
1. CRUSHED STONE SHALL MEET MASSDOT M2.01.7 SPECIFICATION AND GRADATION REQUIREMENTS.
2. CONTRACTOR SHALL PREPARE SUBGRADE TO RECEIVE THE CRUSHED STONE AND SHALL PERFORM AT A MINIMUM PROOF ROLLS THE SUBGRADE FOUR TIMES WITH A PLATE COMPACTOR OR AS DIRECTED BY THE ENGINEER BEFORE PLACING CRUSHED STONE.
3. UPON PLACEMENT OF MATERIAL AND REACHING FINAL GRADE, CONTRACTOR SHALL TAMP CRUSHED STONE WITH PLATE COMPACTOR TO ENSURE MATERIAL IS WELL CONSOLIDATED.

CRUSHED STONE PAD DETAIL

SCALE: N.T.S.



DISCHARGE POINT	La	Wo	W	RIPRAP STONE	LAYER THICKNESS
BASIN EMERGENCY SPILLWAY	6.5'	5.0'	6.5'	D50=4"	9"

RIPRAP OUTLET CONTROL PAD DETAIL

SCALE: N.T.S.

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS STEPHEN C. OLSON 49836 REGISTERED PROFESSIONAL ENGINEER

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS III

DRAWING NO.:
C-14
SHEET NO. 15 OF 18

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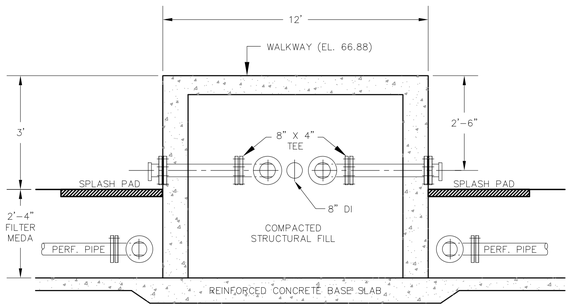
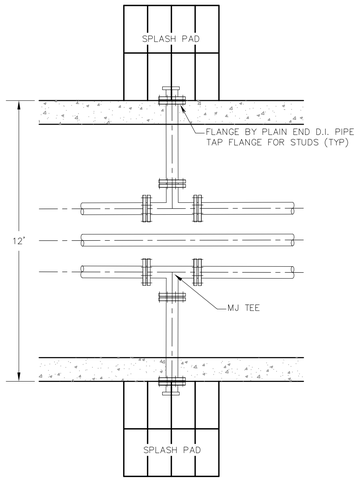
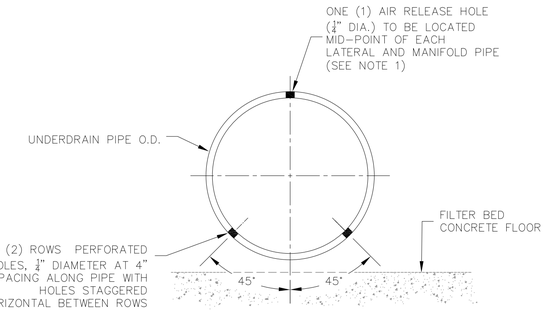


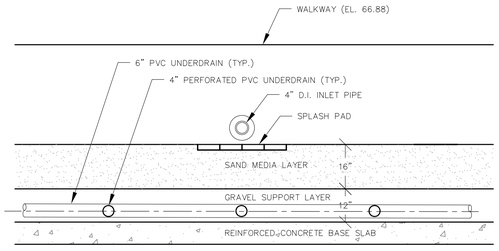
SECTION B - B
SCALE: NTS



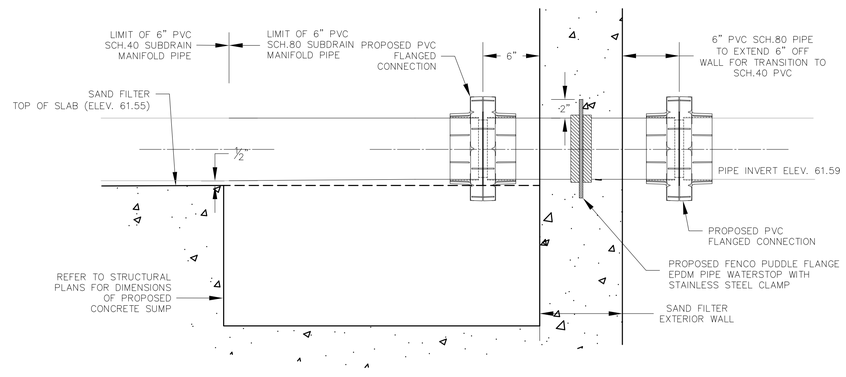
PLAN VIEW - FILTER BED DISCHARGE PIPE
SCALE: NTS



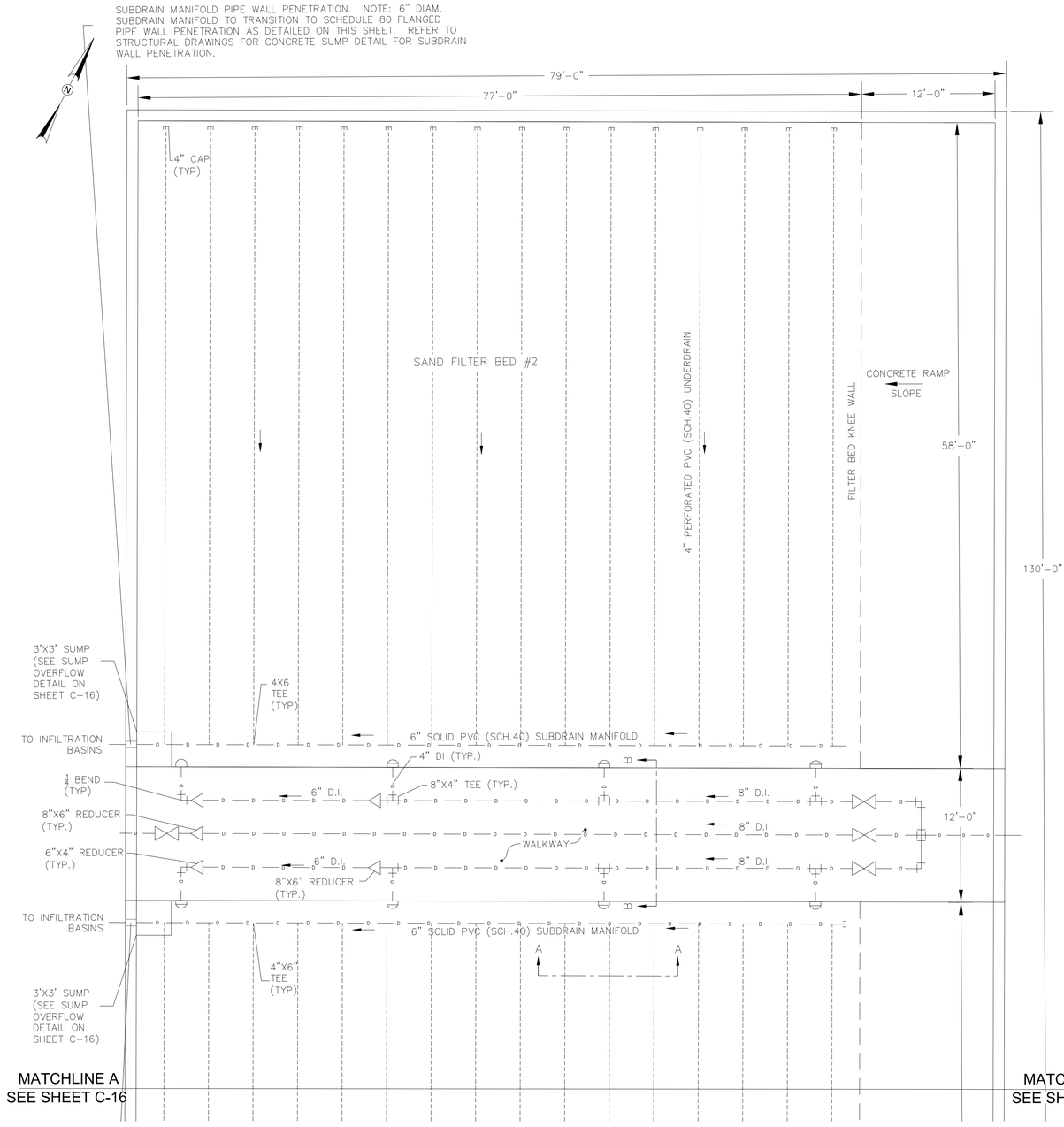
PERFORATION HOLE PLACEMENT DETAIL FOR FILTER BED UNDERDRAIN
SCALE: N.T.S.



SECTION A - A
SCALE: NTS



6-INCH SUBDRAIN MANIFOLD WALL PENETRATION DETAIL
SCALE: N.T.S.



FILTER BED PLAN VIEW
SCALE: NTS

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0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
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SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS IV

DRAWING NO.:
C-15
SHEET NO. 16 OF 18

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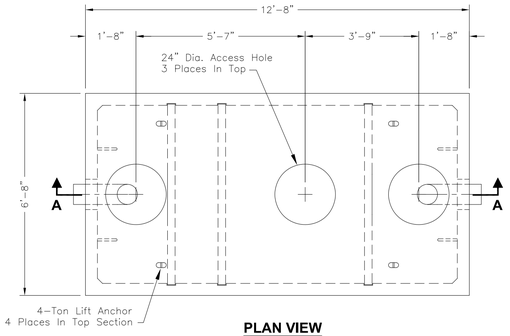
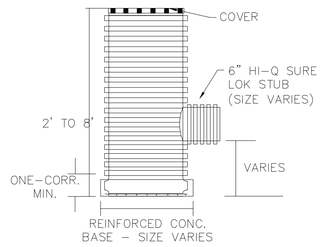
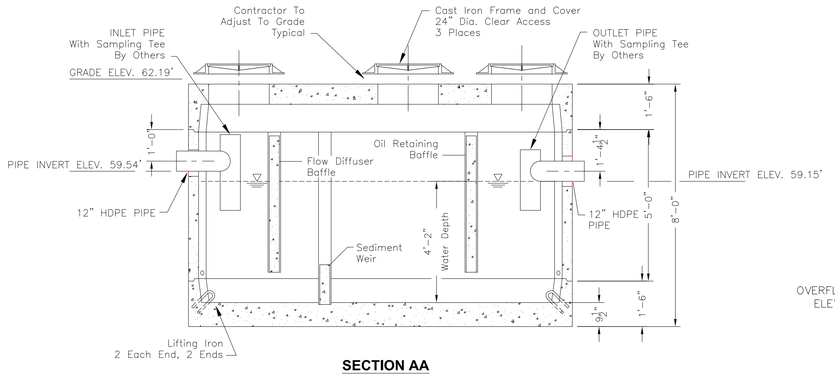


PLAN VIEW
Castings Not Shown



ROOF DRAIN ACCESS CLANOUT
SCALE: N.T.S.

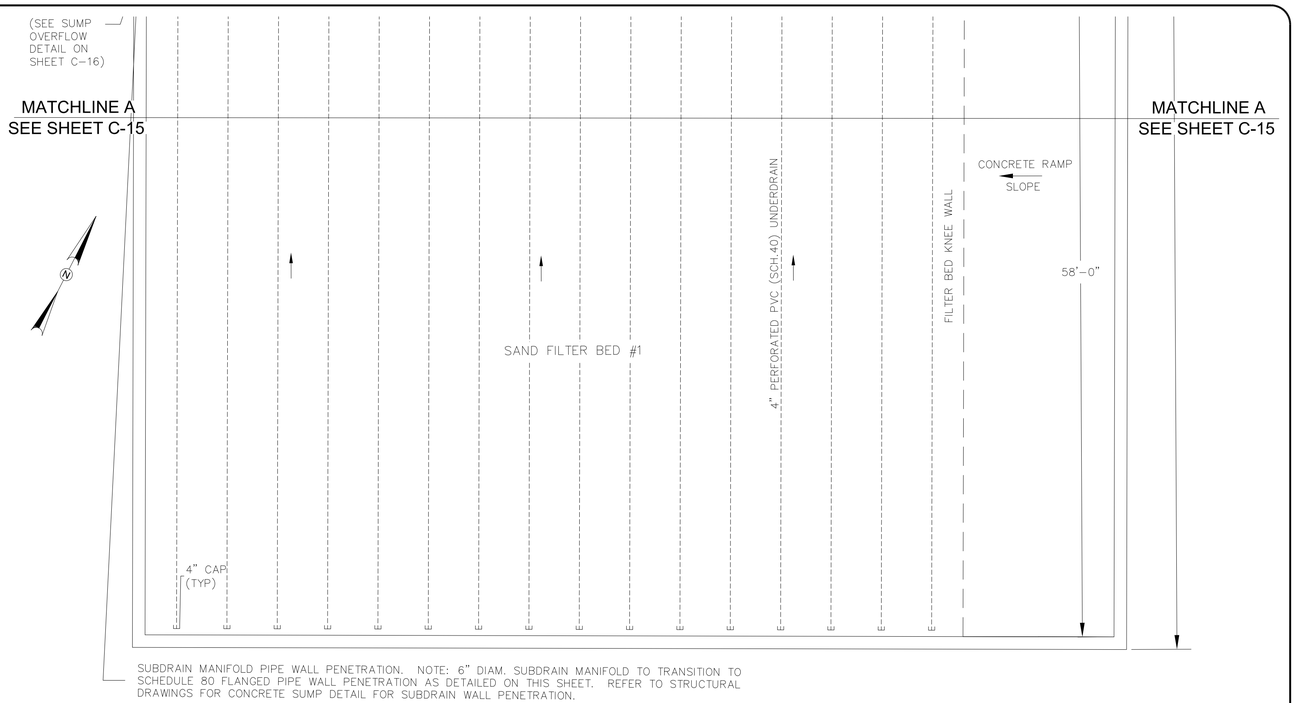


SECTION AA

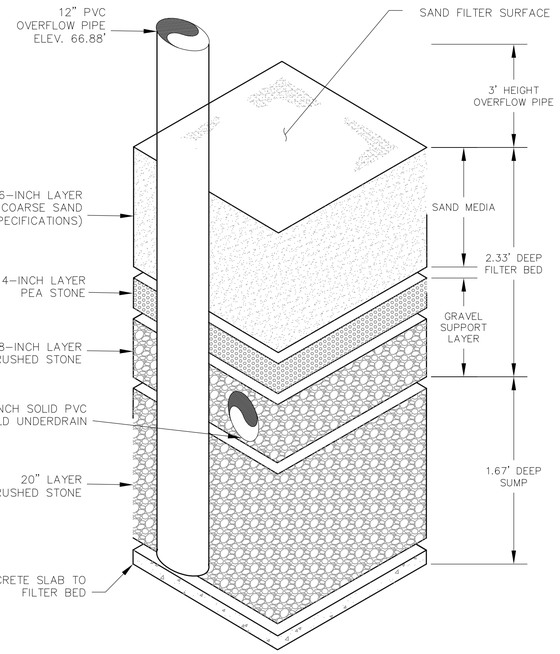
GENERAL NOTES:

1. CONCRETE: 28 DAY COMPRESSIVE STRENGTH f'c = 7,000 PSI
2. STEEL REINFORCEMENT: ATSMA-615 GRADE 60
3. MESH: ATSM A-185 GRADE 65
4. DESIGN: ACL-318-05 BUILDING CODE
   ATSM C-890 MINIMUM STRUCTURAL DESIGN
5. LOADS: HS-20 TRUCK WHEEL W/ 30% IMPACT PER AASHTO
6. OIL/GRIT SEPARATOR CAPACITY = 2,200 GALLONS
7. OIL/GRIT SEPARATOR UNIT SHALL BE OLDCASTLE PRECAST MODEL 612SA OR EQUAL.

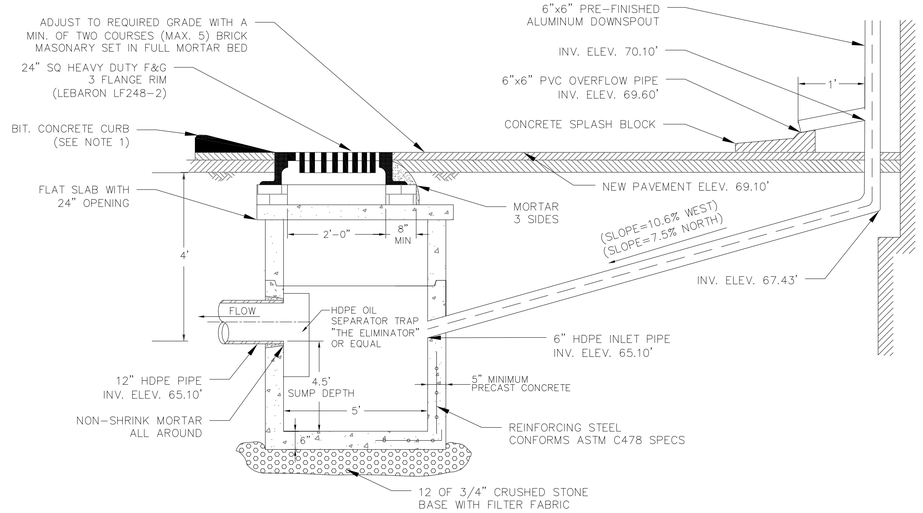
OIL / GRIT SEPARATOR
SCALE: 1" = 30'



FILTER BED PLAN VIEW
SCALE: 3/16" = 1'



SUMP OVERFLOW
SCALE: N.T.S.



GENERAL NOTES:

1. MANHOLE DESIGN TO CONFORM TO LASTEST ASTM C478 SPEC. FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".

PRECAST CONCRETE CATCH BAISN
SCALE: N.T.S.

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NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS STEPHEN C. OLSON REGISTERED PROFESSIONAL ENGINEER 6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS V

DRAWING NO.:
C-16
SHEET NO. 20 OF 42

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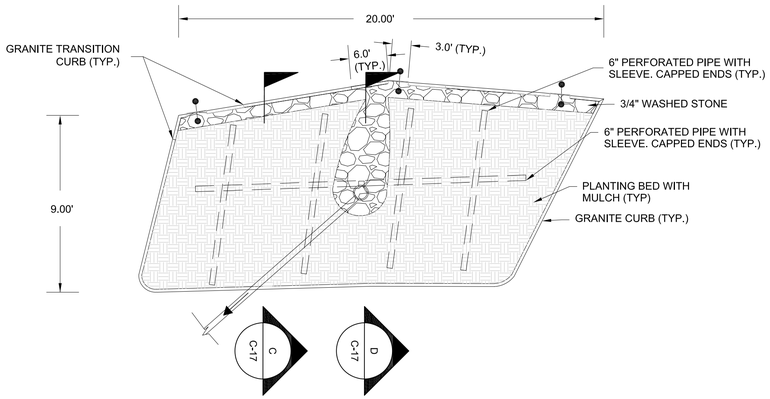
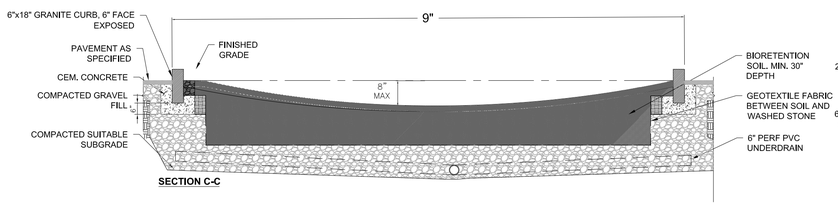
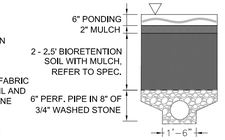


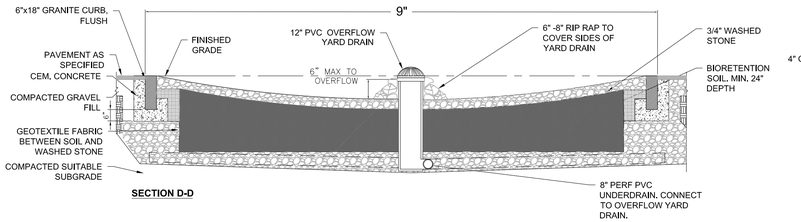
LAYOUT PLAN



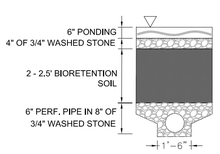
SECTION C-C



BIORETENTION MATERIALS SECTION

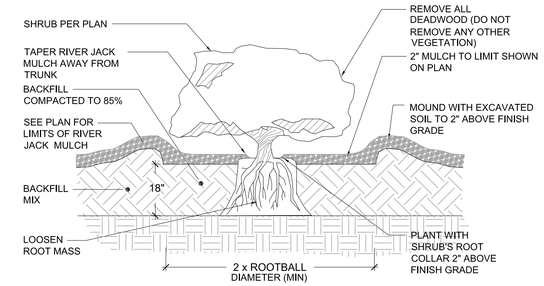


SECTION D-D

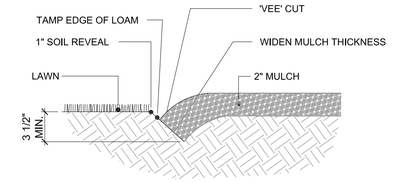


BIORETENTION MATERIALS SECTION

FILTERING RAIN GARDEN
SCALE: N.T.S.

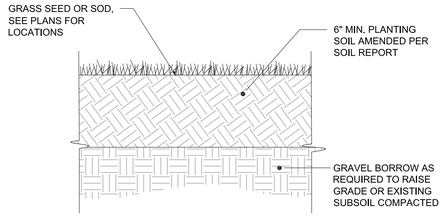


CONTAINER GROWN TREE & SHRUB PLANTING
SCALE: N.T.S.

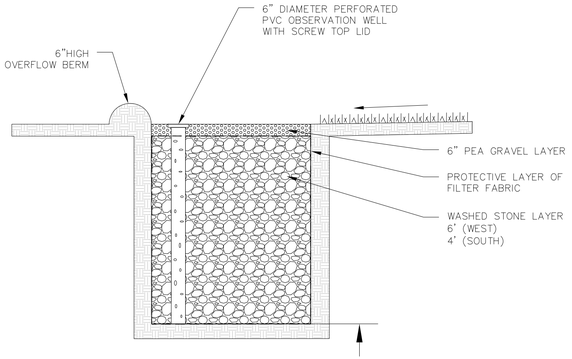


NOTE; LOCATE BEDLINE AS SHOWN ON PLAN.

BEDLINE EDGE
SCALE: N.T.S.

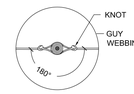


LOAM AND SEED OR SOD
SCALE: N.T.S.



GENERAL NOTES:
1. STONE FILL SHALL BE 2"–5" IN DIAMETER.

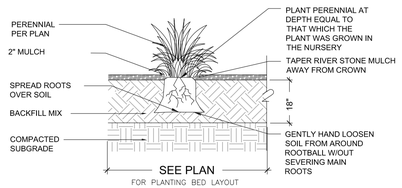
INFILTRATION TRENCH
SCALE: N.T.S.



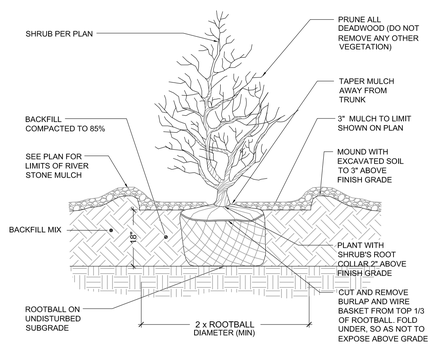
GUYING DETAIL
NTS

NOTE:
AFTER THE GUARANTEE PERIOD THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REMOVAL OF STAKES AND GUY WEBBING.

EVERGREEN TREE STAKING & PLANTING
SCALE: N.T.S.



PERENNIAL AND GROUND COVER PLANTING
SCALE: N.T.S.



SHRUB PLANTING
SCALE: N.T.S.

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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. OLSON — REGISTERED PROFESSIONAL ENGINEER — 6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS VI

DRAWING NO.:
C-17

SHEET NO. 18 OF 18

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Appendix E – Soils Data

Soil Map—Barnstable County, Massachusetts
(Barnstable Fire District Wells 3&4 WTP)



Map Scale: 1:9,580 if printed on B landscape (17" x 11") sheet.

N

0 100 200 400 600 Meters

0 450 900 1800 2700 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Barnstable County, Massachusetts
Survey Area Data: Version 24, Sep 5, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 10, 2022—Jun 30, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	111.4	10.2%
53A	Freetown muck, ponded, coastal lowland, 0 to 1 percent slopes	2.2	0.2%
54A	Freetown and Swansea mucks, coastal lowland, 0 to 1 percent slopes	7.2	0.7%
55A	Freetown coarse sand, 0 to 3 percent slopes, sanded surface	1.4	0.1%
242C	Hinckley loamy sand, 8 to 15 percent slopes	35.3	3.2%
245A	Hinckley loamy sand, 0 to 3 percent slopes	4.6	0.4%
245B	Hinckley loamy sand, 3 to 8 percent slopes	55.3	5.1%
252C	Carver coarse sand, 8 to 15 percent slopes	22.4	2.1%
252D	Carver coarse sand, 15 to 35 percent slopes	22.2	2.0%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	156.8	14.4%
264A	Eastchop loamy fine sand, 0 to 3 percent slopes	45.3	4.2%
264B	Eastchop loamy fine sand, 3 to 8 percent slopes	12.4	1.1%
264C	Eastchop loamy fine sand, 8 to 15 percent slopes	150.5	13.8%
435C	Plymouth loamy coarse sand, 8 to 15 percent slopes	60.6	5.6%
435D	Plymouth loamy coarse sand, 15 to 35 percent slopes	35.9	3.3%
436C	Plymouth loamy coarse sand, 8 to 15 percent slopes, very stony	10.8	1.0%
483C	Plymouth-Barnstable complex, rolling, very bouldery	45.2	4.2%
483D	Plymouth-Barnstable complex, hilly, very bouldery	174.3	16.0%
488C	Barnstable-Plymouth complex, rolling, bouldery	31.1	2.9%
600	Pits, sand and gravel	46.9	4.3%
602	Urban land	35.0	3.2%
665	Udipsamments, smoothed	21.0	1.9%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Totals for Area of Interest		**1,087.9**	**100.0%**

JOHN TURNER CONSULTING

JTC Project No.: 25-04-150
January 13, 2026

GEOTECHNICAL ENGINEERING REPORT

PROPOSED WATER TREATMENT PLANT
FAIRWELL LANE
BARNSTABLE, MASSACHUSETTS

Prepared for:
H_2Olson Engineering, Inc.
10 Riverside Drive, Suite 103
Lakeville, MA 02347

Prepared by:
John Turner Consulting, Inc.

January 13, 2026

Peter Newton, P.G.
H_2Olson Engineering, Inc.
10 Riverside Drive, Suite 103
Lakeville, MA 02347
P: 508-965-2037
E: pgn@h20lsonengineering.com

RE: Geotechnical Engineering Report
Proposed Water Treatment Plant
Fairwell Lane
Barnstable, Massachusetts

Dear Mr. Newton:

John Turner Consulting, Inc. (JTC) is pleased to present this Geotechnical Engineering Report for the above captioned project. The purpose of our services was to obtain information on the subsurface conditions at the site and to provide geotechnical engineering recommendations to support the planning, design, and construction of the proposed development.

This report completes our scope of services under the approved contract. We appreciate the opportunity to assist you on this project and look forward to working with you through its completion. Please do not hesitate to contact us if you have any questions or require additional information.

Respectfully,
JOHN TURNER CONSULTING, INC.



Stephen C. Lanne, PE
Vice President of Engineering
P: 413.222.1675
E: slanne@consultjtc.com

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1.0 PROJECT INFORMATION

To complete our work, JTC referenced the following information that you provided:

- Preliminary Floor Plan, by H_2Olson, Sheet No. M-1, dated October 2025;
- Aerial photographs and surficial geologic maps of the area.

1.1 Site Description

The following table summarizes our understanding of the existing site:

ITEM	DESCRIPTION
Location	Fairwell Lane, Barnstable, MA
Existing Improvements	Undeveloped site
Current Ground Cover	Densely wooded area
Topography	Relatively flat
Regional Geology [1]	End moraine deposits of sand, gravel, and boulders
1. Likely native soils based on local, publicly available surficial geology map	

1.2 Proposed Development

The following table summarizes our understanding of the project:

ITEM	DESCRIPTION
Structure	Single-story water treatment plant Two sand filters
Size	Building – 3,534 square feet (sf) Sand filters – 3,700 sf each
Finished Floor	Elevation (El) = 63 feet (estimated)
Loads	Strip footings: 2 to 3 kips per linear foot (klf) (assumed) Slab-on-grade: 200 pounds per square foot (psf) (assumed)
Basement	Under building slab 40,000 gal water tank Sand filters extended below grade
Cut/Fill - Building	Cut: Up to 10 feet (assumed – for under slab water tank) Up to 3 feet for finished grade (estimated) Fill: Minimal +/- 3 ft (assumed)
Cut/Fill - Site	Cuts: Minimal +/- 3 ft (assumed) Fill: Minimal +/- 3 ft (assumed)

ITEM	DESCRIPTION
Retaining Walls	Up to 10 ft (assumed – for under slab water tank) Up to 6 ft (assumed – for sand filters
Slopes	Unknown
Pavements	Unknown
Drainage Areas	Unknown

2.0 GEOTECHNICAL EXPLORATIONS

The following table summarizes the field exploration program performed at the site:

ITEM	DESCRIPTION
Soil Borings	
Dates	12/4/25 through 12/5/25
Drilling Contractor	GeoSearch, Inc.
Drilling Rig	ATV-mounted CME
Number of Borings	5, B-1 through B-5
Boring Depth Range	22 to 46 feet below ground surface (bgs)
Drilling Method	4¼-inch internal diameter hollow stem augers (HSA)
Sampling Method	Standard Penetration Tests (SPTs) 2-inch outside diameter split-spoon samplers

The attached *Exploration Location Plan* depicts the approximate locations of the explorations.

JTC directed the explorations, field testing, and sampling activities and logged the subsurface conditions encountered at each exploration location. Soil samples were sealed in moisture-tight containers and returned to JTC's office for further review, classification, and/or testing. The explorations were backfilled with spoils prior to departing the site. Laboratory testing results are included in the appendix *Laboratory Testing Reports*.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Subsurface Profile

The following table provides a general summary description of the typical subsurface conditions encountered in the explorations. Detailed descriptions of the conditions observed at each exploration are provided in the appendix *Exploration Logs*.

LAYER	LAYER DESCRIPTION	CLASSIFICATION/TYPE	USCS	DEPTH TO TOP (FEET)	THICKNESS (FEET)	RELATIVE DENSITY/RQD	NOTES
1	Surface Materials	Forest Mat	-	0	0 – 0.3	-	
2	Subsoil	Orange Brown Silty Sand, rootlet	SM	0.2 – 0.3	0.5	Loose	
3	Native Sand	Silty Sand Well Graded Sand with Silt and Gravel Poorly Graded Sand Poorly Graded Sand with Gravel	SM SW SP	0.7	>46	Loose to dense	Typically loose beneath subsoil. Medium dense to dense from 5ft and below

Bedrock was not encountered in the explorations.

3.2 Groundwater

The following table provides a summary description of the observed groundwater levels encountered in the explorations. Detailed descriptions of the conditions observed at each exploration are provided in the appendix *Exploration Logs*.

EXPLORATION NUMBER	GROUNDWATER DEPTH (FEET)	OBSERVATION NOTES
B-2	30	Open borehole
B-5	26	Open borehole

Groundwater level observations made at the time of the explorations should be considered approximate. JTC estimates that this investigation occurred during a period of seasonally normal ground water levels.

Fluctuations in groundwater level should be expected to occur because of seasonal rainfall variations, runoff, grade adjustments on and around the site, as well as surrounding drainage improvements, and other factors. Water may also become temporarily perched over low permeability soils or bedrock. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 EARTHWORK

- Earthwork recommendations apply to site earthwork and subgrade preparation for foundations, slabs-on-grade, pavements, and retaining walls.
- See the appendix *Additional Earthwork Recommendations* for additional guidance.

4.1 Site Preparation

- The Geotechnical Engineer should directly observe key subgrade preparation and earthwork. At a minimum, the Geotechnical Engineer should observe:
  - removal of unsuitable materials within the building footprint
  - observation and proofrolling of foundation and slab-on-grade subgrades, prior to placing fill or preparing for concrete placement
- Subgrade conditions will be influenced by excavation methods, precipitation, stormwater management, groundwater control(s), and/or construction activities. The site soils contain substantial proportions of fine sand and/or silt that may degrade and/or become unworkable when subjected to construction traffic or other disturbance during wet conditions. The Contractor should be aware of these conditions and take precautions to minimize subgrade disturbance.
- The site should be cleared and stripped of existing pavement/concrete; existing trees/vegetation; Topsoil, Rootmat, Forest Mat; loamy/organic-laden Subsoil; spoils generated from other work; and any otherwise unsuitable materials. Stripping should include removal of the root structure of trees and shrubs. Organic soils may be deeper within and around the root structure.
- Loose, soft, wet, and/or otherwise unsuitable soils should be over-excavated to expose suitable soils, or other remedial measures should be taken, as directed by the Geotechnical Engineer. Over-excavations should be backfilled with properly placed and compacted fill, as appropriate for the location.
- Following clearing, stripping, cutting, and/or over-excavation, the exposed subgrade soils should be proof-rolled as recommended in the appendix *Additional Earthwork Recommendations* and to the satisfaction of the Geotechnical Engineer. Proof-rolling should not be performed if the exposed subgrade soils are wet, as this may result in soil pumping and instability. Therefore, the proof-rolling efforts, should be directed by the on-site Geotechnical Engineer.
- Should groundwater be encountered during foundation or utility excavations, it is expected that it will be limited in volume and/or occur as relatively slow seepage which may be controlled through standard sump and pump methods of dewatering. However, wellpoints or other more rigorous means of dewatering may be necessary in the event that sumps and pumps prove unsatisfactory.
- Pavement and slab-on-grade subgrades should be restored and proof compacted after installing utilities.
- The Geotechnical Engineer should be provided and review all earthwork testing and inspection reports.

4.2 Fill Materials

- To facilitate placement, stability of subgrades during construction, and long-term performance of the project, we recommend the following engineered fill material requirements:

FILL TYPE [1]	LOCATION	RECOMMENDATIONS	MINIMUM COMPACTION [2]
Structural Fill	Below and inside settlement sensitive structures	Well-graded, Granular soils; maximum particle size 4 inches; <15% passing #200 sieve	95%
Common Fill	Site fill, behind retaining walls	Granular soils; maximum particle size 6 inches; <25% passing #200 sieve	92% below 3 ft of finished grade or within 3 ft of back of wall 95% within 3 ft of finished grade or beyond 3 ft of back of wall
General Fill	Landscape areas with no site improvements or slopes	Workable soil materials	90%
Non-Frost Susceptible Fill	Within the frost depth below settlement sensitive structures	Granular soils; maximum particle size 4 inches; <8% passing #200 sieve	95%
Slab and Pavement Base Course	Directly below slabs and pavements	Granular soils and crushed rock aggregate blend meeting local DOT requirements	95%
Crushed Stone	As Structural Fill, for wet subgrades, and drainage aggregate	Crushed durable rock; maximum particle size ¾ inch; <10% passing #4 sieve	Multiple passes of compaction equipment until fully seated

1. Fill materials should be free of organics, clays, frozen materials, debris, brush or tree materials, trash, and otherwise unsuitable materials, and be at workable moisture content, i.e. +/- 3% of optimum.
2. Minimum compaction requirements refer to percentage of maximum dry density per ASTM D1557C.

4.3 Re-Use of Site Soils

- Soils excavated during site development may be re-used as engineered fill as tabulated below:

SOIL TYPE	SUITABILITY FOR RE-USE	NOTES
Silty Sand	Common Fill, General Fill	High fines content
Well Graded Sand/Poorly Graded Sand	Structural Fill, Common Fill	

- Materials proposed for re-use should be segregated and stockpiled based on composition. Bulk samples should be submitted for laboratory testing to demonstrate conformance with the project specifications. Non-conforming materials may be blended with more granular soils or aggregate and/or screened to meet the recommended gradation. Alternately, these materials could be used in landscaped areas or disposed of offsite.

5.0 FOUNDATIONS

5.1 Foundation Design Recommendations

- Design recommendations for shallow foundations are tabulated below:

DESCRIPTION	VALUE
Bearing Stratum	Proof-rolled Native Sand
Allowable Bearing Pressure	3,000 psf
Design Frost Depth for Exterior Foundations (from finished grade)	4 feet
Estimated Depth to Groundwater (from existing grade)	>26 ft
Minimum Strip Footing Width	1.5 ft
Minimum Isolated Footing Width	2.5 ft
Estimated Maximum Total Settlement	1 inch
Estimated Maximum Differential Settlement	½ inch
Total Unit Weight of Bearing Material	120 pcf
Friction Angle of Bearing Material	30 degrees
Cohesion of Bearing Material	0 psf
Passive Earth Pressure Coefficient	3.0
Coefficient of Sliding Friction – concrete cast on prepared subgrade	0.4

5.2 Foundation Subgrade Preparation

- The foundation bearing soils should be proof compacted in the presence of the Geotechnical Engineer to densify near surface soils disturbed during the excavation process and to assess stability of the subgrade.
- Due to elevated fines content, foundation subgrade soils may be easily disturbed with increased moisture content and construction traffic. The subgrade could be protected from disturbance with a minimum 6-inch thick layer of ¾-inch minus crushed stone fully-wrapped in a geotextile separation fabric. The fabric and crushed stone should be placed immediately following proof-rolling of the subgrade soils and seated with multiple passes with a plate compactor.
- See the appendix *Additional Earthwork Recommendations* for additional guidance.

5.3 Seismic Considerations

PARAMETER	VALUE
Seismic Site Class	C
Liquefaction Potential	Not Susceptible

5.4 Slab-On-Grade

- Design recommendations for floor slabs-on-grade are tabulated below:

DESCRIPTION	VALUE
Bearing Stratum	Proof-rolled Native Sand
Slab Base Course Thickness	9 inches
Modulus of Subgrade Reaction	125 pci

- The floor slab should be isolated structurally from foundation walls and columns/piers to allow for differential movement.
- The slab-on-grade subgrade should be restored by the Contractor and evaluated by the Geotechnical Engineer following installation of sub-slab utilities.
- The requirement for a moisture/vapor barrier beneath floor slab-on-grade should be evaluated by others.
- Sub-slab drainage is not required.

6.0 RETAINING WALLS

Retaining wall foundations should be designed and subgrades prepared using the same recommendations as building foundations. The following table outlines the recommended lateral earth pressure coefficients for the design of site retaining walls. These parameters are not applicable for the design of reinforced, modular block walls.

WALL CONDITION	LATERAL MOVEMENT (D/H)	EARTH PRESSURE COEFFICIENT (K)	EQUIVALENT FLUID DENSITY ($K*\gamma$) [1,2,3]
Cantilever – Unrestrained - (Active Earth Pressure)	>0.002	Ka = 0.33	42 pcf
Braced - Restrained or Bedrock <H ft behind wall - (At Rest Earth Pressure)	<0.002	Ka = 0.5	63 pcf
Passive - Unrestrained	>0.02	Ka = 3.0	375 pcf

1. Hydrostatic pressures are not included;
2. Assumes level grading in front of and behind the wall;
3. Parameters do not include Factors of Safety.

where: D = deflection at top of wall by rotation or lateral translation
H = exposed height of wall
γ = soil unit weight – 125 pcf – assumes compacted *Common or Structural Fill*

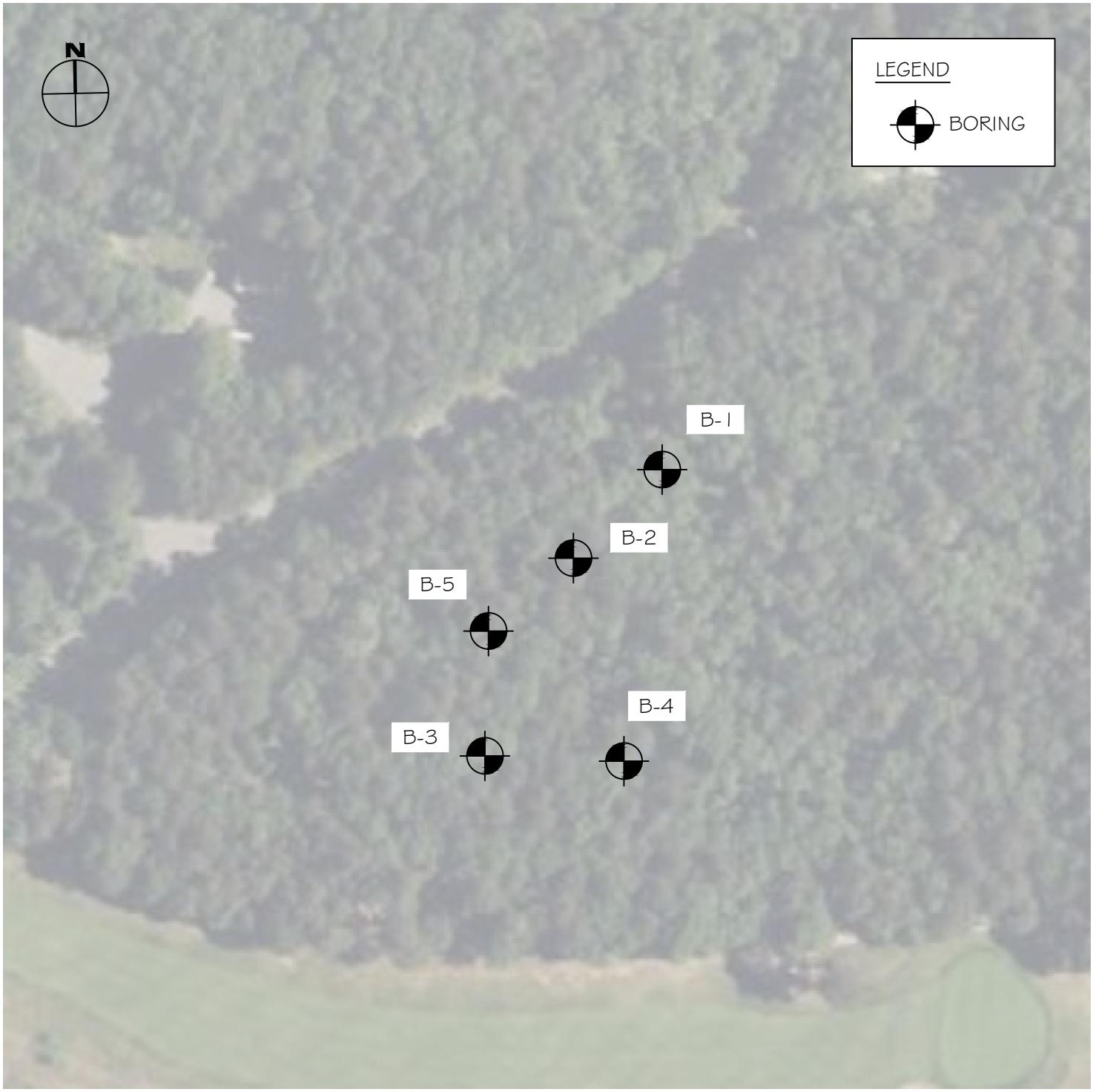
- Retaining walls should be designed to accommodate any possible surcharge loads located within a horizontal distance equal to the height of the wall. Surcharges should be added as a uniform pressure equal to the vertical surcharge pressure multiplied by the appropriate earth pressure coefficient.
- To account for possible soil softening due to saturation and freeze thaw action, passive pressure should be ignored in the upper two feet below finished grade on site retaining walls.
- A drainage system should be installed behind the wall to prevent the buildup of hydrostatic pressure. The drainage system should consist of the following:
  - Chimney Drain - Minimum 12-inch-wide column of Crushed Stone placed directly behind the wall
  - Collector Drain – Minimum 4-inch diameter perforated PVC pipe installed at the base of the chimney drain, discharged through weep holes or into the stormwater collection system.
  - Weep Holes – (For free-standing retaining walls). Minimum 4-inch diameter solid PVC pipe connected at maximum 30-foot spacing to the collector drain and discharging through the face of the retaining wall at least 12 inches above finished grade to limit the potential for clogging from debris, soils, snow/ice, etc.
  - Grading should direct stormwater runoff away from retaining walls, wherever possible. Provide drainage swales at the top of the retaining wall when stormwater cannot be directed away. Surface materials adjacent to the wall should be relatively impermeable to reduce infiltration.
- If drainage is not provided, the design should include retaining hydrostatic pressures.
- The retaining wall design should consider the possibility of future excavations in front of the wall.
- Global stability analysis should be completed for free-standing retaining walls greater than 5 feet in height.

7.0 CLOSING

We recommend that JTC be retained during design development to review the plans and specifications, to assess conformance with our geotechnical recommendations and during the construction phase to evaluate earthwork operations and review subgrade soils for consistency with our assumptions.

We trust the contents of this report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office. The contents of this report are subject to the attached *Limitations*.

APPENDIX A: SITE PLAN & EXPLORATION LOCATION PLAN



Notes:

1. Explorations were performed on December 4, 2025, by GeoSearch, Inc. of Sterling, MA, under the direction of JTC.
2. Exploration locations should be considered approximate.
3. Refer to the Exploration Logs for the subsurface conditions encountered at each exploration location.
4. Basemap source: Aerial Image by Microsoft Corporation, accessed on December 24, 2025.
5. Drawing Scale: 1 inch = 100 feet

DATE:	12/24/2025
JOB #	25-04-150
DRAFT:	AP
DESIGN:	AP
REVIEW:	SL
REVISIONS:	

DRAWING NAME: EXPLORATION LOCATION PLAN

PROJECT: PROPOSED WATER TREATMENT PLANT
BARNSTABLE, MASSACHUSETTS

CLIENT: H2OLSON ENGINEERING, INC.
LAKEVILLE, MASSACHUSETTS

JOHN TURNER CONSULTING

DRAWING #: 1

APPENDIX B: EXPLORATION LOGS & KEY TO SYMBOLS & DESCRIPTIONS

JOHN TURNER CONSULTING

LOG OF BORING No. B-1

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150
CLIENT: H2Olson Engineering, Inc.
PROJECT LOCATION: Fairwell Lane, Barnstable, MA
LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**
DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor
DRILLING METHOD: 4.25-inch HSA **DATE:** 12/4/25
DEPTH TO - WATER> INITIAL: NE **AFTER 24 HOURS:**

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
0	[FOREST MAT] 2 inches dark brown, Silty Sand, rootlets, leaves			SS01	1 1 6 7	
	0.2					
	[SUBSOIL] Orange brown, Silty Sand (SM), rootlets, loose			SS02	4 2 2 4	
	0.7					
5	[NATIVE SAND] Light brown, Silty Sand (SM), loose			SS03	5 8 8 9	
	Tan, Well graded Sand (SW) with Silt and Gravel, medium dense			SS04	8 9 11 11	
10	Tan, Poorly Graded Sand (SP), medium dense			SS05	5 6 7 7	
15	-becomes coarser			SS06	4 9 10 14	
20				SS07	8 9 13 13	
25	-mottling			SS08	4 8 13 12	
	-1/2 inch grey-brown seam of very fine sand					
30	-becomes dense			SS09	7 13 34 26	
	Boring terminated at 32 ft.					
35						

TEST RESULTS
Plastic Limit ⊢⊣ Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-2

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150
CLIENT: H2Olson Engineering, Inc.
PROJECT LOCATION: Fairwell Lane, Barnstable, MA
LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**
DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor
DRILLING METHOD: 4.25-inch HSA **DATE:** 12/4/25
DEPTH TO - WATER> INITIAL: ▽ 30 **AFTER 24 HOURS:** ▽

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
0	[FOREST MAT] 2 inches dark brown, Silty Sand, rootlets, leaves			SS01	1 1 2 1	
	0.2 [SUBSOIL] Brown, Silty Sand (SM), rootlets, very loose			SS02	1 2 3 5	
	0.7 [NATIVE SAND] Light brown to tan, Well Graded Sand (SW) with Silt and Gravel, loose			SS03	7 12 7 7	
5	Tan, Poorly Graded Sand (SP), medium dense			SS04	6 7 8 15	
10				SS05	14 10 15 17	
15				SS06	11 21 20 27	
20	-becomes coarser			SS07	10 15 17 17	
25	-mottling			SS08	52 9 10 13	
30 ▽				SS09	5 7 9 10	
	Boring terminated at 32 ft.					
35						

TEST RESULTS
Plastic Limit ⊢⊣ Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-3

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150

CLIENT: H2Olson Engineering, Inc.

PROJECT LOCATION: Fairwell Lane, Barnstable, MA

LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**

DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor

DRILLING METHOD: 4.25-inch HSA **DATE:** 12/4/25

DEPTH TO - WATER> INITIAL: NE **AFTER 24 HOURS:**

TEST RESULTS

Plastic Limit ⊢⊣ Liquid Limit

Water Content - ●

Penetration - ▨

10 20 30 40 50

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
0	[FOREST MAT] 3 inches dark brown, Silty Sand, rootlets, leaves			SS01	1 1 1 1	
	0.2					
	[SUBSOIL] Orange brown, Silty Sand (SM), rootlets, very loose			SS02	2 3 4 4	
	0.7					
5	[NATIVE SAND] Light brown to tan, Silty Sand (SM), loose to medium dense			SS03	4 5 6 7	
				SS04	7 7 10 9	
10	Tan, Poorly Graded Sand (SP) with gravel, medium dense			SS05	8 11 14 20	
15				SS06	10 12 13 18	
20				SS07	14 13 13 18	
	Boring terminated at 22 ft.					
25						
30						
35						

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-4

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150

CLIENT: H2Olson Engineering, Inc.

PROJECT LOCATION: Fairwell Lane, Barnstable, MA

LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**

DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor

DRILLING METHOD: 4.25-inch HSA **DATE:** 12/4/25

DEPTH TO - WATER> INITIAL: NE **AFTER 24 HOURS:**

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
0	[FOREST MAT] 2 inches dark brown, Silty Sand, rootlets, leaves			SS01	3 3 3 3	
	0.2 [SUBSOIL] Orange brown, Silty Sand (SM), rootlets, loose			SS02	4 6 6 7	
	0.7 [NATIVE SAND] Light brown to tan, Silty Sand (SM), loose to medium dense			SS03	2 3 3 9	
5	Tan, Poorly Graded Sand (SP) with gravel, loose to medium dense			SS04	7 7 8 9	
10				SS05	6 7 9 9	
15	-becomes coarser			SS06	4 6 6 8	
20				SS07	3 3 7 15	
	Boring terminated at 22 ft.					
25						
30						
35						

TEST RESULTS

Plastic Limit ⊢⊣ Liquid Limit

Water Content - ●

Penetration - ▨

10 20 30 40 50

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-5

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150
CLIENT: H2Olson Engineering, Inc.
PROJECT LOCATION: Fairwell Lane, Barnstable, MA
LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**
DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor
DRILLING METHOD: 4.25-inch HSA **DATE:** 12/5/25
DEPTH TO - WATER> INITIAL: ▽ 26 **AFTER 24 HOURS:** ▽

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS
0	[FOREST MAT] 2 inches dark brown, Silty Sand, rootlets, leaves			SS01	1/12 - 1 1		Plastic Limit ⊢⊣ Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50
	0.2 [SUBSOIL] Orange brown, Silty Sand (SM), rootlets			SS02	2 2 3 9		
5	0.7 [NATIVE SAND] Light brown, Silty Sand (SM), very loose to loose			SS03	3 4 6 5		
	5 Tan, Well Graded Sand (SW) with Silt and Gravel, medium dense to dense			SS04	7 9 10 10		
10				SS05	11 16 19 20		
15				SS06	7 10 10 12		
20	Tan, Poorly Graded Sand (SP), loose to medium dense mottling			SS07	7 12 12 7		
25	-becomes coarser			SS08	4 13 7 5		
30				SS09	7 2 3 13		
35				SS10	4 4 4		

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-5

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150

CLIENT: H2Olson Engineering, Inc.

PROJECT LOCATION: Fairwell Lane, Barnstable, MA

LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**

DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor

DRILLING METHOD: 4.25-inch HSA **DATE:** 12/5/25

DEPTH TO - WATER> INITIAL: ▽ 26 **AFTER 24 HOURS:** ▽

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
					4	
40				SS11	12 15 5 5	
45				SS12	33 15 12 12	
	Boring terminated at 46 ft.					
50						
55						
60						
65						
70						

TEST RESULTS

Plastic Limit ⊢—⊣ **Liquid Limit**

Water Content - ●

Penetration - ▨

10 20 30 40 50

This information pertains only to this boring and should not be interpreted as being indicative of the site.

MAJOR DIVISIONS			SYMBOLS		TYPICAL NAMES
COARSE-GRAINED SOILS OVER 50% > No.200 SIEVE SIZE	GRAVELS MORE THAN 1/2 OF COARSE FRACTION > No.4 SIEVE SIZE	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW		Well-graded gravels or gravel-sand mixtures, little or no fines
			GP		Poorly graded gravels or gravel-sand mixtures, little or no fines
		GRAVELS WITH OVER 15% FINES	GM		Silty gravels, gravel-sand mixtures
			GC		Clayey gravels, gravel-sand-clay mixtures
	SANDS MORE THAN 1/2 OF COARSE FRACTION < No.4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 5% FINES	SW		Well-graded sand or gravelly sands, little or no fines
			SP		Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH OVER 15% FINES	SM		Silty sand, sand-silt mixtures
			SC		Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS OVER 50% < No.200 SIEVE SIZE	SILTS & CLAYS LIQUID LIMIT 50% OR LESS		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LIQUID LIMIT GREATER THAN 50%		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH		Inorganic clays of high plasticity, fat clays
			OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS			PT		Peat and other highly organic soils

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KEY TO SYMBOLS AND DESCRIPTIONS

TYPICAL SYMBOLS

- Shelby Tube
- Auger Cuttings
- Standard Split Spoon Sample
- 3" Split Spoon Sample
- Rock Core
- Dynamic Cone Penetrometer
- Vane Shear
- Bulk/Grab Sample
- Geoprobe Sample
- Sonic or Vibro-Core Sample
- Water Table (at time of drilling)
- Water Table (after 24 hours)

SOIL MOISTURE MODIFIERS

Term	Description
Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

The descriptor "damp" should not be used (use "moist").
The descriptor "saturated" should not be used (use "wet").

WELL SYMBOLS

- Recessed Cover Set in Concrete
- Top of Well, Recessed Pipe
- Covered Riser
- Capped Riser w/ Locking Cover
- Pipe Riser
- Concrete Seal
- Gravel Backfill
- Assorted Cuttings
- Bentonite Slurry
- Bentonite Pellets
- Silica Sand, blank PVC
- Slotted Pipe w/ Sand
- Endcap on Pipe Packed in Sand
- Silica Sand, No Pipe (End Plug)

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.75
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.75
SAND	No. 4 to No. 200	4.75 to 0.075
coarse	No. 4 to No. 10	4.75 to 2.00
medium	No. 10 to No. 40	2.00 to 0.425
fine	No. 40 to No. 200	0.425 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

RELATIVE DENSITY/CONSISTENCY

Gravel, Sand, and Silt (nonplastic)		Silt (plastic) and Clay		
N-Value	Relative Density	N-Value	Su	Consistency
0 - 4	Very Loose	0 - 2	0 - 250	Very Soft
5 - 10	Loose	3 - 4	251 - 500	Soft
11-30	Medium Dense	5 - 8	501 - 1000	Medium Stiff
31 - 50	Dense	9 - 15	1001 - 2000	Stiff
51 +	Very Dense	16 - 30	2001 - 4000	Very Stiff
		31 +	4001+	Hard

Standard Penetration Testing (SPT) N_{60} based on blows per 12 inches.
WR = Weight of Rods; WH = Weight of Hammer

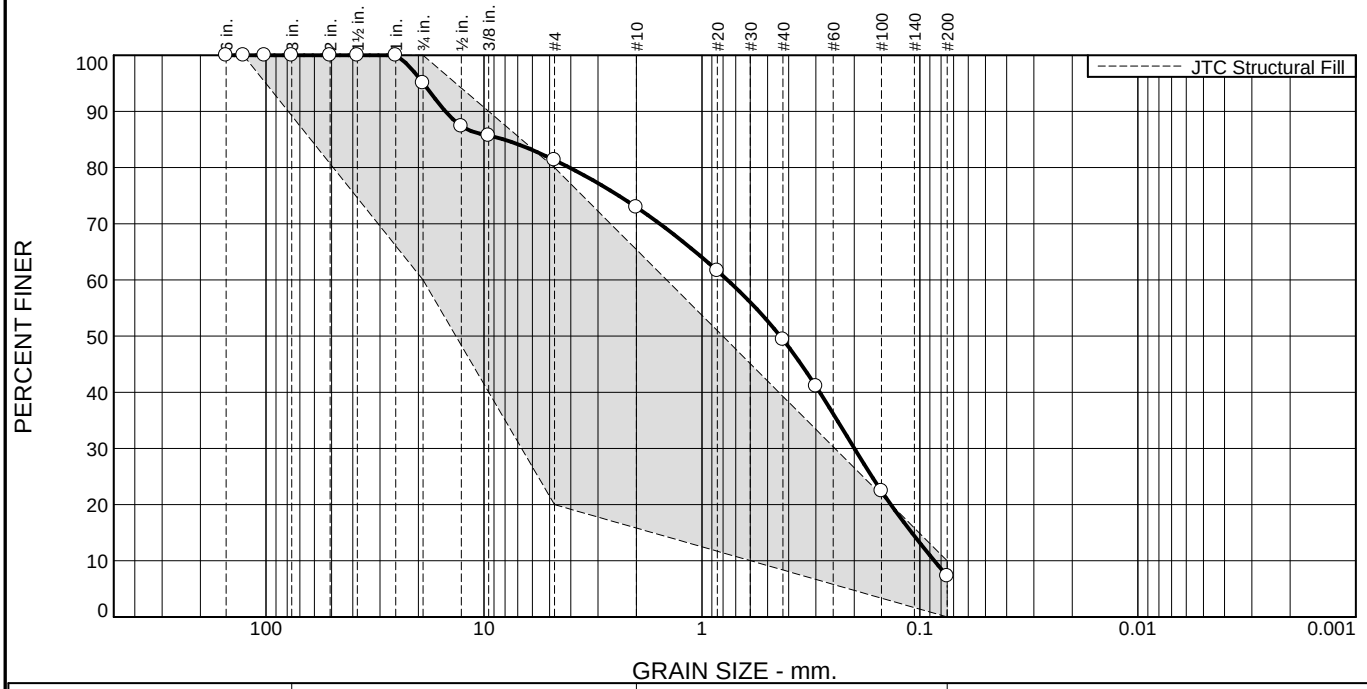
PERCENT OR PORTIONS OF SOIL

Term	Description
Parting:	> 1/16 in.
Seam:	0.5 in. to 1/16 in.
Layer:	12 in. to 0.5 in.
Stratum:	> 12 in.
Pocket:	Small erratic deposit
Lens:	Lenticular deposit
Occasional:	One or less per foot of thickness
Frequent	More than one per foot of thickness
Varved	Alternating seams or layers of silt and/or clay and sometimes f. sand

REFERENCE: UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488-93

APPENDIX C: LABORATORY TESTING REPORTS

Particle Size Distribution Report



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	27.0	23.6	42.1	7.3	

Test Results (ASTM C 136 & ASTM C 117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
6	100.0		
5	100.0	100.0	
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	95.1	60.0 - 100.0	
1/2	87.4		
3/8	85.7		
#4	81.3	20.0 - 80.0	X
#10	73.0		
#20	61.6		
#40	49.4		
#50	41.1		
#100	22.4		
#200	7.3	0.0 - 10.0	

* JTC Structural Fill

Material Description

Well Graded Sand with Silt and Gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=**

Coefficients

D_{90}= 15.0277 D_{85}= 8.1091 D_{60}= 0.7643
D_{50}= 0.4375 D_{30}= 0.1998 D_{15}= 0.1089
D_{10}= 0.0858 C_u= 8.91 C_c= 0.61

Remarks

3.8% Moisture

Date Received: 12/12/25 **Date Tested:** 12/15/25

Tested By: Alex Bair

Checked By: Mike Bronstein

Title: Branch Manager

Sample Number: B-1 SS03 **Depth:** 5-7 **Date Sampled:** 12/12/25

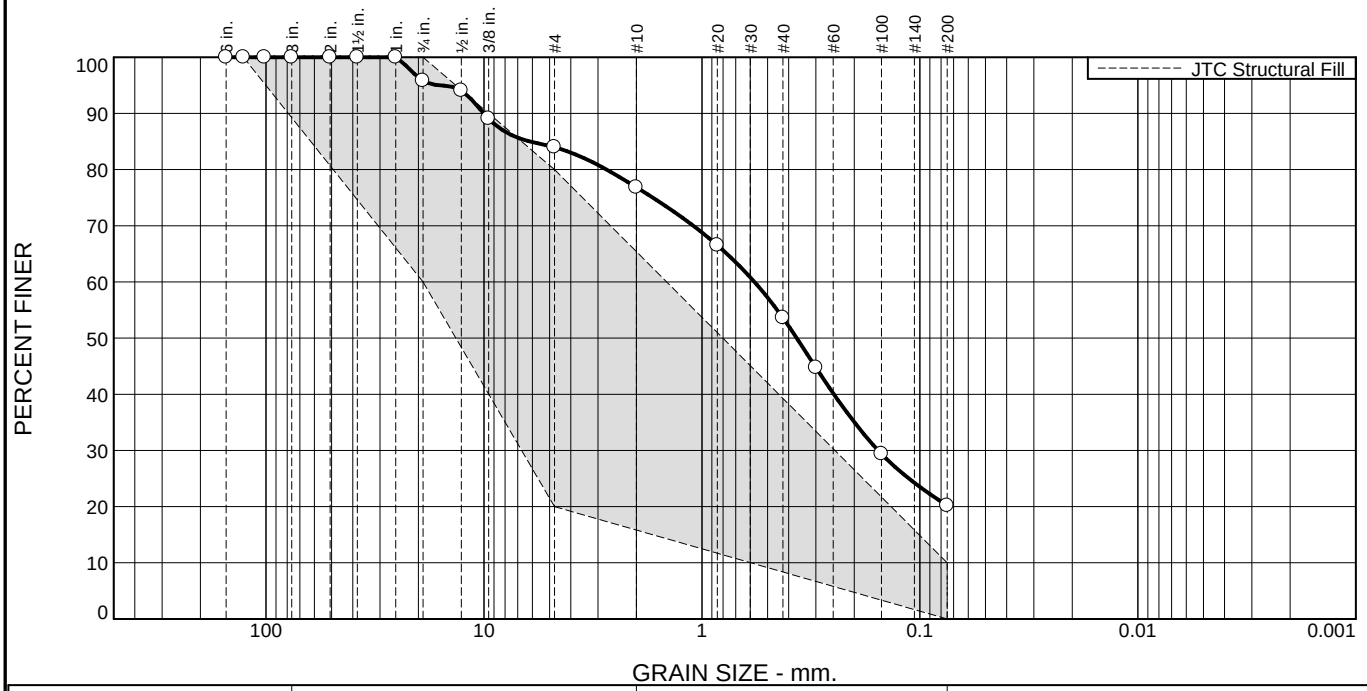
JOHN TURNER CONSULTING

Client: H2Olson Engineering, Inc.

Project: Proposed Water Treatment Plant
Fairwell Lane, Barnstable, MA

Project No: 25-04-150 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	23.1	23.3	33.4	20.2	

Test Results (ASTM C 136 & ASTM C 117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
6	100.0		
5	100.0	100.0	
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	95.8	60.0 - 100.0	
1/2	94.1		
3/8	89.1		
#4	84.0	20.0 - 80.0	X
#10	76.9		
#20	66.5		
#40	53.6		
#50	44.8		
#100	29.4		
#200	20.2	0.0 - 10.0	X

* JTC Structural Fill

Material Description

Silty Sand with Gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 10.0203 D_{85}= 6.1527 D_{60}= 0.5743
D_{50}= 0.3674 D_{30}= 0.1554 D_{15}=
D_{10}= C_u= C_c=

Remarks

8.7% Moisture

Date Received: 12/12/25 **Date Tested:** 12/15/25

Tested By: Alex Bair

Checked By: Mike Bronstein

Title: Branch Manager

Sample Number: B-5 SS02 **Depth:** 2-4 **Date Sampled:** 12/12/25

JOHN TURNER CONSULTING

Client: H2Olson Engineering, Inc.

Project: Proposed Water Treatment Plant
Fairwell Lane, Barnstable, MA

Project No: 25-04-150 **Figure**

APPENDIX D: SITE PHOTOGRAPHS

JOHN TURNER CONSULTING

PHOTO LOG

John Turner Consulting, Inc.	
Photo No. **1**	**Date:** 12/5/2025



Description: Site, facing South

Site Location: Fairwell Lane, Barnstable, MA	
Photo No. **2**	**Date:** 12/5/2025



Description: Drill Rig

John Turner Consulting, Inc.	
Photo No. **3**	**Date:** 12/5/2025



Description: B-1 (5-7 ft)

Site Location: Fairwell Lane, Barnstable, MA	
Photo No. **4**	**Date:** 12/5/2025



Description: B-5 (2-4 ft)

APPENDIX E: ADDITIONAL EARTHWORK RECOMMENDATIONS

Fill Placement and Compaction Recommendations

- The adequacy of compaction efforts should be verified by field density testing compared to the maximum theoretical density of the material as determined by ASTM D1557, Method C.
- All fill materials should be placed in lifts not exceeding 12 inches for heavy ride-on, vibratory rollers and 8 inches for hand-operated plate compactors.
- Crushed Stone should be placed in lifts, seated with compaction equipment, and completely wrapped in geotextile separation fabric.
- Where Recycled Building Materials are used as Structural Fill, placement and compaction should be observed by the Geotechnical Engineer.
- Fill should not be placed on soft, saturated, or frozen subgrade soils.

Grading and Drainage

- Grading and drainage should be provided at the site to direct stormwater runoff away from site improvements to reduce the likelihood of water ponding near the structure.
- Roof drains should discharge at least 5 feet from buildings or connect to the stormwater collection system.
- Drainage swales and/or edge drains should be added near the toe of slopes grading downward into the site to collect stormwater runoff. The swales or drains should be designed to direct stormwater runoff away from site improvements.
- Permanent fill or cut slopes should have a maximum slope of 2.5H:1V (horizontal to vertical) or flatter for dry conditions and 3H:1V for wet/submerged conditions. Steeper slopes may be possible with implementation of a slope stabilization system.
- All slopes should be protected from erosion during and after construction.

Removal of Existing Features

- Existing buildings, structures, associated foundations (including footings, foundation walls, slabs-on-grade, and/or basements), and/or utilities, should be completely removed from within proposed building areas. The resulting excavations should be replaced/backfilled with properly placed and compacted *Structural Fill.*
- Existing structures or subsurface utilities, including any private septic tank, leach field, and associated piping, located in areas outside of the proposed building areas may be removed or abandoned in place. Utilities abandoned in place should be plugged or capped to prevent migration of water. Tanks left in place should be filled. Structural elements to remain in place should be at least 3 feet below existing grade. Slabs left in place should be drilled or periodically broken to prevent ponding of water.

Subgrade Preparation

- Footing subgrades should be level or suitably benched and free of standing water and/or debris.
- Foundation subgrade soils should be protected against physical disturbance, precipitation, and/or frost throughout construction. The Contractor should be responsible for the means and methods to protect the foundation subgrade during construction.
- If shallow and/or perched groundwater is encountered, it must be removed in advance of excavation and continuously maintained at least 2 feet below the bottom of excavation and subsequent construction grade until the backfilling is complete.
- Over-excavation below foundations, if required, should include the *Foundation Zone of Influence (FZOI)* defined as the area extending from the edges of the footing outward and downward at a 1H:1.5V (horizontal to vertical) splay of bearing.

- The Contractor should take precautions to minimize subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing construction traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling excavations and footings as soon as practicable, grading and compacting exposed subgrades to promote surface water run-off and prevent ponding, and maintaining an effective dewatering program, as necessary.
- The following minimal proof-rolling efforts should be expected.
  - Building pad: 8 passes with a 10-ton smooth-drum roller
  - Foundation Trenches: 8 passes with a 5-ton smooth-drum roller
  - Utility Trenches: 4 passes with a vibratory plate compactor
  - Site: 8 passes with a 10-ton smooth-drum roller
- Proof-rolling should not be performed if the exposed subgrade soils are wet because this may result in soil pumping and instability. The proof-rolling efforts, including the number of passes and whether to use static or vibratory methods, should be directed by the Geotechnical Engineer
- Safe temporary excavation and/or fill slopes are the responsibility of the Contractor. Excavations should be conducted in accordance with local, state, and federal (OSHA) requirements, at a minimum. If an excavation cannot be properly sloped or benched due to space limitations, adjacent structures, water seepage, or other reasons, the Contractor should install an engineered excavation support system.
- If the subgrade should become frozen, wet, or disturbed, the affected material should be removed, or should be scarified, moisture conditioned, and recompacted.
- Proper groundwater control and stormwater management are necessary to maintain site stability. Groundwater should be removed in advance and continuously maintained at least 2 feet below the working construction grade until earthworks and/or backfilling are complete.
- If groundwater seepage and/or wet soils are observed at subgrade level, a ¾-inch minus crushed stone base may be placed over the exposed subgrade soils. The stone should be completely wrapped with a geotextile separation fabric. The fabric and stone should be immediately placed over the undisturbed subgrade and then tamped with a plate compactor until exhibiting stable conditions.
- Fill should not be placed on soft, saturated, or frozen subgrade soils.

Construction Dewatering

- Any seepage of groundwater or collected precipitation should be intercepted and maintained below the excavation bottom such that construction proceeds in the dry.
- Water collected from dewatering efforts should be screened and discharged per the project permits.

Foundation Backfill

- To minimize the potential for foundation wall damage during backfill and compaction activities, foundation wall backfill should be placed in a manner that maintains balanced fill height on both sides of the wall.

Construction Monitoring and Quality Control Testing

- A qualified geotechnical engineer or representative should be retained to review the site preparation and grading activities and foundation subgrade preparations, at a minimum. Similarly, quality control testing, including in-place field density and moisture tests, should be performed to confirm that the specified compaction is achieved. It is recommended that JTC be retained to provide earthwork construction monitoring and quality control testing services.

APPENDIX F: ASFE GEOTECHNICAL ENGINEERING REPORT INFORMATION

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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IIGER06085.0MRP

APPENDIX G: LIMITATIONS

Explorations

1. The analyses and recommendations presented in this report are based in part upon the data obtained from widely-spaced subsurface explorations. Subsurface conditions between exploration locations may vary from those encountered at the exploration locations. The nature and extent of variations between explorations may not become evident until construction. If variations appear, it will be necessary to re-evaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to portray the typical subsurface conditions at the site. The boundaries between strata are approximate and have been developed by interpretation of widely-spaced explorations and samples; actual strata transitions may be different at each location and across the site. For specific information, refer to the individual exploration logs.
3. Water level readings have been made in the explorations under conditions stated on the logs. This data has been reviewed and interpretations have been made in the text of this report. However, fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the conditions at the time the measurements were made.

Review

1. We recommend that John Turner Consulting, Inc. (JTC) be retained to review the design drawings and specifications to evaluate the appropriate implementation of our geotechnical engineering recommendations.
2. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed, and the conclusions of the report modified or verified in writing by JTC

Construction

1. We recommended that JTC be retained during construction to observe compliance with the design concepts, specifications, and recommendations and to recommend changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.
2. Site safety, excavation support, and dewatering requirements are the responsibility of others.

Use of Report

1. This report has been prepared by JTC for the exclusive use of the addressee for the specific project discussed. All considerations are based on the available information, in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.
2. This report was completed for preliminary design purposes and may be limited in scope. The report includes our geotechnical recommendations for the project. The final drawings and specifications may or may not have followed our recommendations. The report should be considered a reference document, not a specification.
3. The scope of services for this report did not include any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such conditions, other studies should be undertaken.

FORM 11: SOIL EVALUATION FORM

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

Location Address or Lot No. : 1650 Iyannough Rd
BFD #3&4 WTP

Deep Hole Number: Resid 1 Date: 5/15/26 Time: 0800 Weather: Clr 55°
Location (identify on site plan):
Land Use: Slope (%): 0% Surface Stones: NONE
Vegetation:
Landform:
Position on landscape (sketch on the back):
Distances from:
Open Water Body (ft) N/A
Possible Wet Area (ft) N/A
Drinking Well (ft) ~350'
Drainage way (ft)
Property Line (ft)
Other (ft)

DEEP OBSERVATION HOLE LOG

Depth from Surface (in)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsel)	Soil Motting	Other (Structure, Stress, Boulder, Consistency, Gravel)
3"	A	LOAM	DK BROWN	NONE	
18"	B	SILTY SAND	TAN	NONE	
24"	C	"	GRAY	ERRATIC AT 24"	DISCONTINUOUS MOTTLE AT 24"
132"	C		TAN/GRAY	NONE	TAN/GRAY F-M SAND SOME GRAVEL

PERCOLATION TEST

Test Pit No.			
Perc Depth			
Start Pre-Soak			
End Pre-Soak			

Parent Material (geologic):
Depth to Groundwater: >11' Standing Water in Hole: NONE Depth to Bedrock:
Estimated Seasonal High Ground Water: >25' Weeping from Pit Face: NONE
Site Passed: Site Failed:
Performed by: Witnessed by:

SOIL EVALUATION FORM

Location Address or Lot No. :

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

Deep Hole Number: Resid 2 Date: 5/15/26 Time: 0845 Weather: O/C 50°F

Location (identify on site plan):

Land Use: Slope (%): 0% Surface Stones: N/A

Vegetation:

Landform:

Position on landscape (sketch on the back):

Distances from:

Open Water Body (ft) Drainage way (ft)

Possible Wet Area (ft) N/A Property Line (ft)

Drinking Well (ft) Other (ft)

DEEP OBSERVATION HOLE LOG

Depth from Surface (in)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsel)	Soil Motting	Other (Structure, Stress, Boulder, Consistency, Gravel)
3"	A	LOAM			COBBLES in top 6"
18"	B	SILTY SAND			
24	C	SILTY SAND w/ GRAVEL		NONE	RUST STREAK AT 40" - inconsistent
120"					

PERCOLATION TEST

Test Pit No.			
Perc Depth			
Start Pre-Soak			
End Pre-Soak			

Parent Material (geologic): Outwash

Depth to Groundwater: >30' Standing Water in Hole: No Depth to Bedrock:

Weeping from Pit Face: No

Estimated Seasonal High Ground Water:

Site Passed: Site Failed:

Performed by: Witnessed by:

FORM 11: SOIL EVALUATION FORM

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

Location Address or Lot No.: ~~Sub-1~~ 1650 Iyannough Rd Barnstable

Deep Hole Number: SW-1 Date: 3/15/26 Time: 12:00pm Weather: O/C 50°
Location (identify on site plan):
Land Use: Slope (%): 0% Surface Stones: None
Vegetation:
Landform:
Position on landscape (sketch on the back):
Distances from:
Open Water Body (ft) N/A Drainage way (ft) N/A
Possible Wet Area (ft) Property Line (ft)
Drinking Well (ft) Other (ft)

DEEP OBSERVATION HOLE LOG

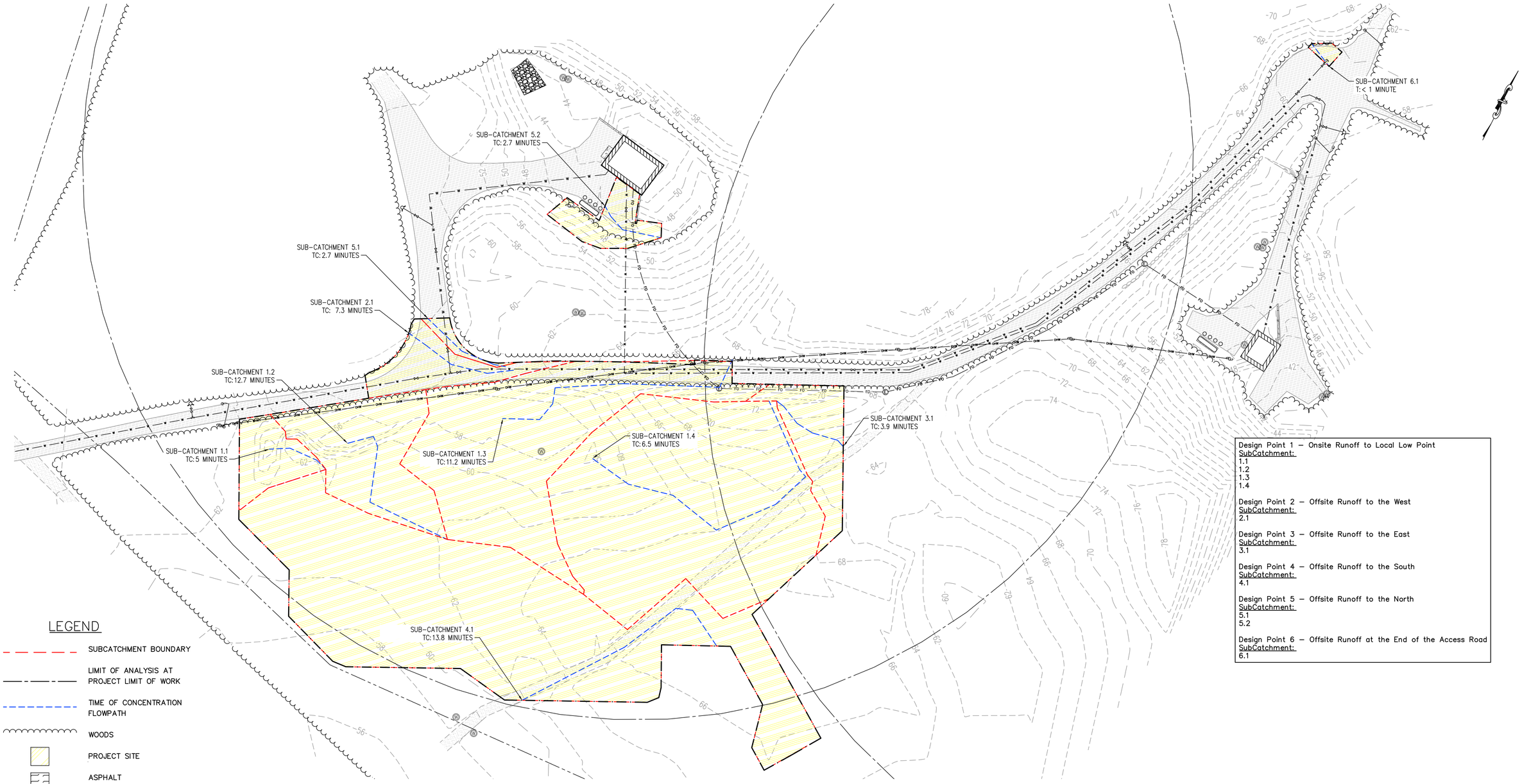
Depth from Surface (in)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsel)	Soil Motting	Other (Structure, Stress, Boulder, Consistency, Gravel)
0-3"	~~Loam~~ A	Loam	DK Br		
3-13"	B	Loamy Silt	Br		
13-84"	C	~~Silt Sand~~ Sand	Tan	None	F-M SAND, Some Silt, Little gravel at 2'
84-120					SAME

PERCOLATION TEST

Test Pit No.			
Perc Depth			
Start Pre-Soak			
End Pre-Soak			

Parent Material (geologic): Outwash
Depth to Groundwater: >30' Standing Water in Hole: No Depth to Bedrock:
Estimated Seasonal High Ground Water: >30' Weeping from Pit Face: No
Site Passed: Site Failed:
Performed by: Witnessed by:

Appendix F – Watershed Plans



LEGEND

- SUBCATCHMENT BOUNDARY
- LIMIT OF ANALYSIS AT PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT

Design Point 1 – Onsite Runoff to Local Low Point
SubCatchment:
1.1
1.2
1.3
1.4

Design Point 2 – Offsite Runoff to the West
SubCatchment:
2.1

Design Point 3 – Offsite Runoff to the East
SubCatchment:
3.1

Design Point 4 – Offsite Runoff to the South
SubCatchment:
4.1

Design Point 5 – Offsite Runoff to the North
SubCatchment:
5.1
5.2

Design Point 6 – Offsite Runoff at the End of the Access Road
SubCatchment:
6.1

PLAN VIEW

SCALE: 1" = 35'

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

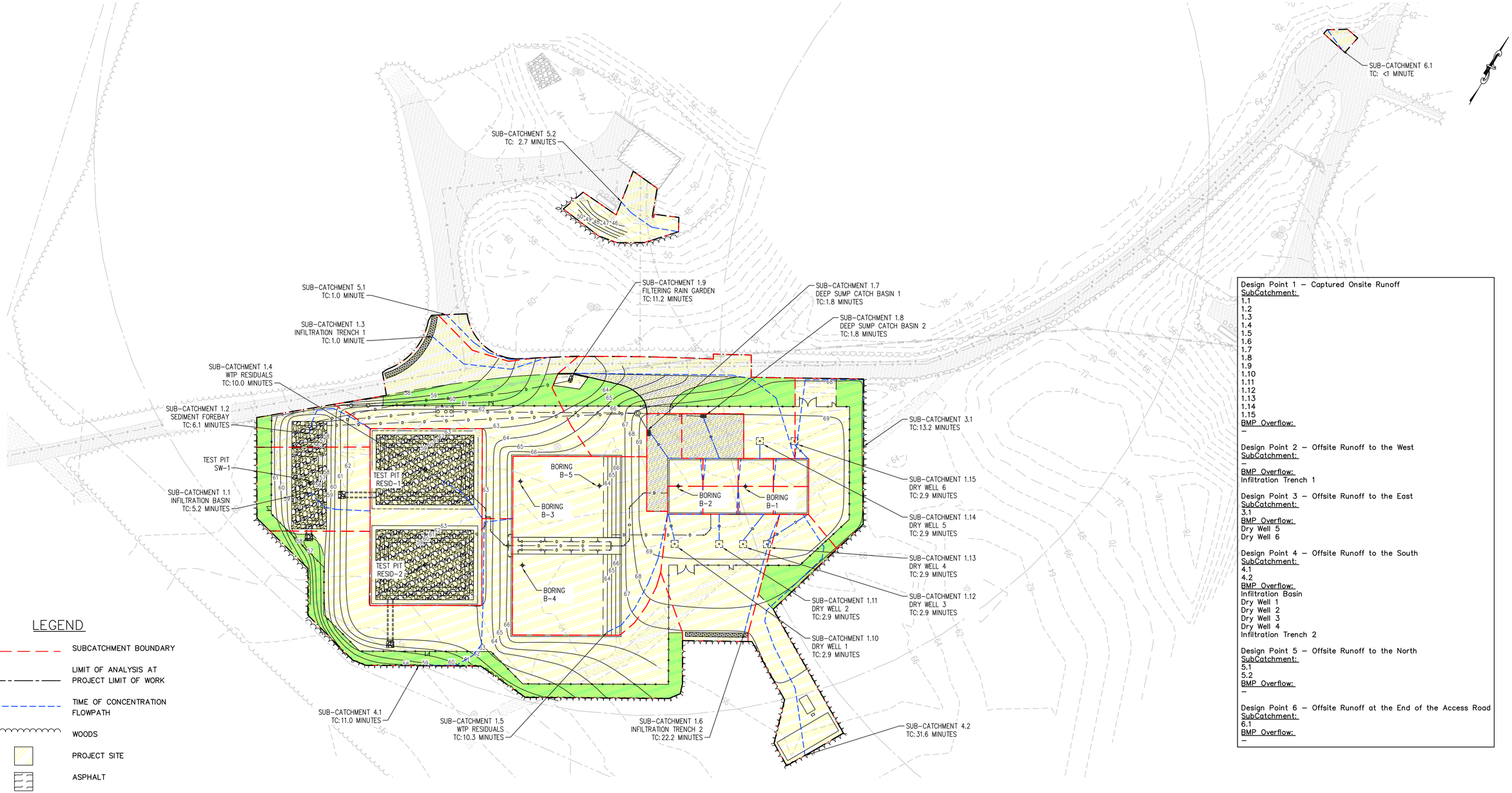
BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
EXISTING WATERSHED PLAN

DRAWING NO.:
AF-1

SHEET NO. 1 OF 3

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\XRefs\XR_Existing.dwg



Design Point 1 – Captured Onsite Runoff
SubCatchment:
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
1.10
1.11
1.12
1.13
1.14
1.15
BMP Overflow:
–

Design Point 2 – Offsite Runoff to the West
SubCatchment:
–
BMP Overflow:
Infiltration Trench 1

Design Point 3 – Offsite Runoff to the East
SubCatchment:
3.1
BMP Overflow:
Dry Well 5
Dry Well 6

Design Point 4 – Offsite Runoff to the South
SubCatchment:
4.1
4.2
BMP Overflow:
Infiltration Basin
Dry Well 1
Dry Well 2
Dry Well 3
Dry Well 4
Infiltration Trench 2

Design Point 5 – Offsite Runoff to the North
SubCatchment:
5.1
5.2
BMP Overflow:
–

Design Point 6 – Offsite Runoff at the End of the Access Road
SubCatchment:
6.1
BMP Overflow:
–

LEGEND

- SUBCATCHMENT BOUNDARY
- LIMIT OF ANALYSIS AT PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT
- BRUSH

PLAN VIEW

SCALE: 1" = 35'

FOR PERMITTING

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DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

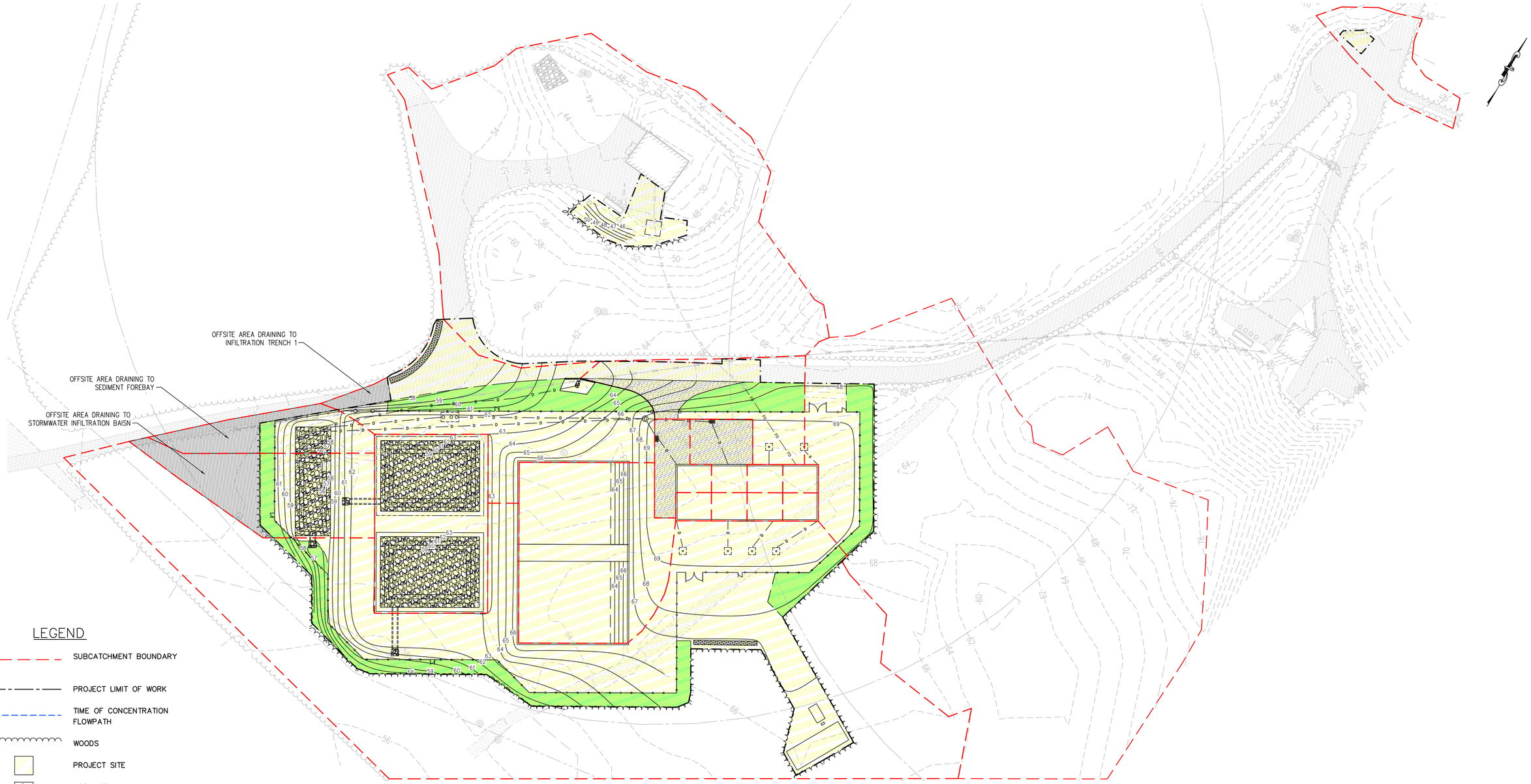
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
PROPOSED WATERSHED PLAN

DRAWING NO.:
AF-2

SHEET NO. 2 OF 3

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C-Sheets.dwg



LEGEND

- SUBCATCHMENT BOUNDARY
- PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT
- BRUSH
- OFFSITE AREAS DRAINING TO PROPOSED DRAINAGE SYSTEM

PLAN VIEW

SCALE: 1" = 35'

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
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APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

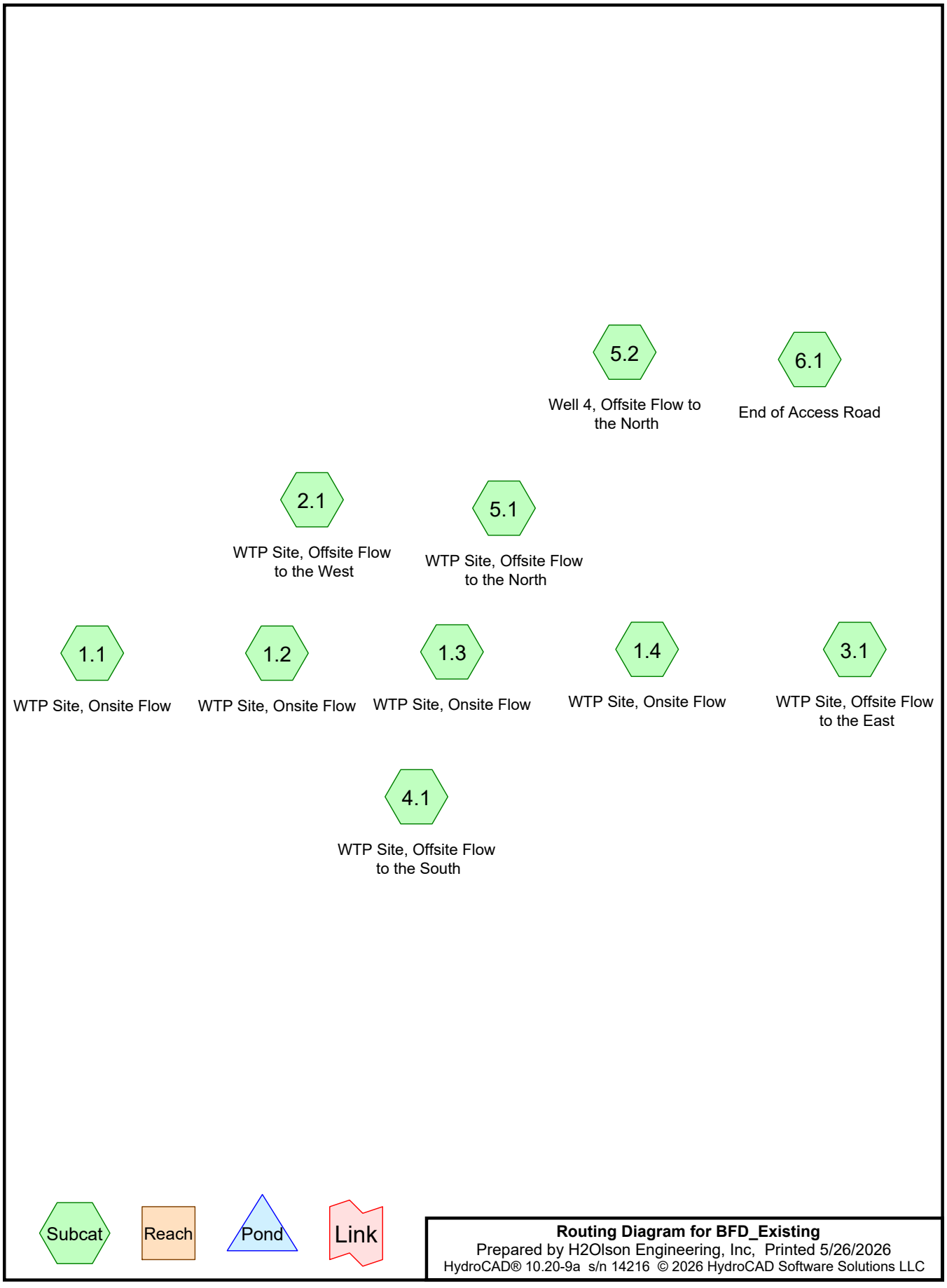
DRAWING TITLE:
PROPOSED OFFSITE CONTRIBUTION PLAN

DRAWING NO.:
AF-3

SHEET NO. 3 OF 3

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C Sheets.dwg

Appendix G – Existing Conditions HydroCAD Model Results



Routing Diagram for BFD_Existing
Prepared by H2Olson Engineering, Inc, Printed 5/26/2026
HydroCAD® 10.20-9a s/n 14216 © 2026 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type II 24-hr		Default	24.00	1	3.39	2
2	10-Year	Type II 24-hr		Default	24.00	1	4.95	2
3	25-Year	Type II 24-hr		Default	24.00	1	5.92	2
4	100-Year	Type II 24-hr		Default	24.00	1	7.41	2
5	RMAT 50-Year	Type II 24-hr		Default	24.00	1	8.70	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.052	49	50-75% Grass cover, Fair, HSG A (1.4, 3.1, 4.1)
0.008	39	>75% Grass cover, Good, HSG A (2.1)
0.132	98	Paved parking, HSG A (1.3, 2.1, 5.1, 5.2, 6.1)
1.594	30	Woods, Good, HSG A (1.1, 1.2, 1.3, 1.4, 3.1, 4.1)
0.311	45	Woods, Poor, HSG A (4.1, 5.2)
2.097	**37**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.097	HSG A	1.1, 1.2, 1.3, 1.4, 2.1, 3.1, 4.1, 5.1, 5.2, 6.1
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.097		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.052	0.000	0.000	0.000	0.000	0.052	50-75% Grass cover, Fair	1.4, 3.1, 4.1
0.008	0.000	0.000	0.000	0.000	0.008	>75% Grass cover, Good	2.1
0.132	0.000	0.000	0.000	0.000	0.132	Paved parking	1.3, 2.1, 5.1, 5.2, 6.1
1.594	0.000	0.000	0.000	0.000	1.594	Woods, Good	1.1, 1.2, 1.3, 1.4, 3.1, 4.1
0.311	0.000	0.000	0.000	0.000	0.311	Woods, Poor	4.1, 5.2
2.097	**0.000**	**0.000**	**0.000**	**0.000**	**2.097**	**TOTAL AREA**	

Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=0.00"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.00 cfs 0.000 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>2.40"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.26 cfs 0.014 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>2.92"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.05 cfs 0.002 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=0.56"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.03 cfs 0.002 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>2.92"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.03 cfs 0.001 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.020 af Average Runoff Depth = 0.11"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

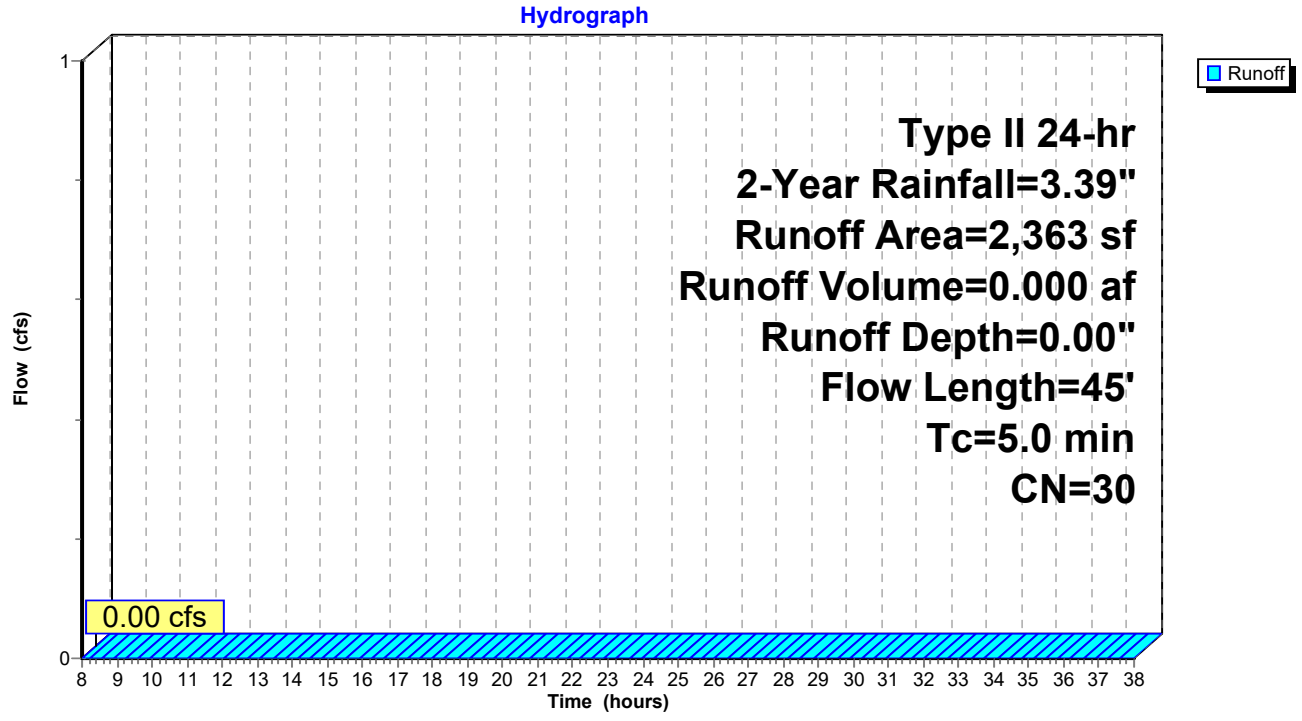
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

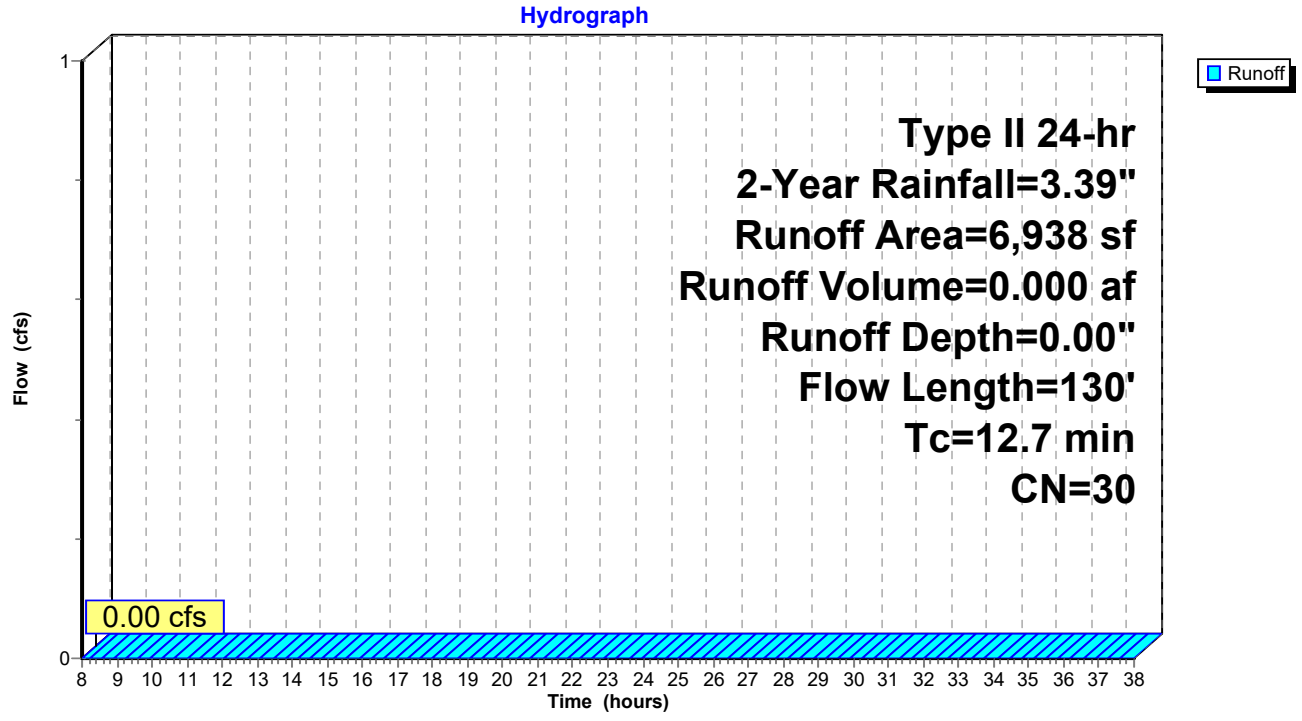
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

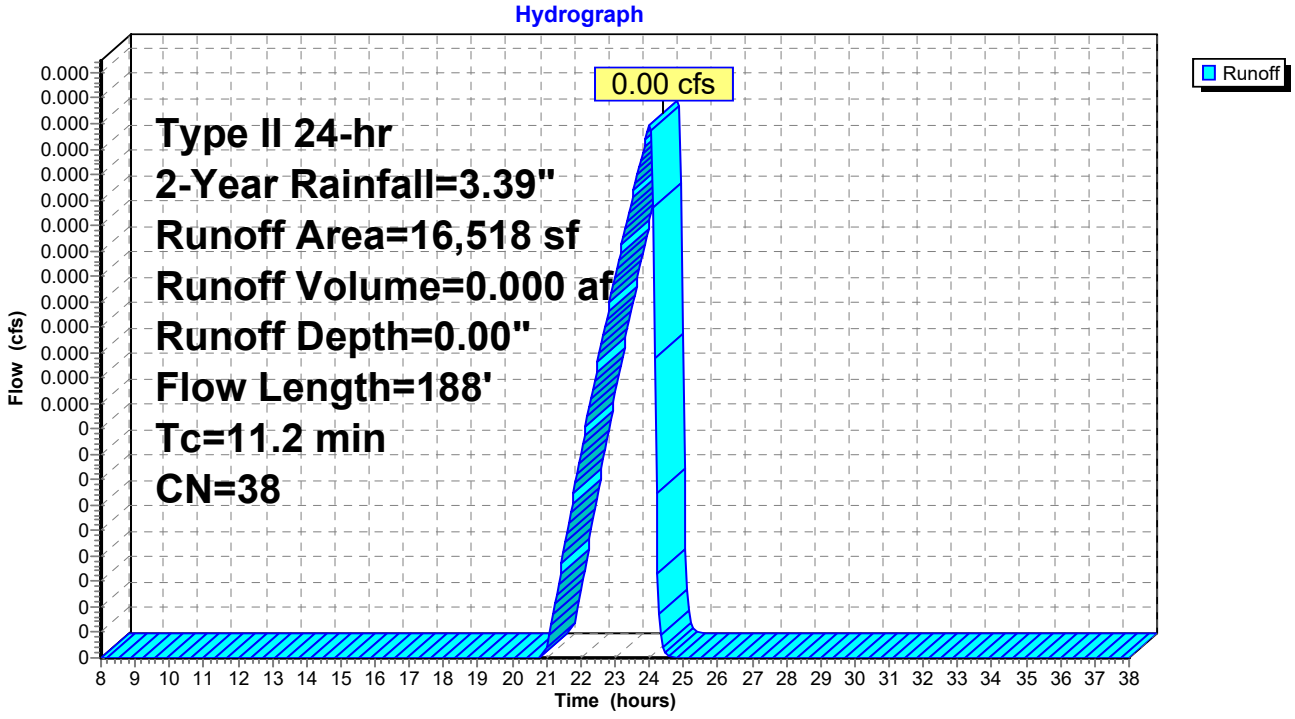
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

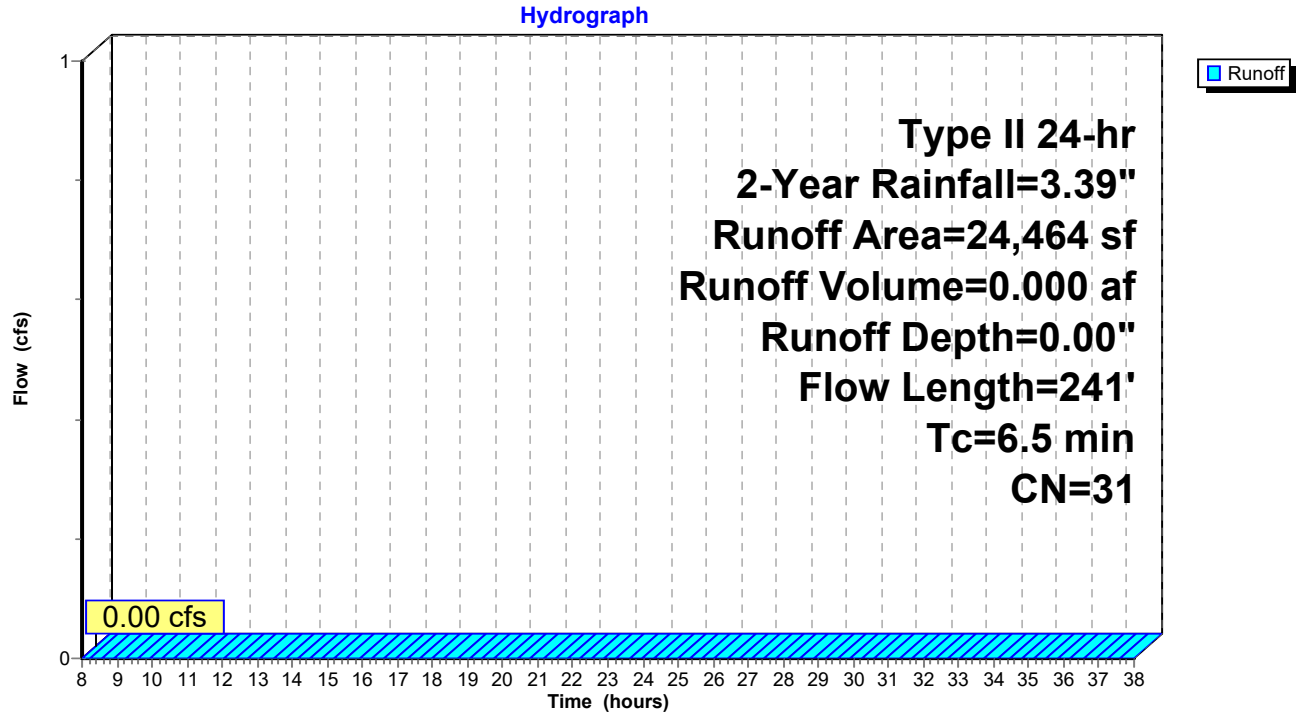
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

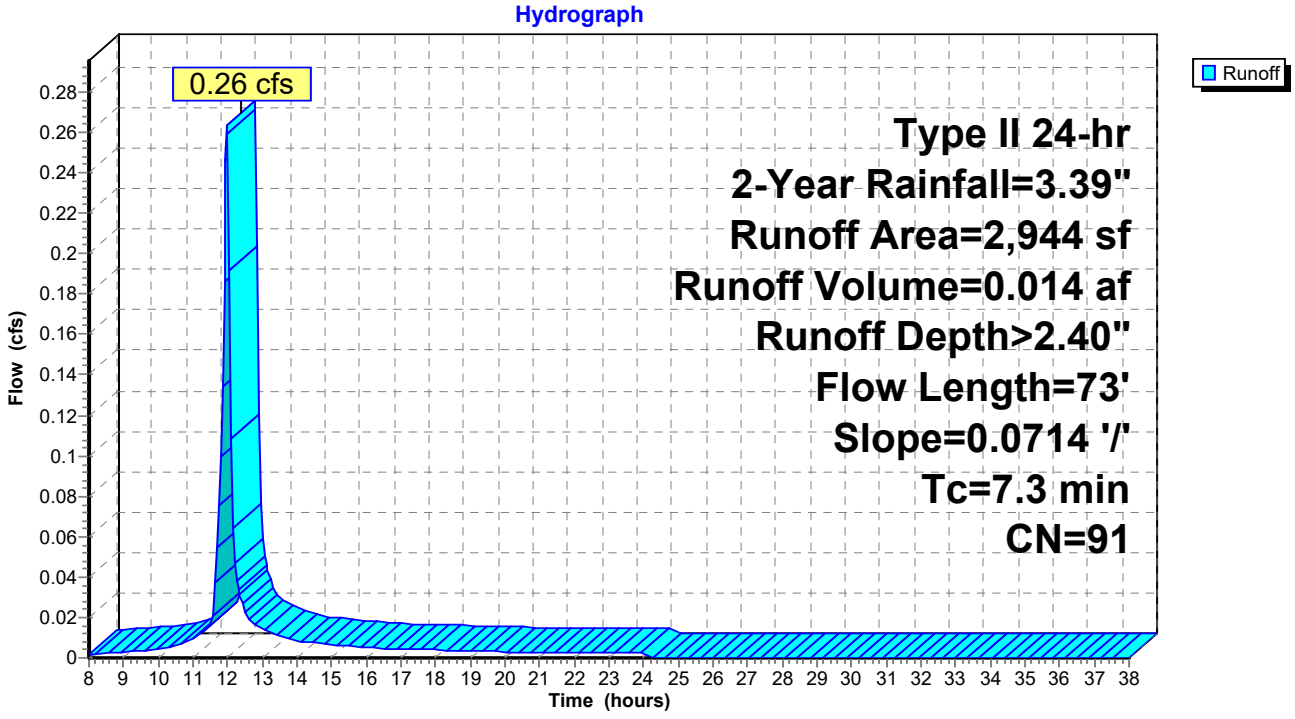
Runoff = 0.26 cfs @ 11.98 hrs, Volume= 0.014 af, Depth> 2.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

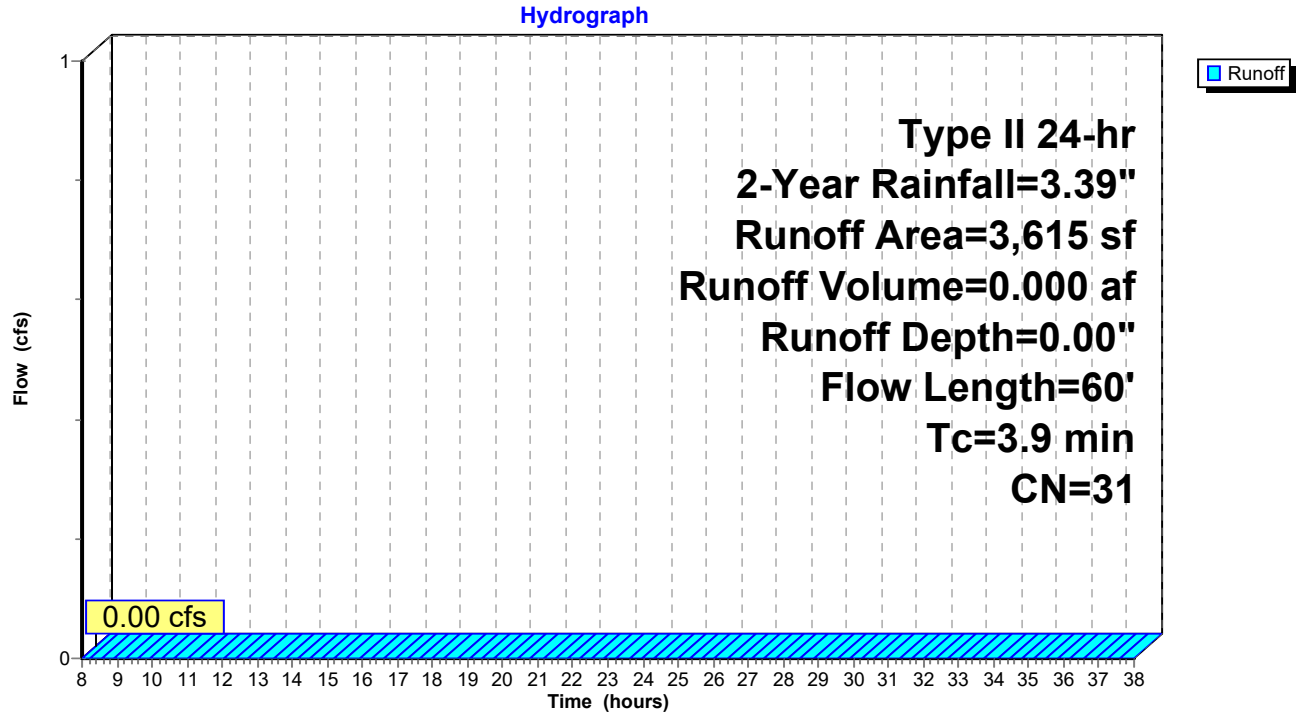
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

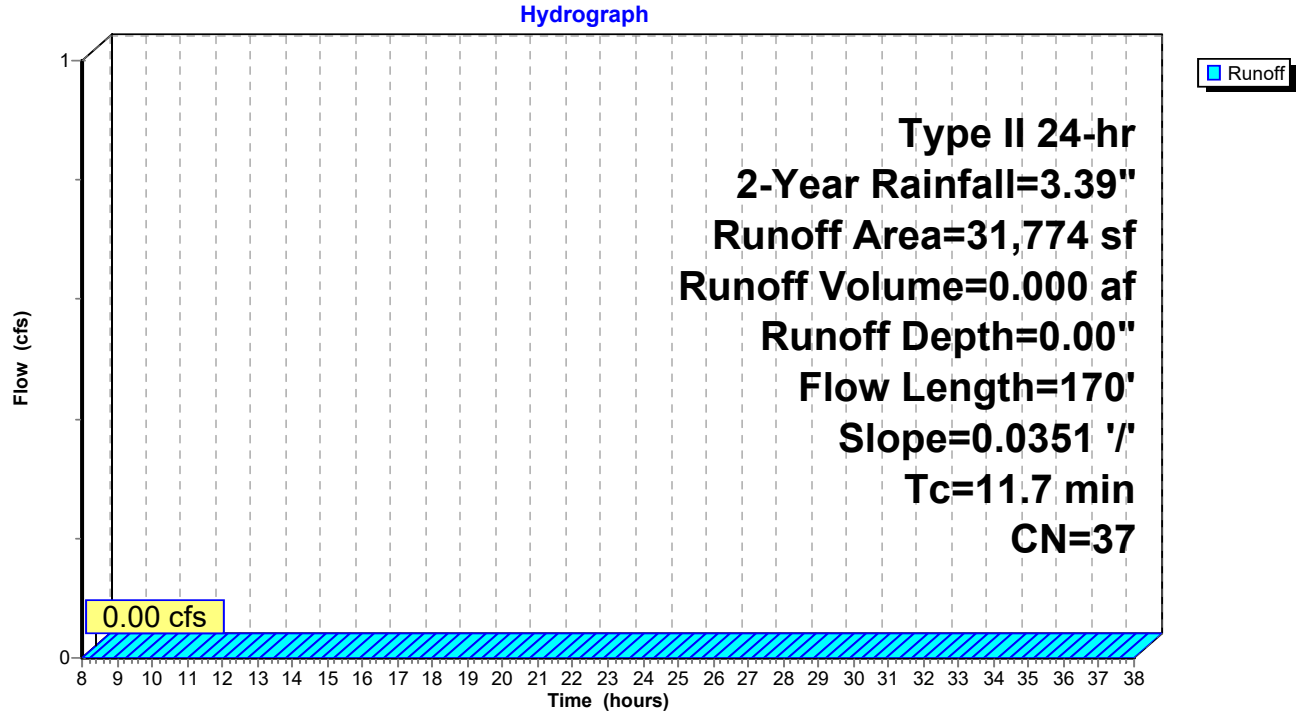
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

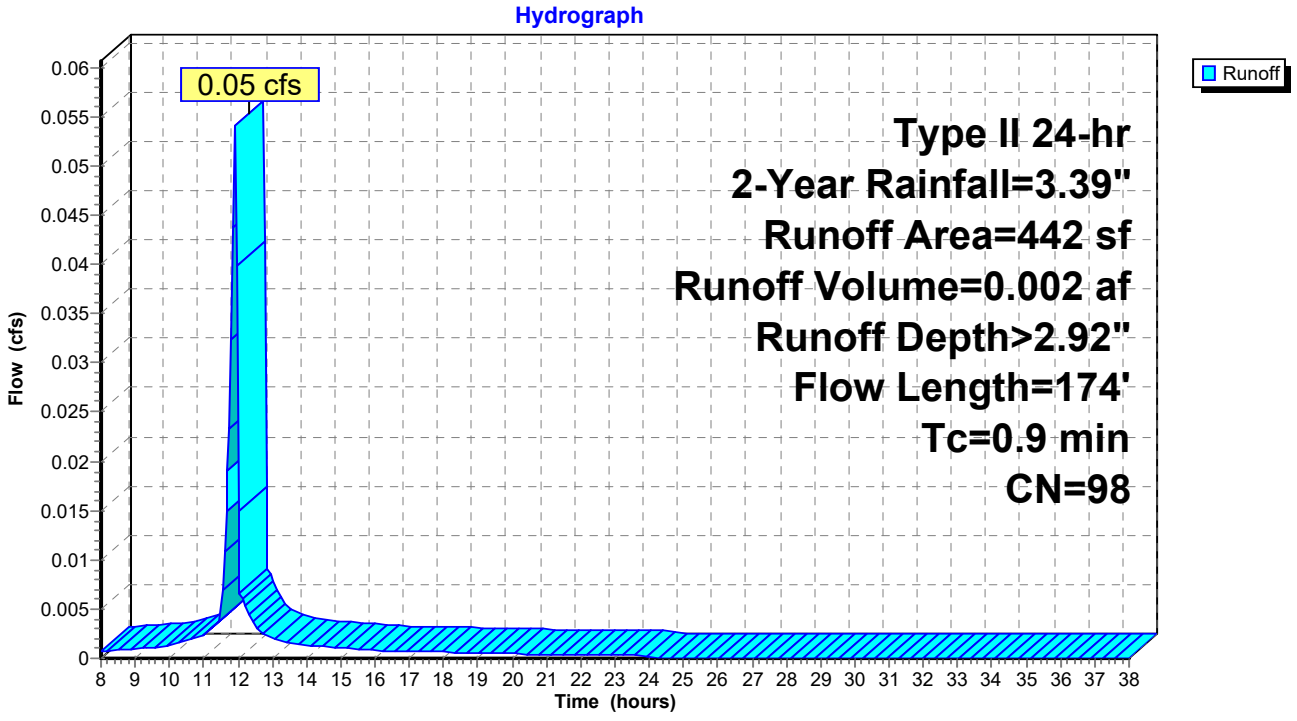
Runoff = 0.05 cfs @ 11.90 hrs, Volume= 0.002 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

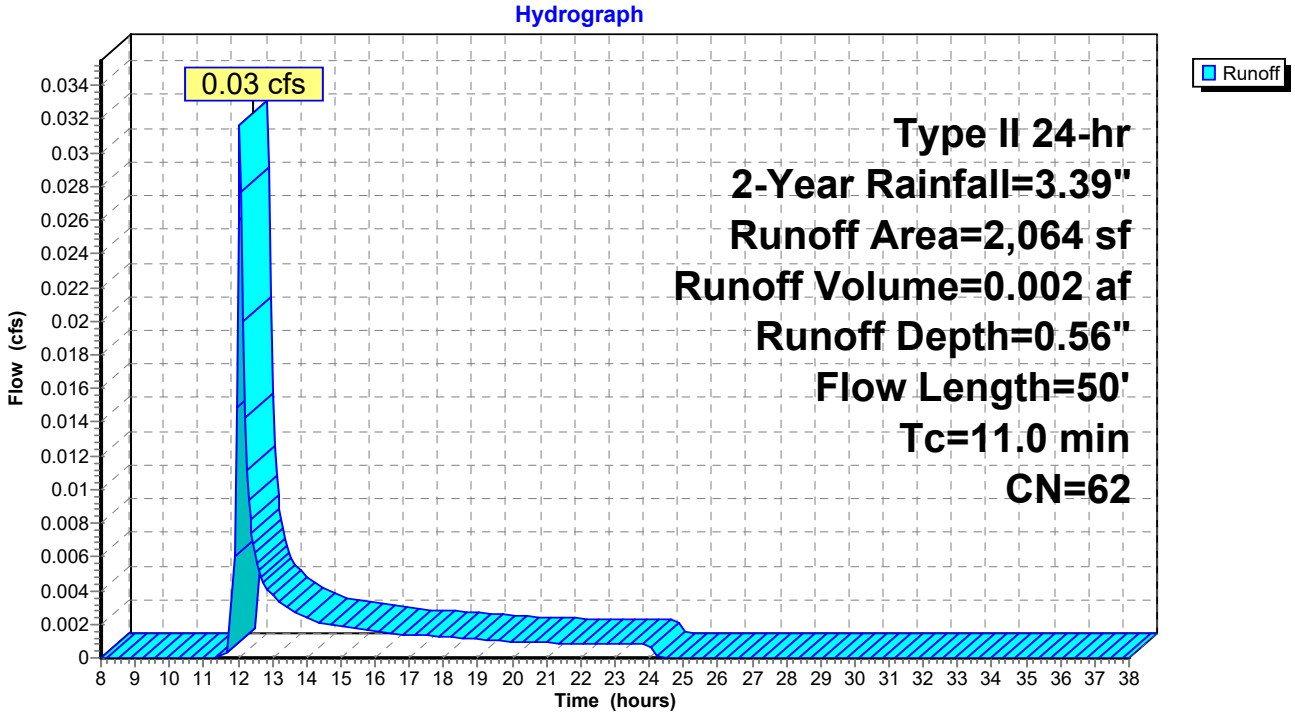
Runoff = 0.03 cfs @ 12.05 hrs, Volume= 0.002 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

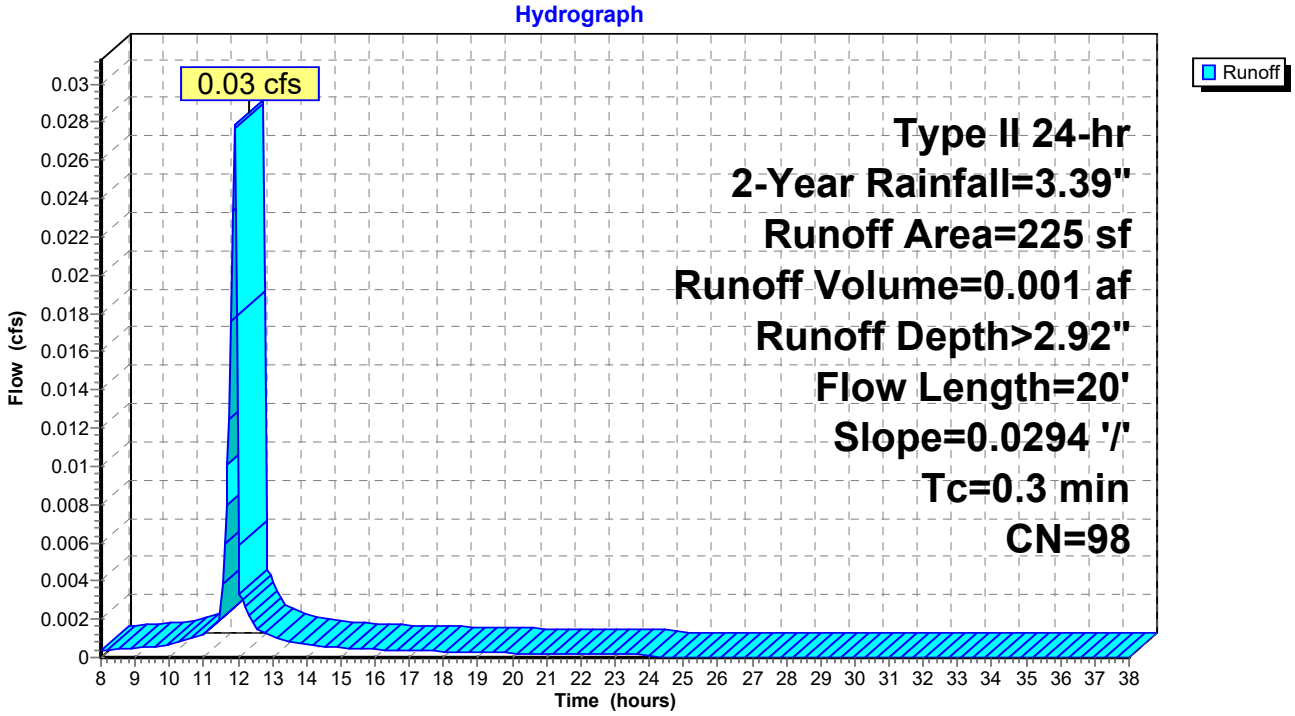
Runoff = 0.03 cfs @ 11.89 hrs, Volume= 0.001 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=0.16"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.01 cfs 0.005 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.00 cfs 0.001 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>3.83"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.41 cfs 0.022 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=0.13"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.01 cfs 0.008 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>4.31"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.08 cfs 0.004 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=1.41"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.09 cfs 0.006 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>4.31"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.04 cfs 0.002 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.046 af Average Runoff Depth = 0.26"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

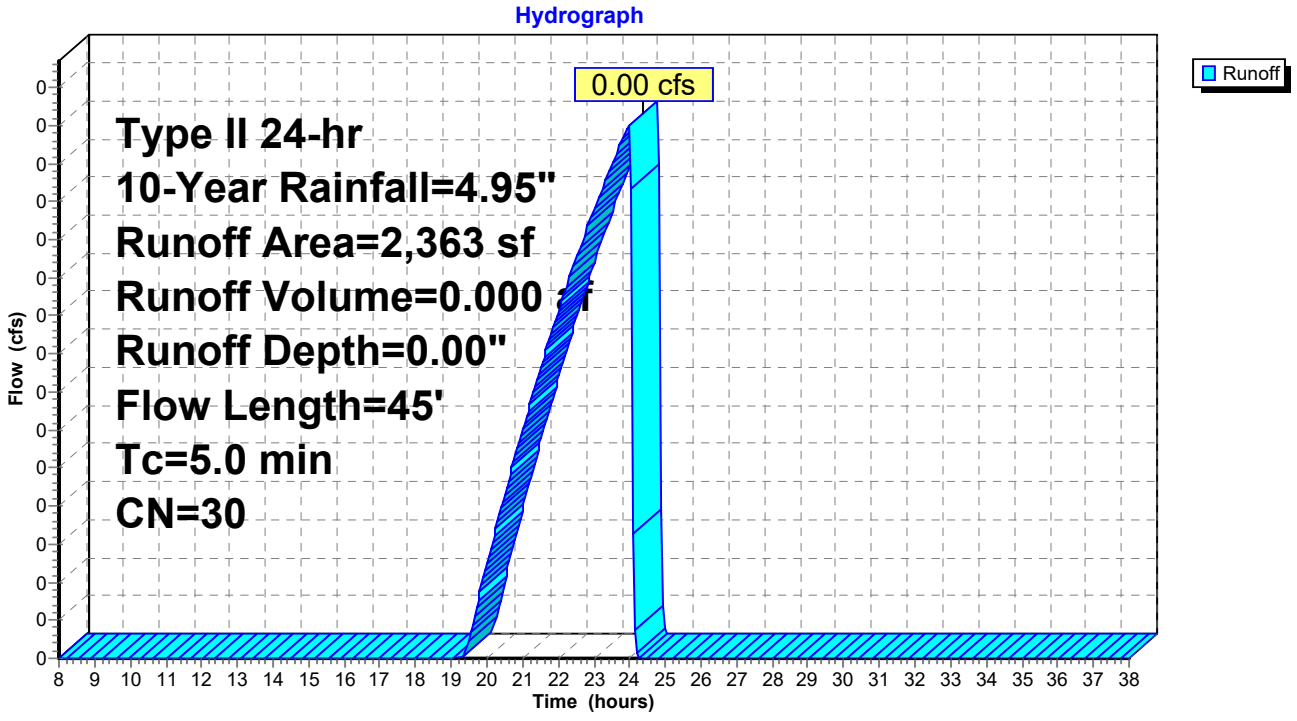
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

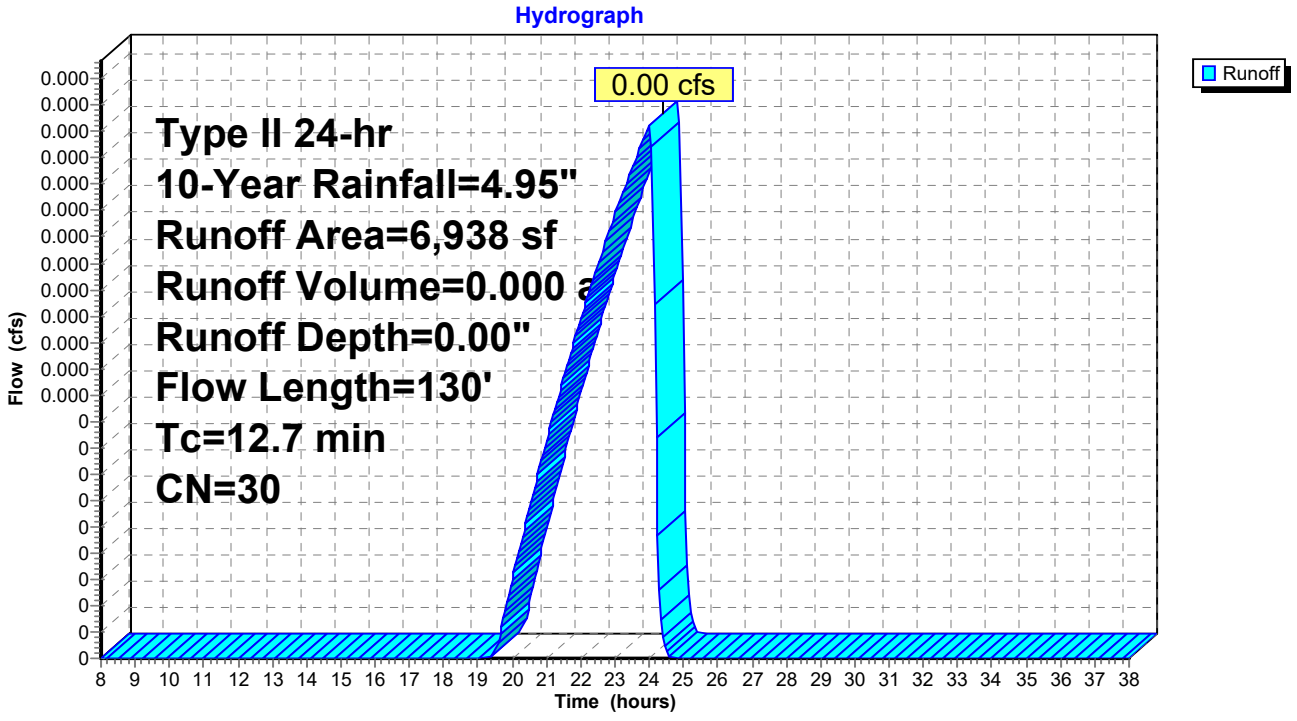
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

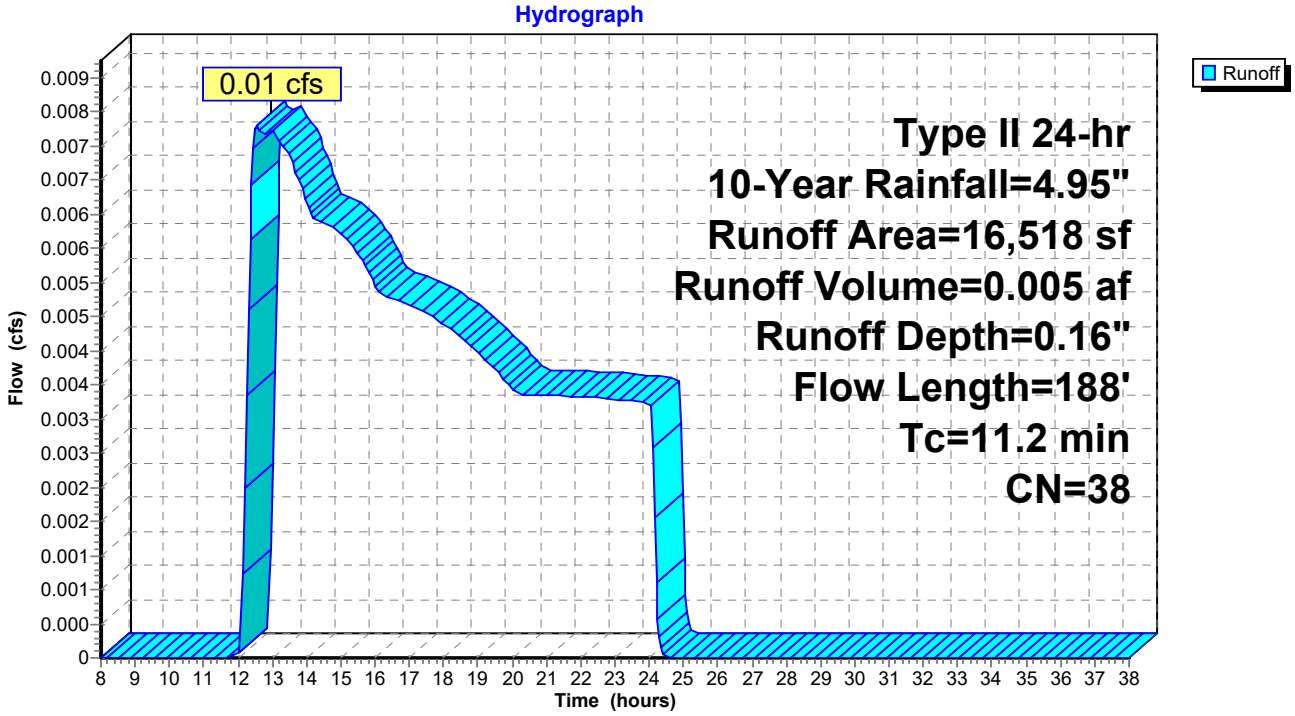
Runoff = 0.01 cfs @ 12.54 hrs, Volume= 0.005 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

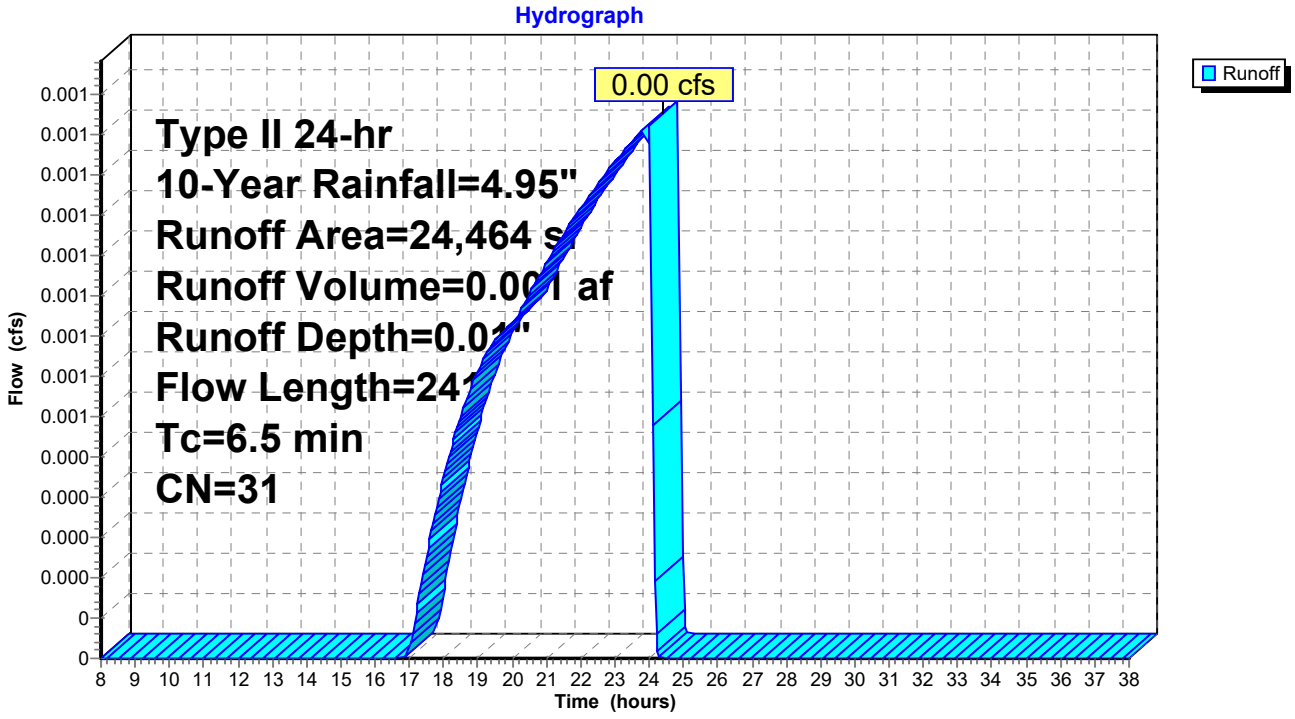
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

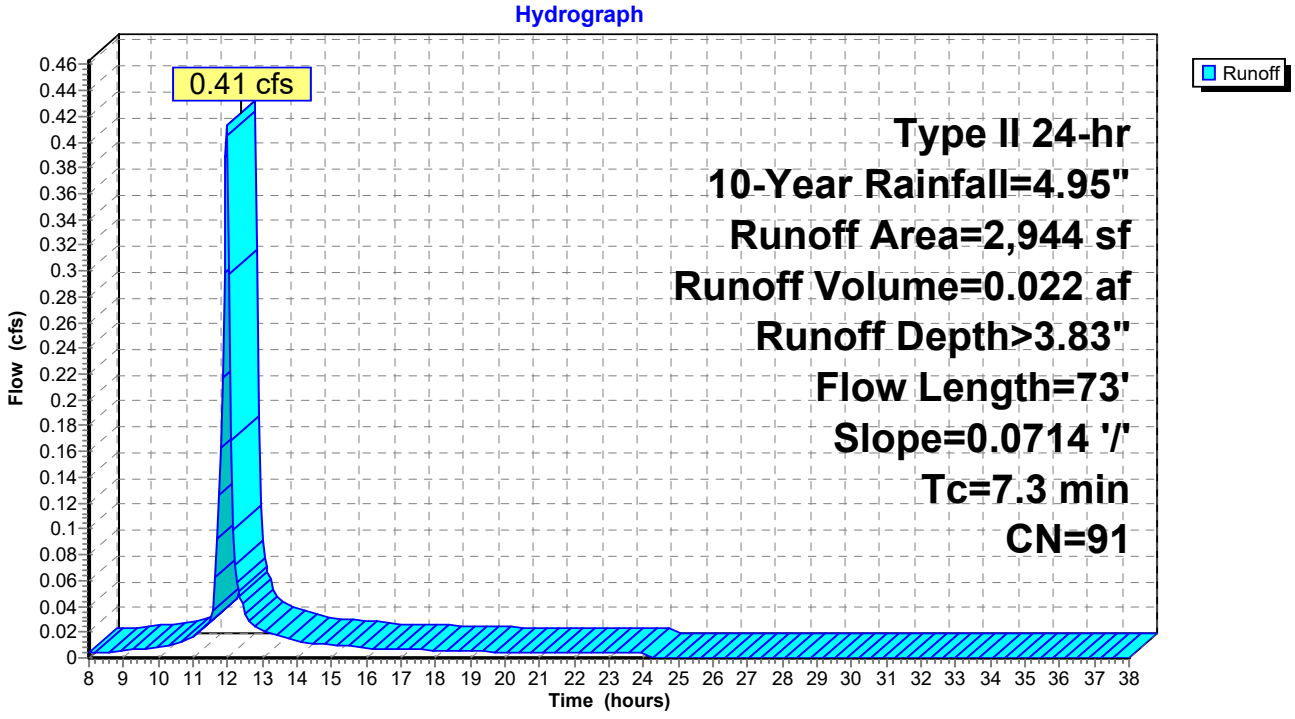
Runoff = 0.41 cfs @ 11.98 hrs, Volume= 0.022 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

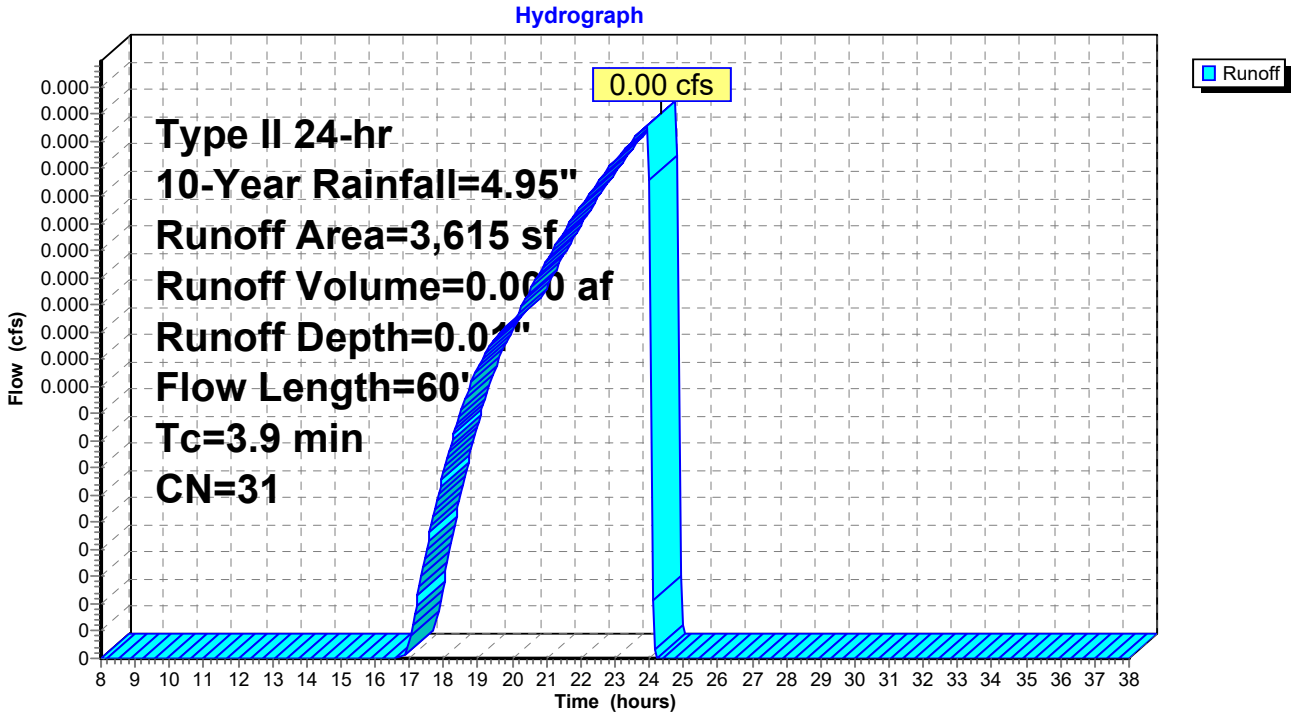
Runoff = 0.00 cfs @ 23.95 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

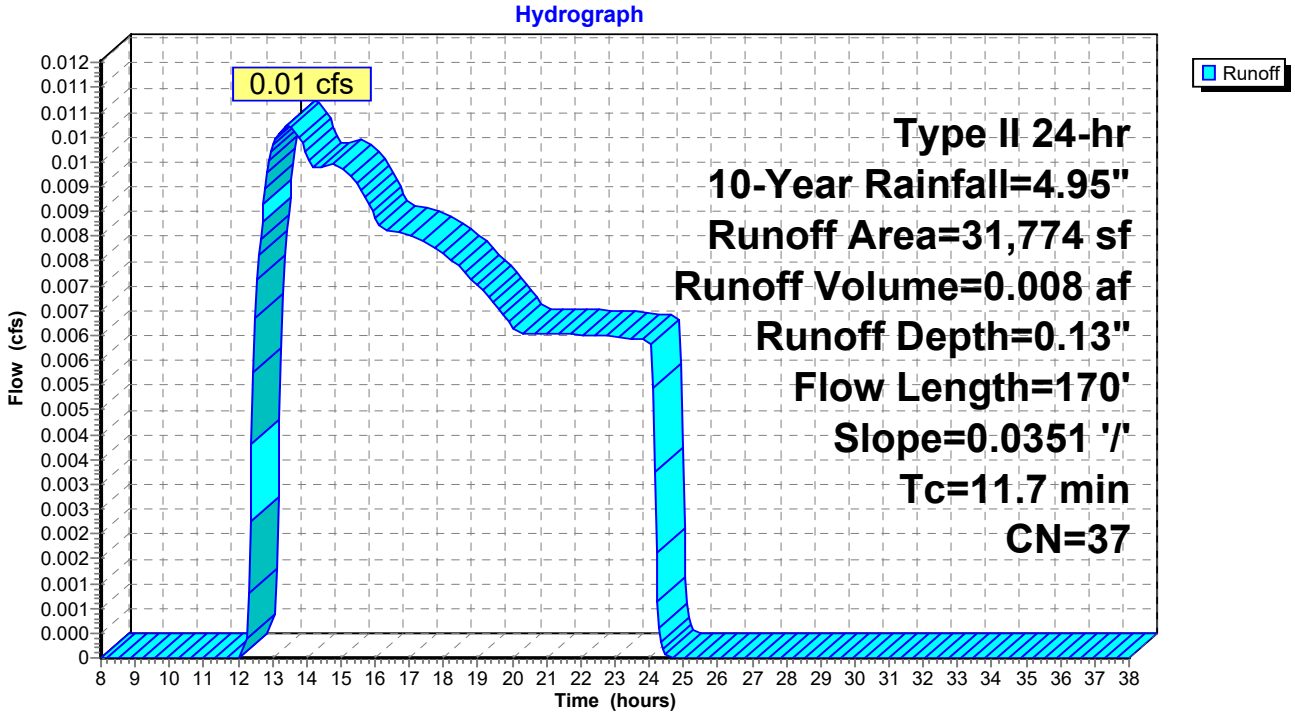
Runoff = 0.01 cfs @ 13.44 hrs, Volume= 0.008 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

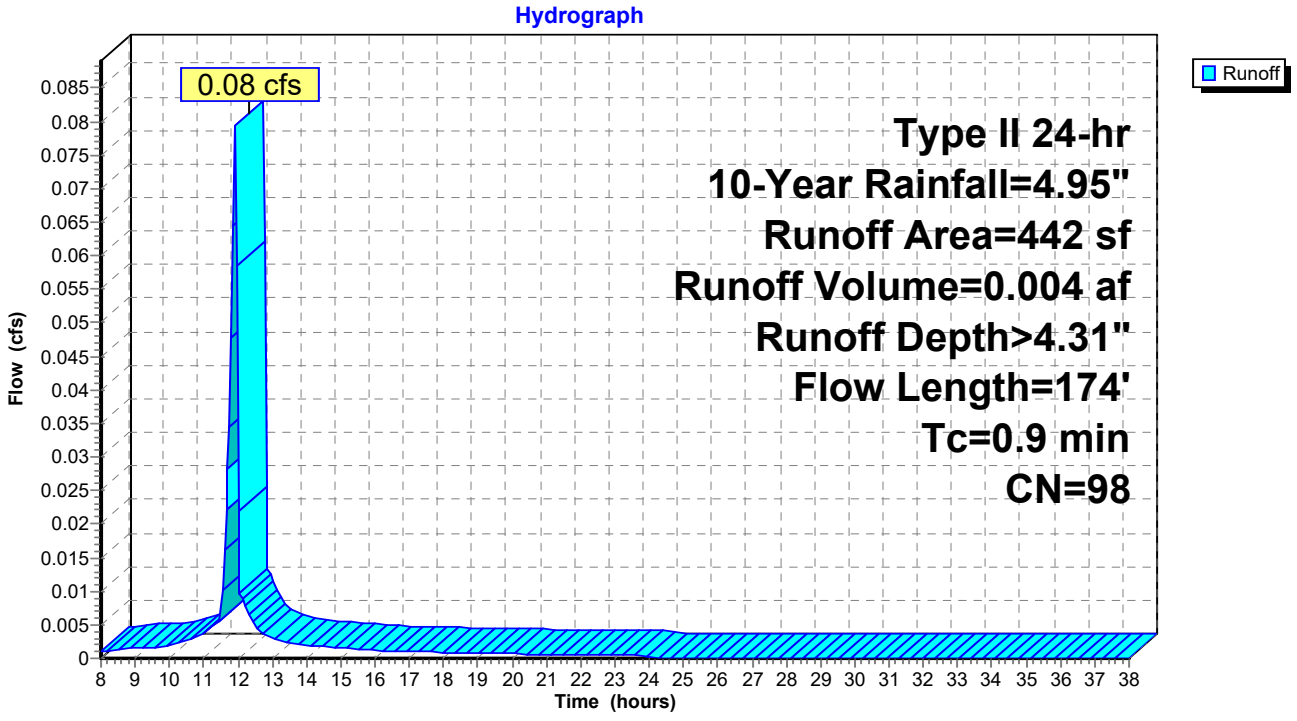
Runoff = 0.08 cfs @ 11.90 hrs, Volume= 0.004 af, Depth> 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

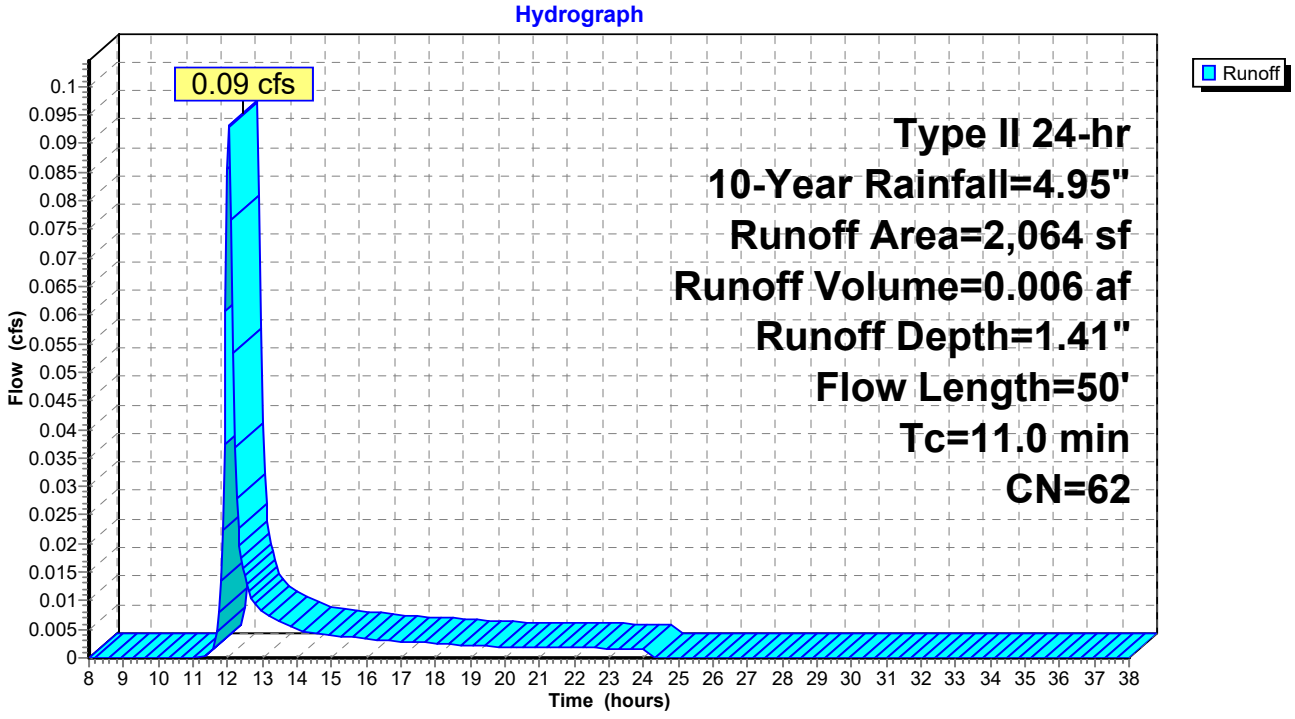
Runoff = 0.09 cfs @ 12.04 hrs, Volume= 0.006 af, Depth= 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

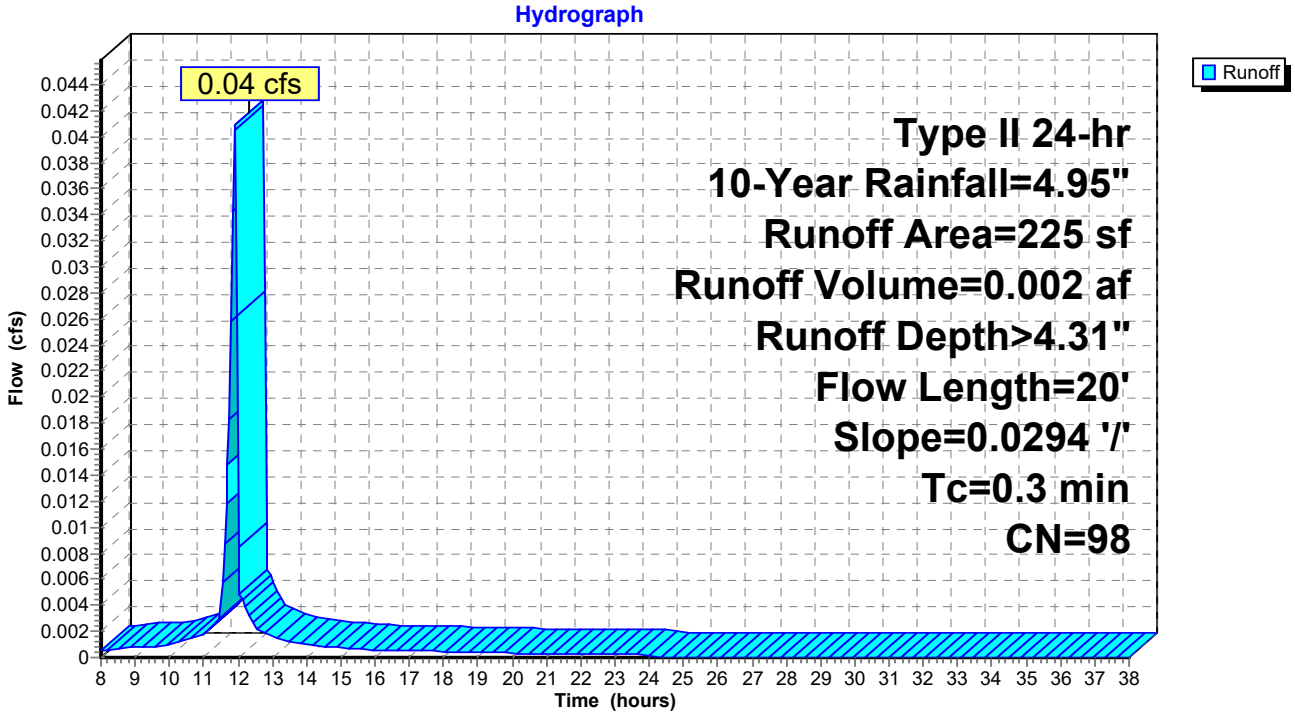
Runoff = 0.04 cfs @ 11.89 hrs, Volume= 0.002 af, Depth> 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.06"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.06"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=0.37"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.06 cfs 0.012 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.09"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.01 cfs 0.004 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>4.71"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.51 cfs 0.027 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.09"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.00 cfs 0.001 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.07 cfs 0.020 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>5.17"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.10 cfs 0.004 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=2.04"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.14 cfs 0.008 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>5.17"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.05 cfs 0.002 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.079 af Average Runoff Depth = 0.45"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

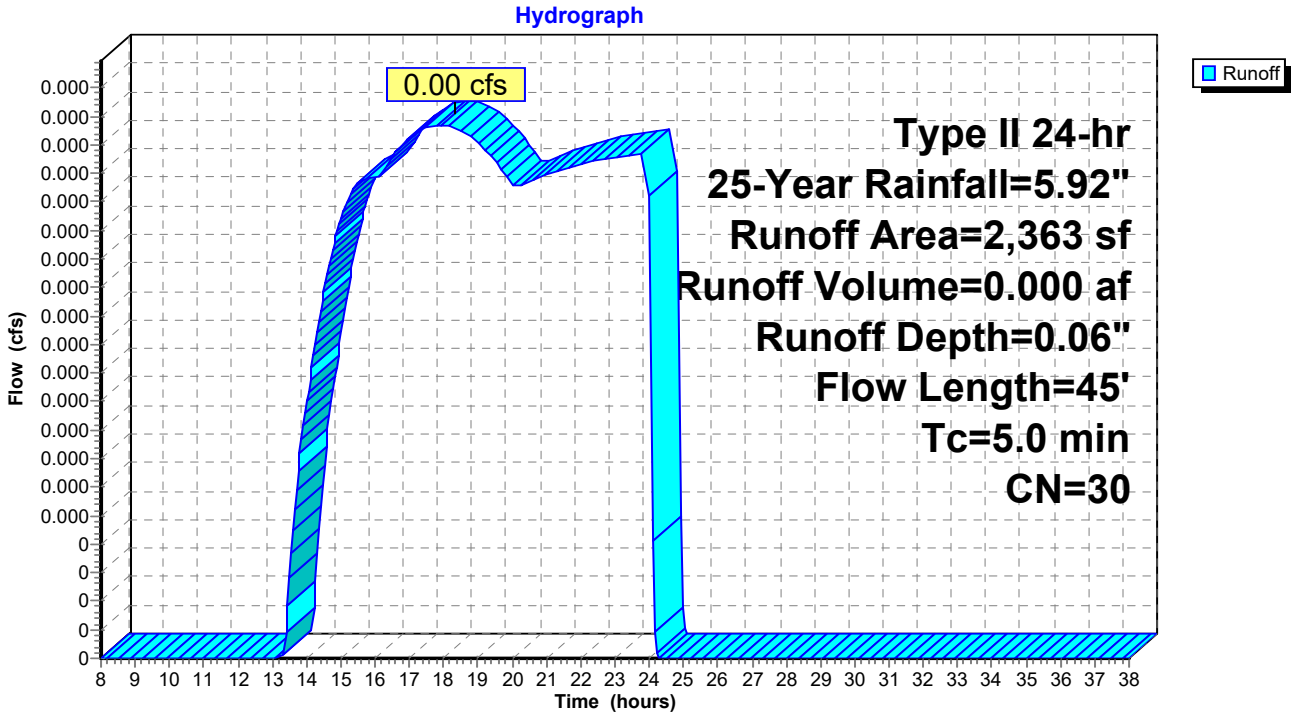
Runoff = 0.00 cfs @ 17.95 hrs, Volume= 0.000 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

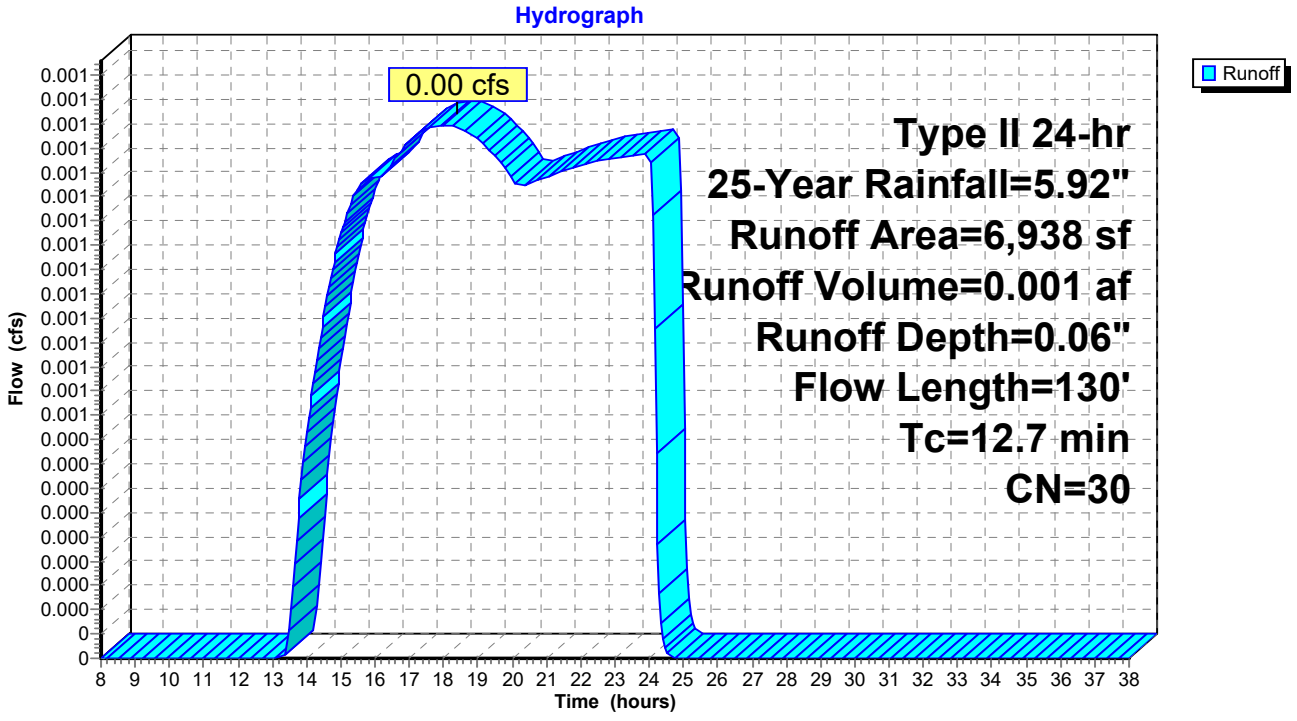
Runoff = 0.00 cfs @ 18.00 hrs, Volume= 0.001 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

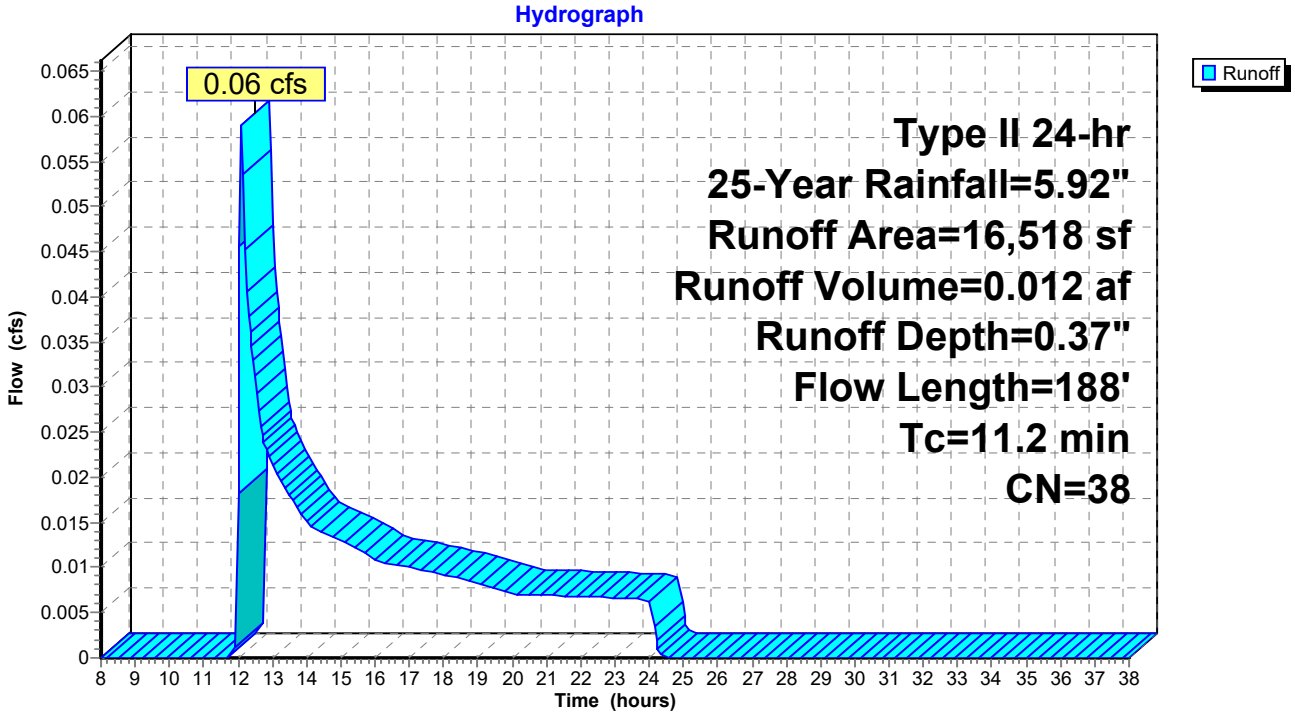
Runoff = 0.06 cfs @ 12.11 hrs, Volume= 0.012 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

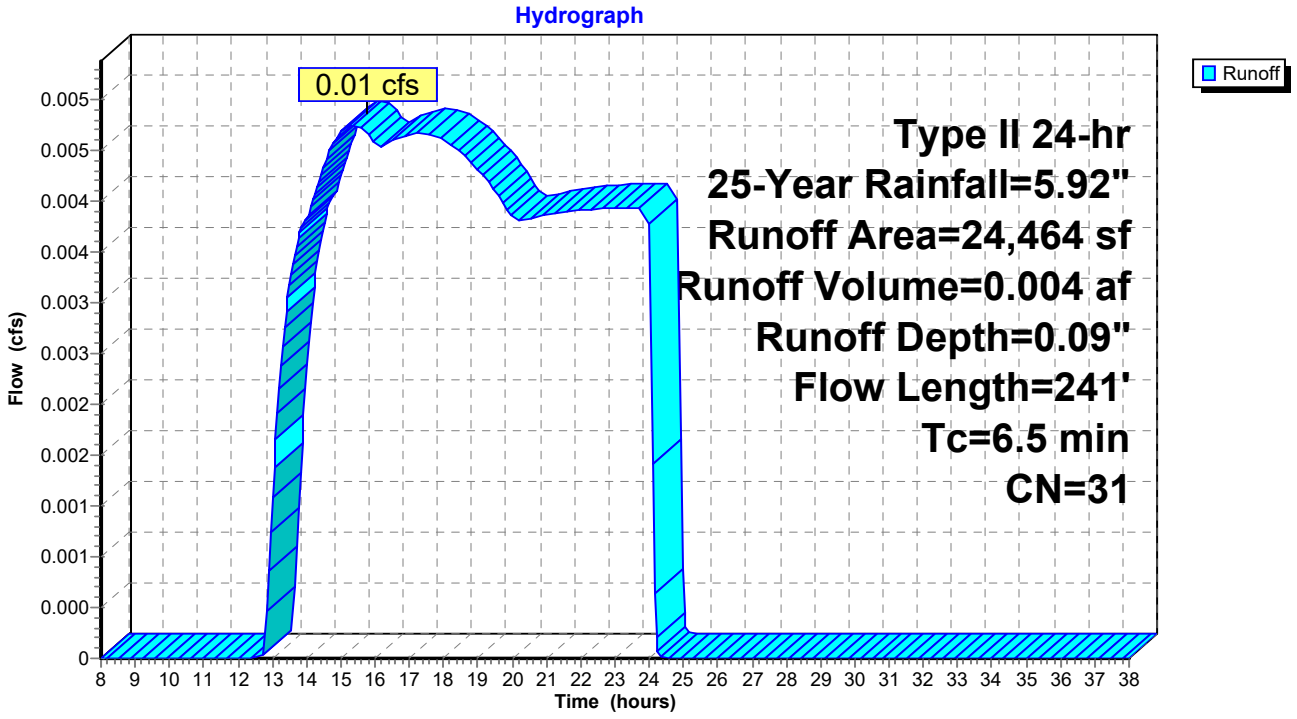
Runoff = 0.01 cfs @ 15.36 hrs, Volume= 0.004 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

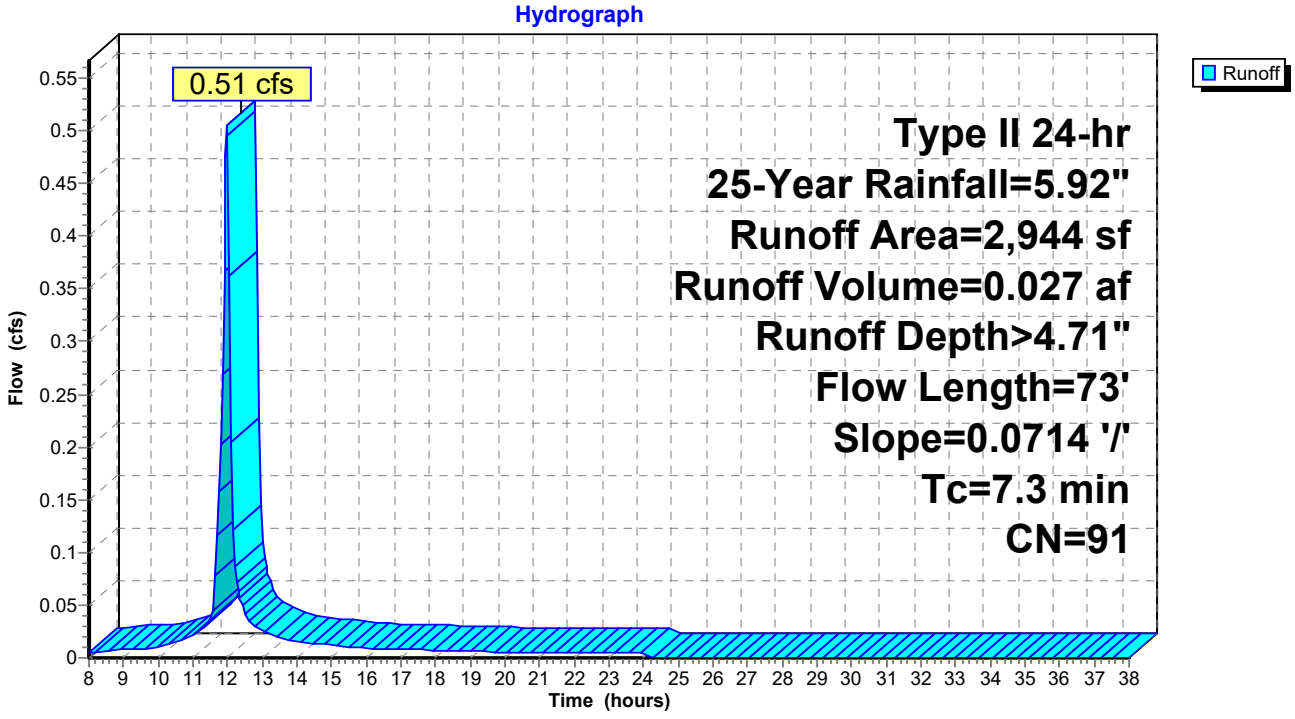
Runoff = 0.51 cfs @ 11.98 hrs, Volume= 0.027 af, Depth> 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

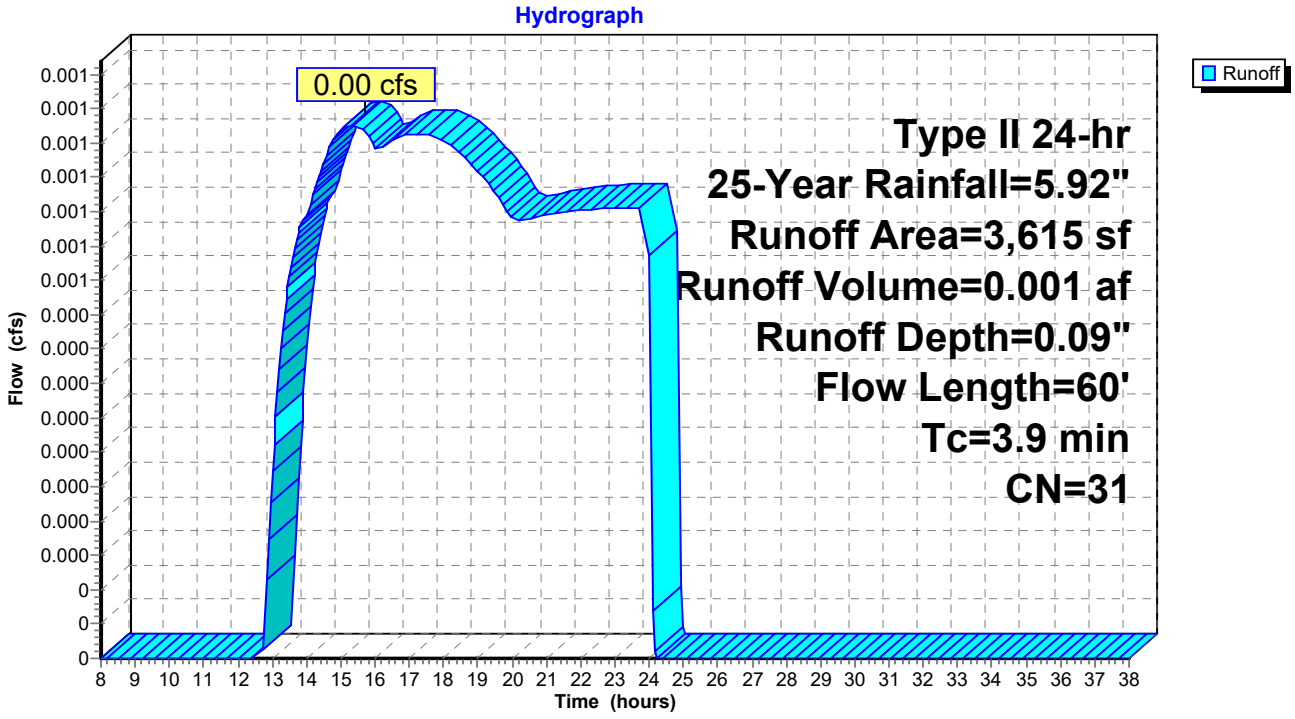
Runoff = 0.00 cfs @ 15.32 hrs, Volume= 0.001 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

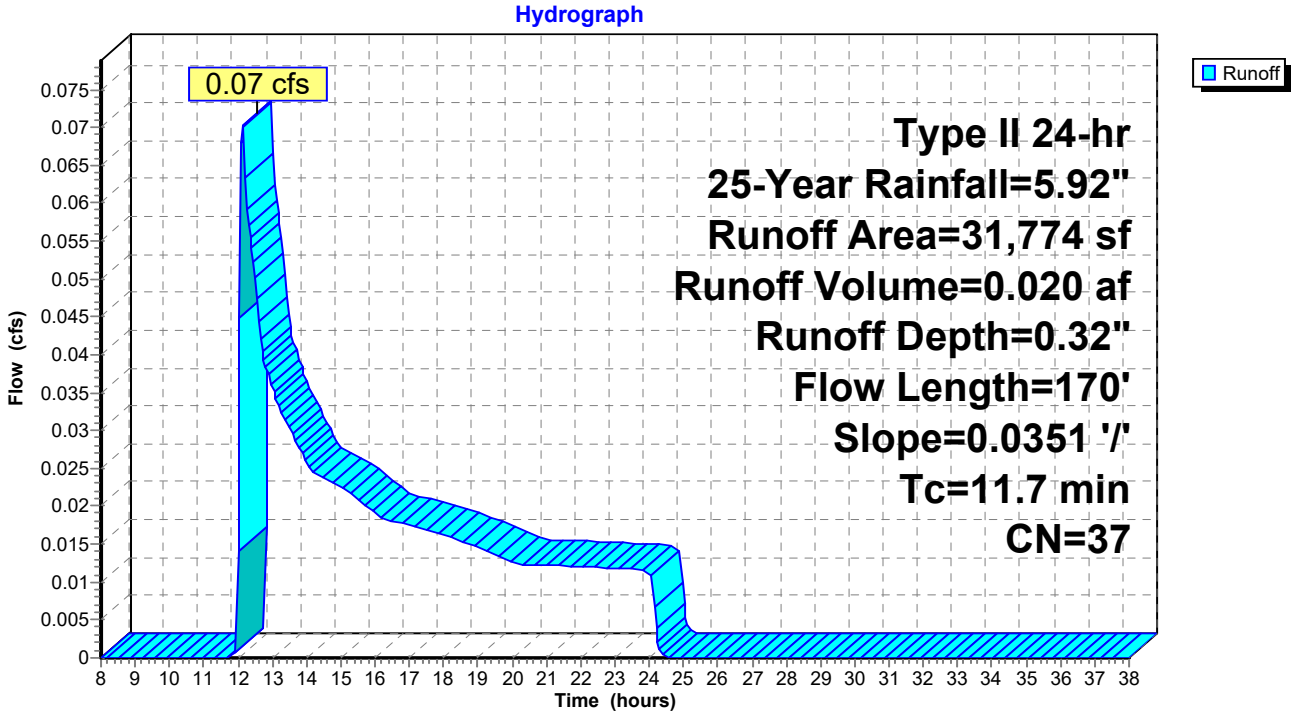
Runoff = 0.07 cfs @ 12.14 hrs, Volume= 0.020 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

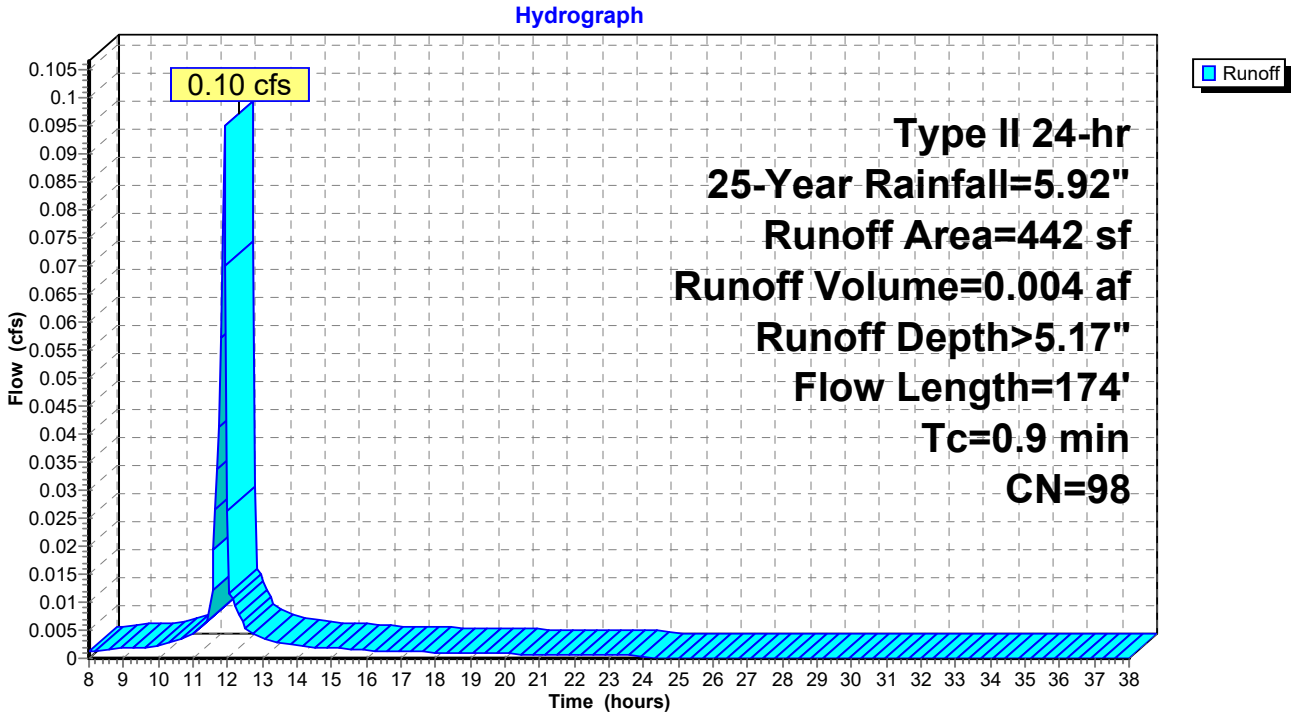
Runoff = 0.10 cfs @ 11.90 hrs, Volume= 0.004 af, Depth> 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

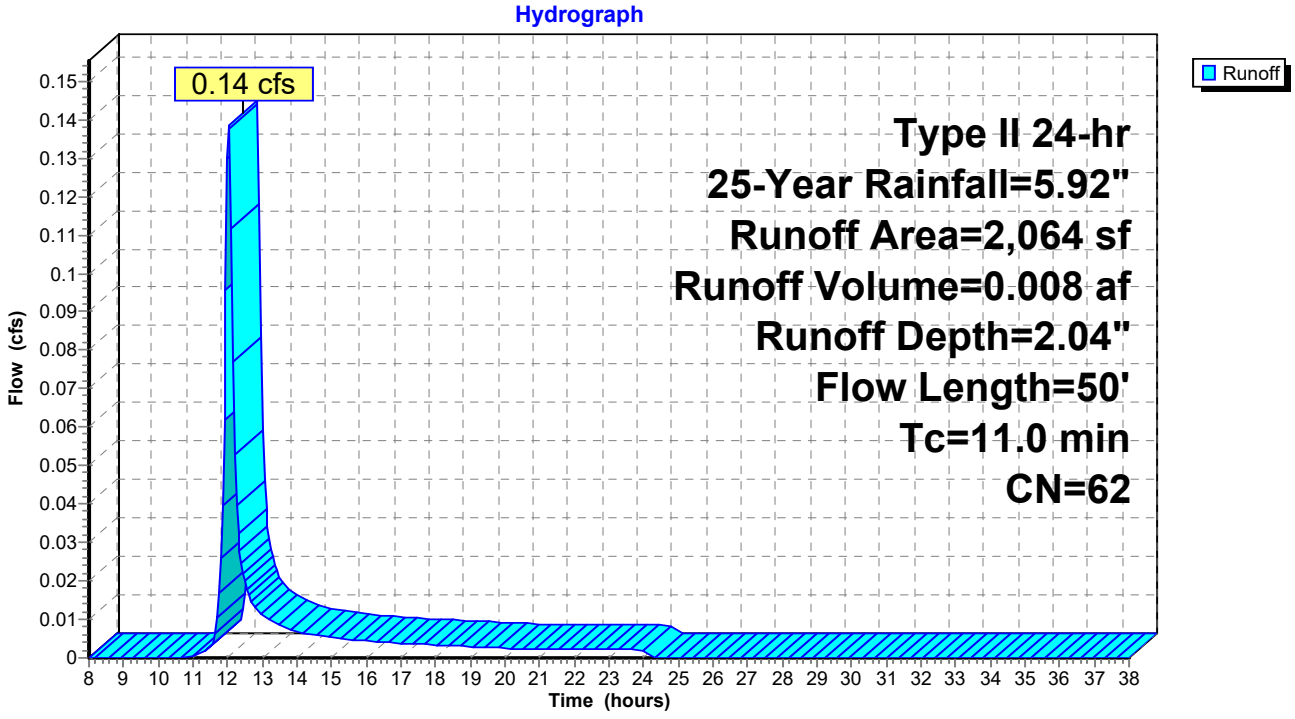
Runoff = 0.14 cfs @ 12.04 hrs, Volume= 0.008 af, Depth= 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

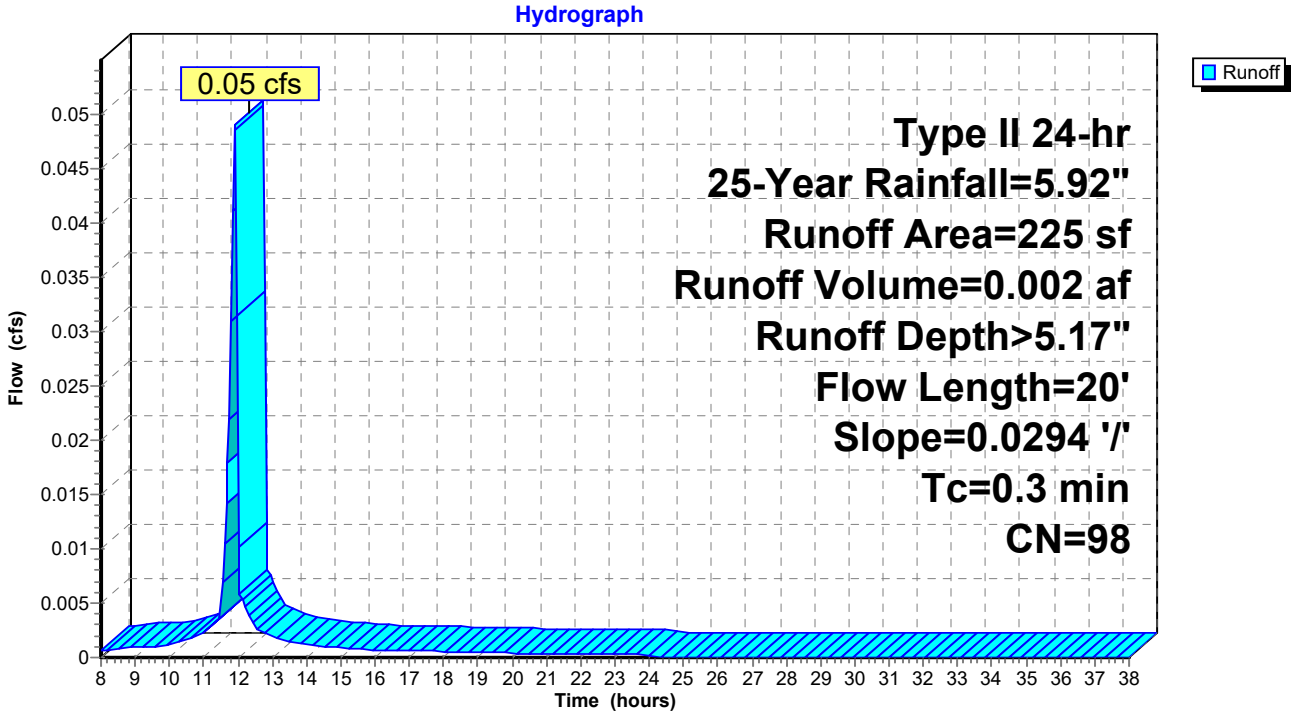
Runoff = 0.05 cfs @ 11.89 hrs, Volume= 0.002 af, Depth> 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.29"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.29"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.01 cfs 0.004 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=0.84"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.29 cfs 0.027 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.35"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.05 cfs 0.016 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>6.07"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.65 cfs 0.034 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.35"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.01 cfs 0.002 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.44 cfs 0.046 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>6.49"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.12 cfs 0.005 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=3.11"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.21 cfs 0.012 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>6.49"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.06 cfs 0.003 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.151 af Average Runoff Depth = 0.87"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

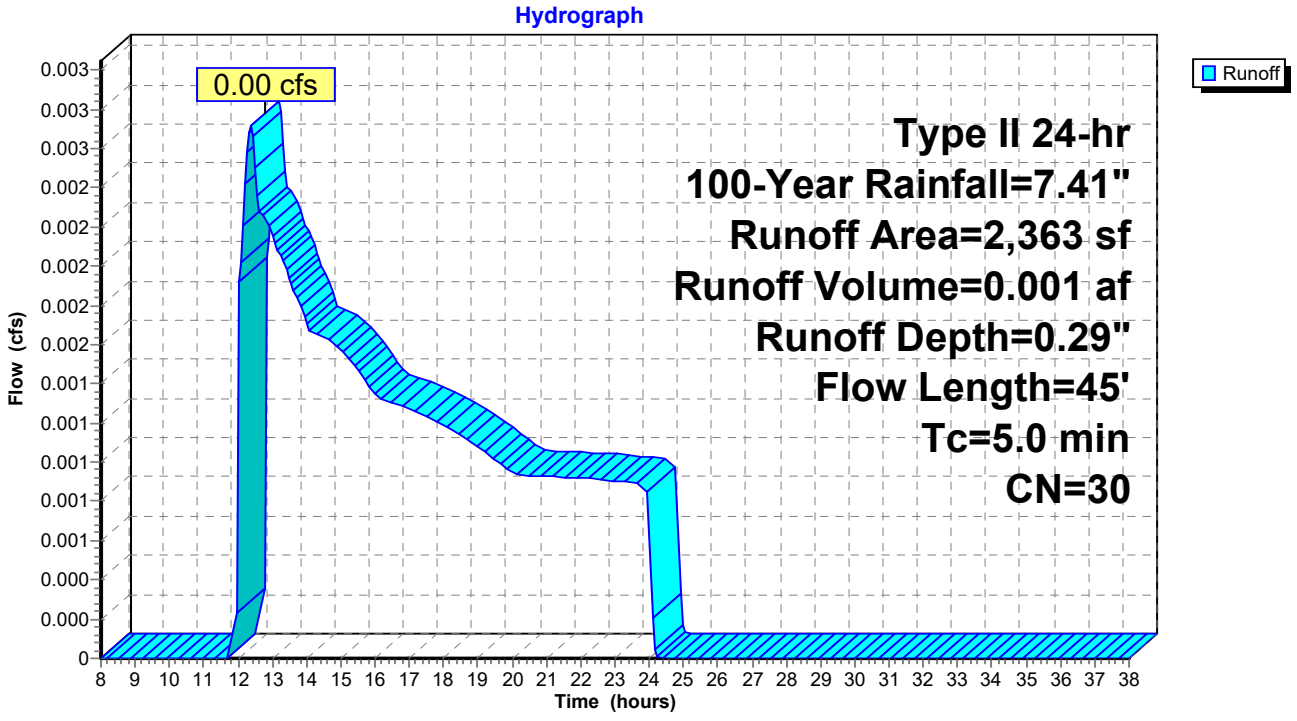
Runoff = 0.00 cfs @ 12.36 hrs, Volume= 0.001 af, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

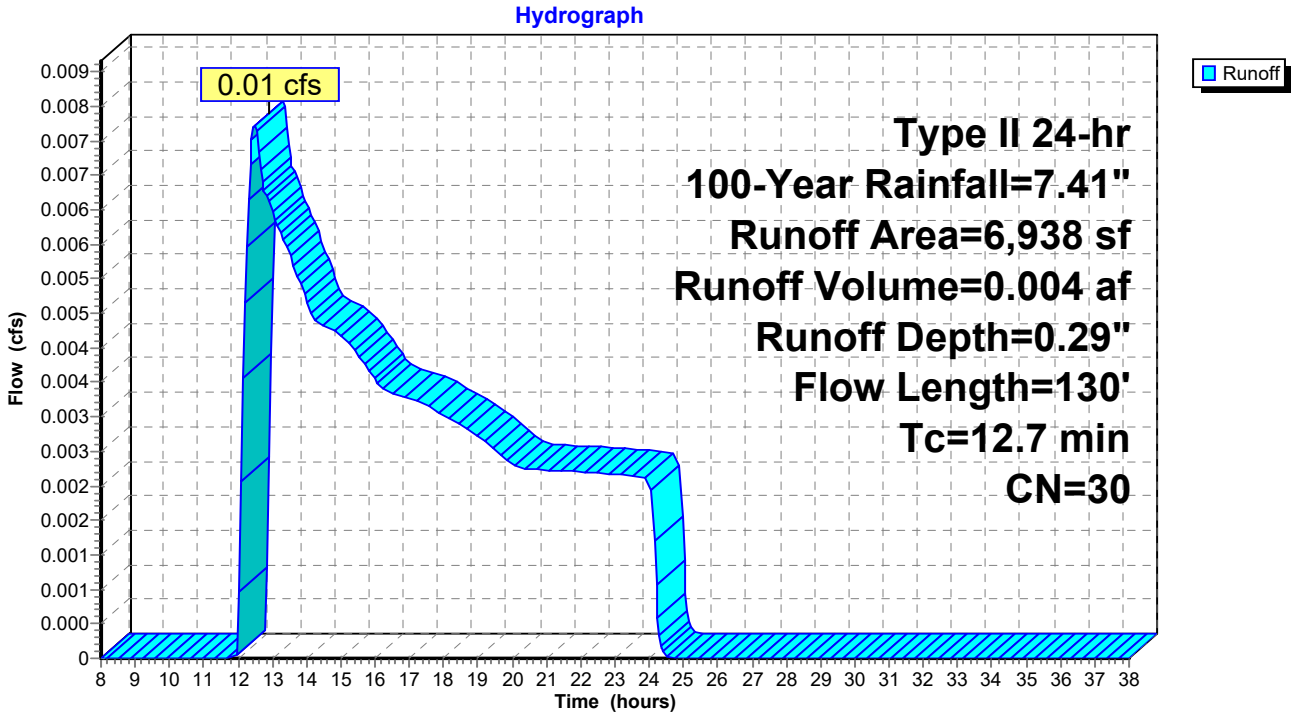
Runoff = 0.01 cfs @ 12.48 hrs, Volume= 0.004 af, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

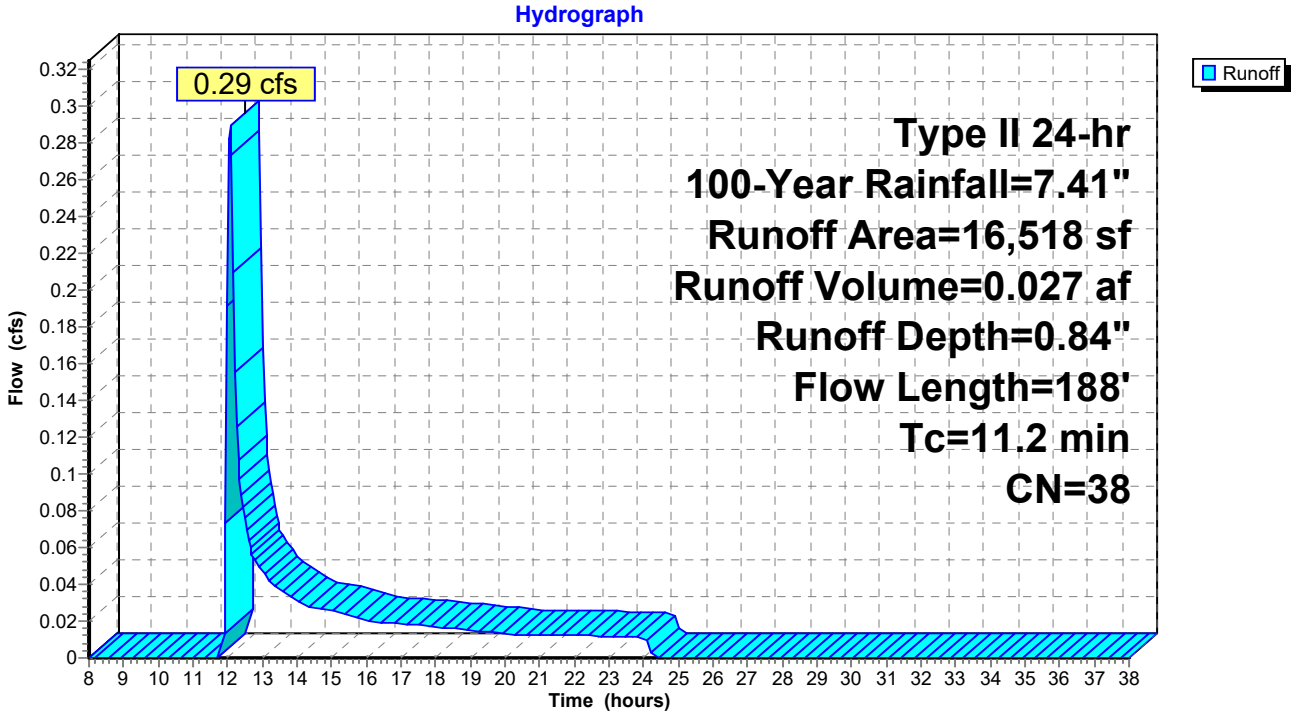
Runoff = 0.29 cfs @ 12.07 hrs, Volume= 0.027 af, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

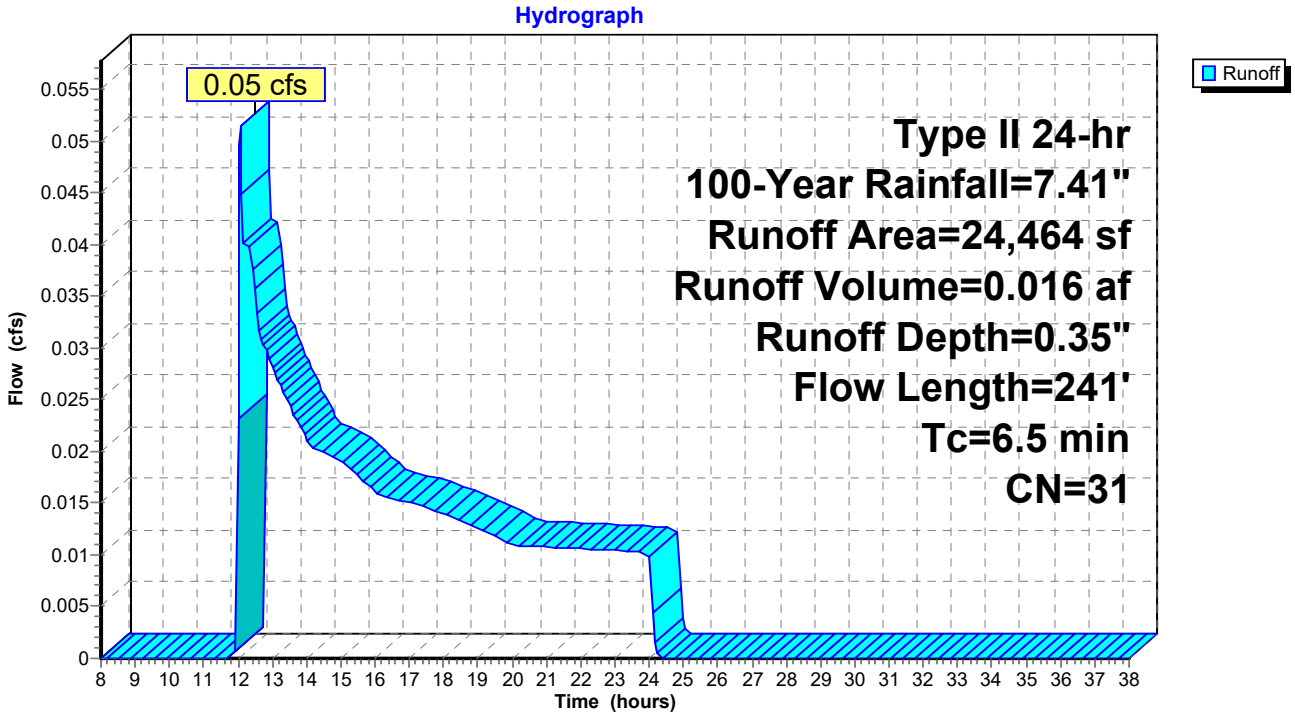
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.016 af, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

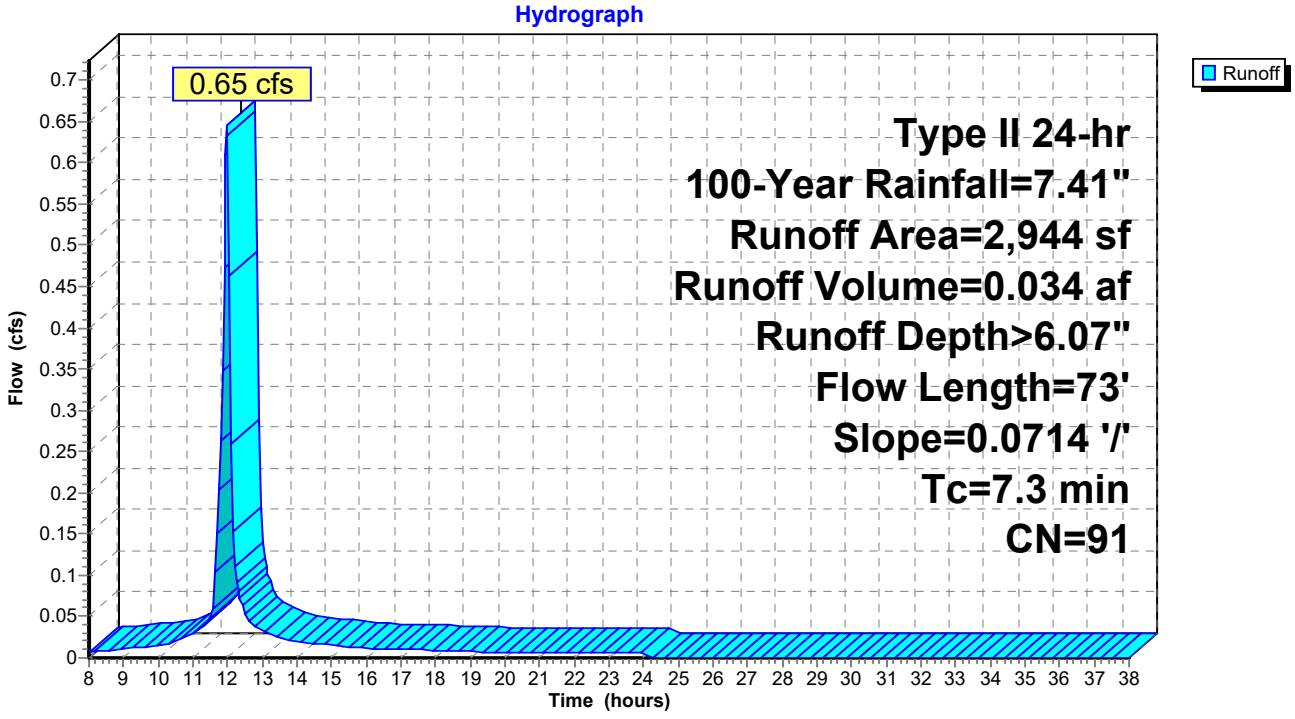
Runoff = 0.65 cfs @ 11.98 hrs, Volume= 0.034 af, Depth> 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

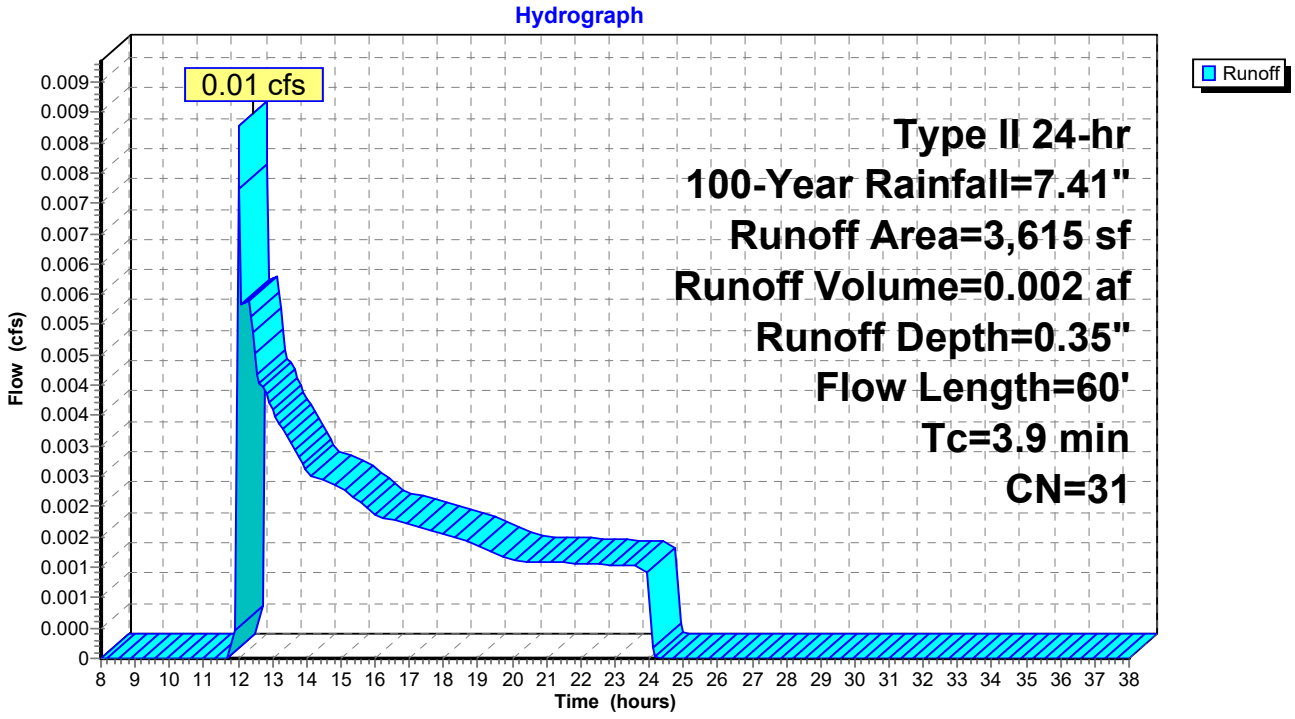
Runoff = 0.01 cfs @ 12.02 hrs, Volume= 0.002 af, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

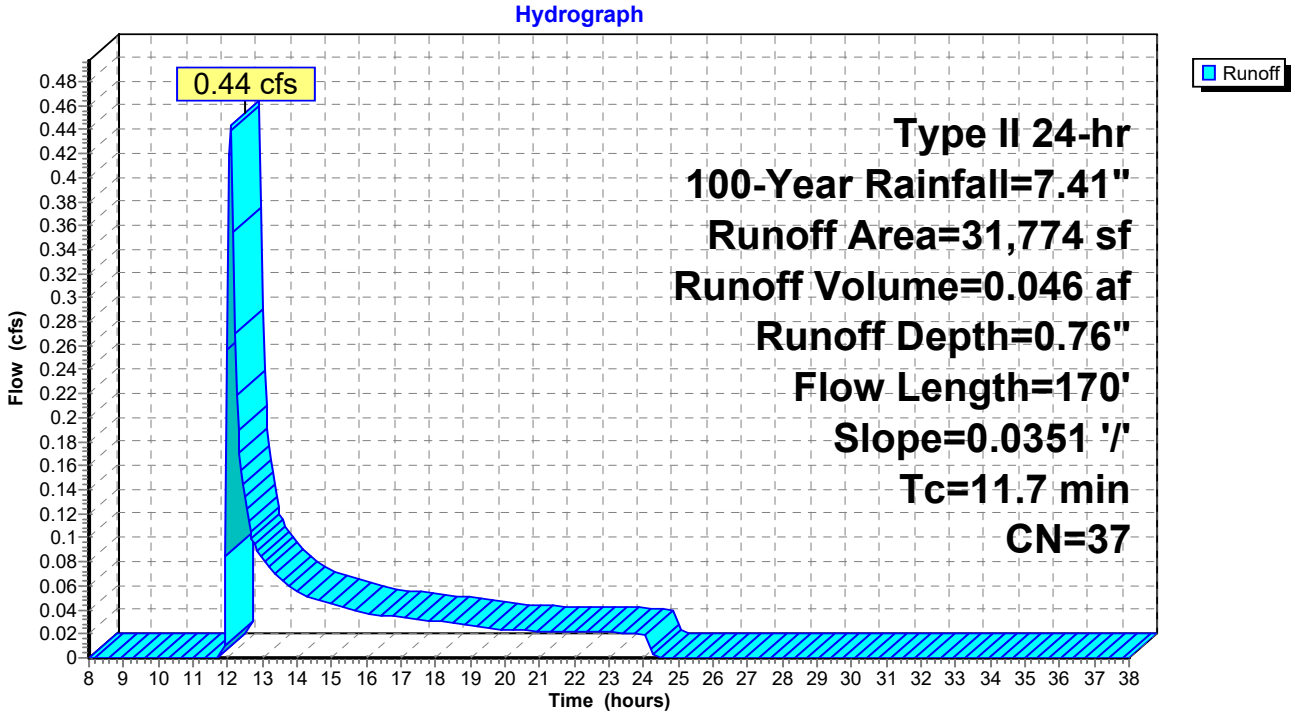
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.046 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

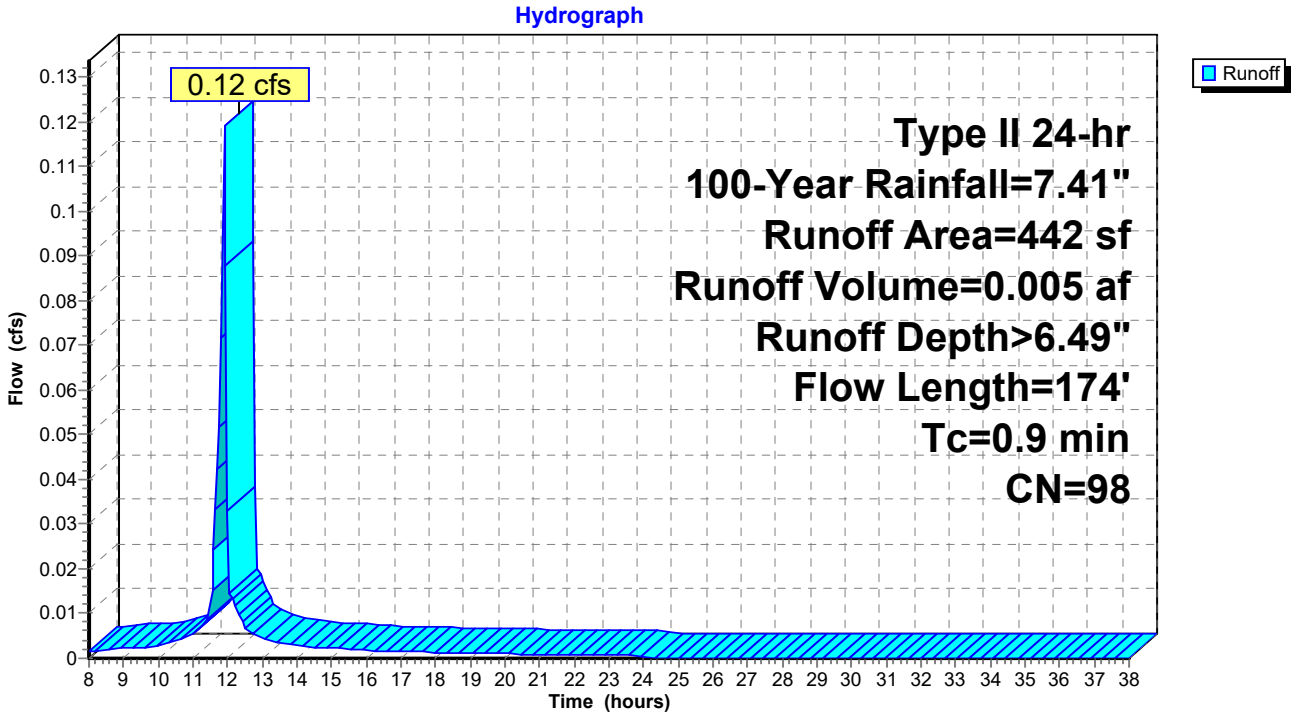
Runoff = 0.12 cfs @ 11.90 hrs, Volume= 0.005 af, Depth> 6.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

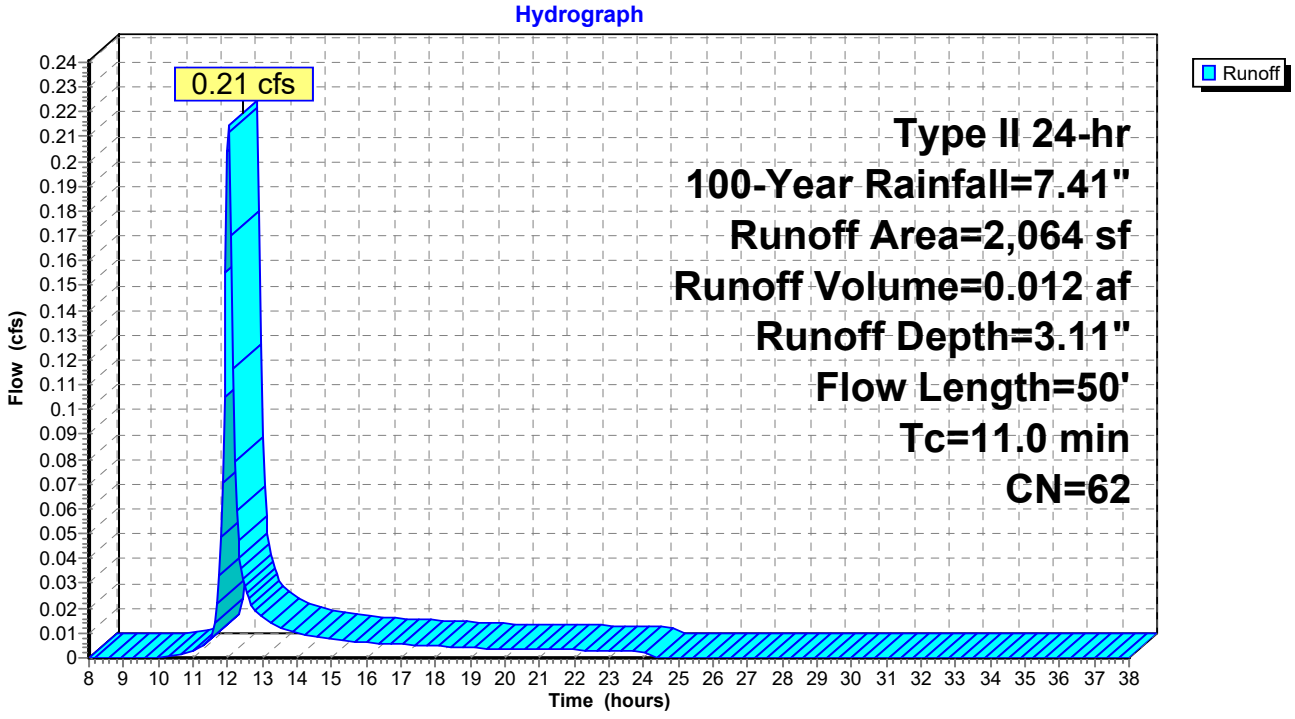
Runoff = 0.21 cfs @ 12.03 hrs, Volume= 0.012 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

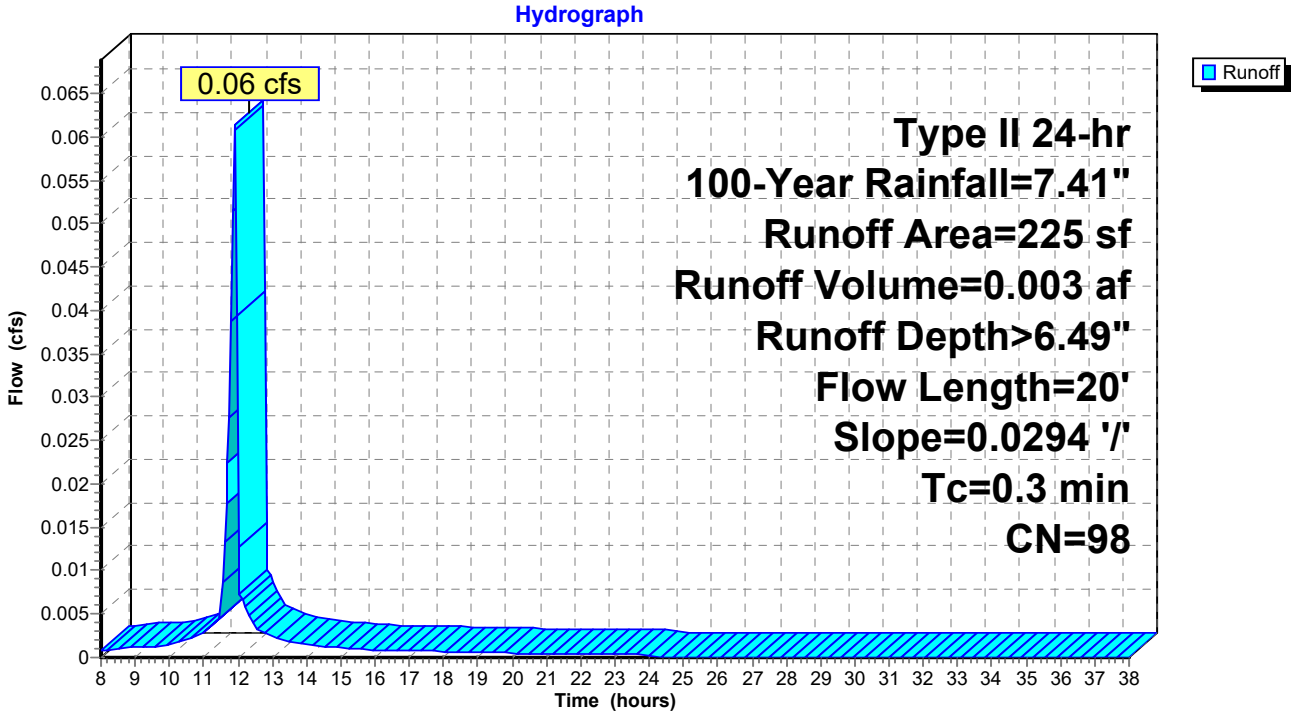
Runoff = 0.06 cfs @ 11.89 hrs, Volume= 0.003 af, Depth> 6.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.59"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.02 cfs 0.003 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.59"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.04 cfs 0.008 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=1.36"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.58 cfs 0.043 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.68"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.29 cfs 0.032 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>7.24"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.77 cfs 0.041 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.68"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.05 cfs 0.005 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=1.26"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.97 cfs 0.076 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>7.63"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.14 cfs 0.006 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=4.11"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.29 cfs 0.016 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>7.63"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.07 cfs 0.003 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.233 af Average Runoff Depth = 1.33"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

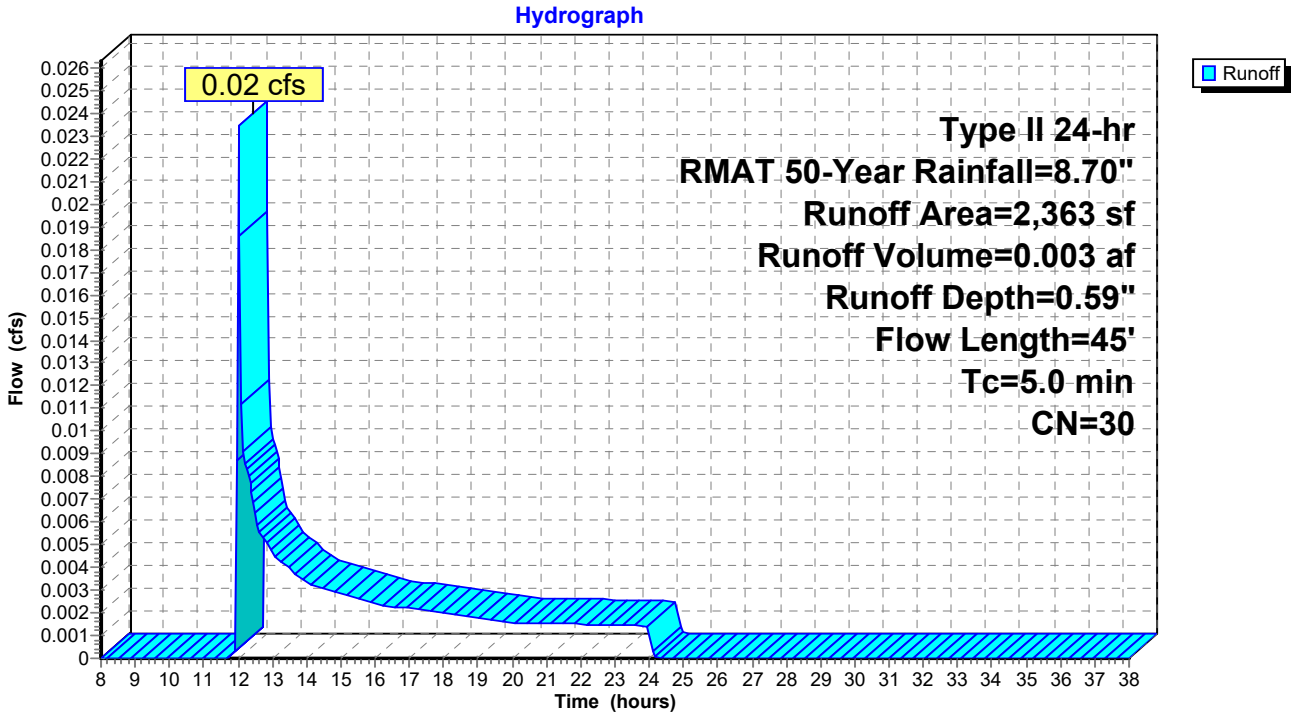
Runoff = 0.02 cfs @ 12.01 hrs, Volume= 0.003 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

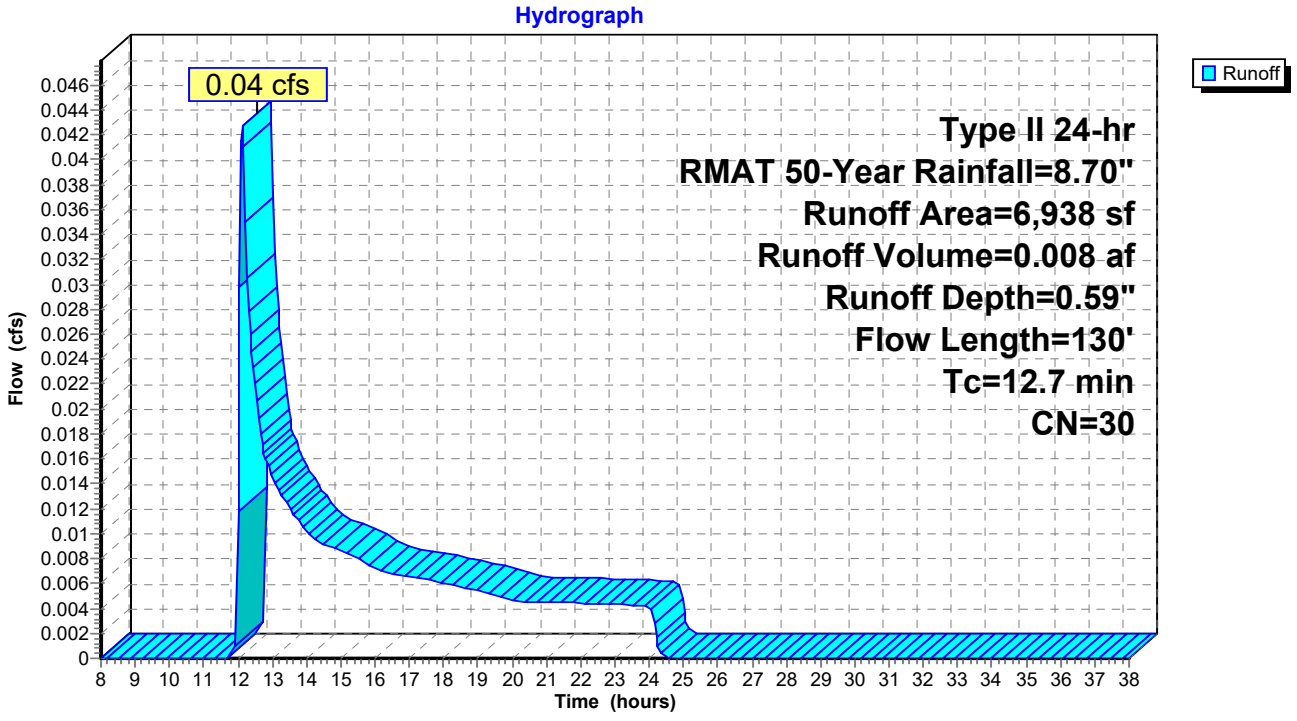
Runoff = 0.04 cfs @ 12.12 hrs, Volume= 0.008 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

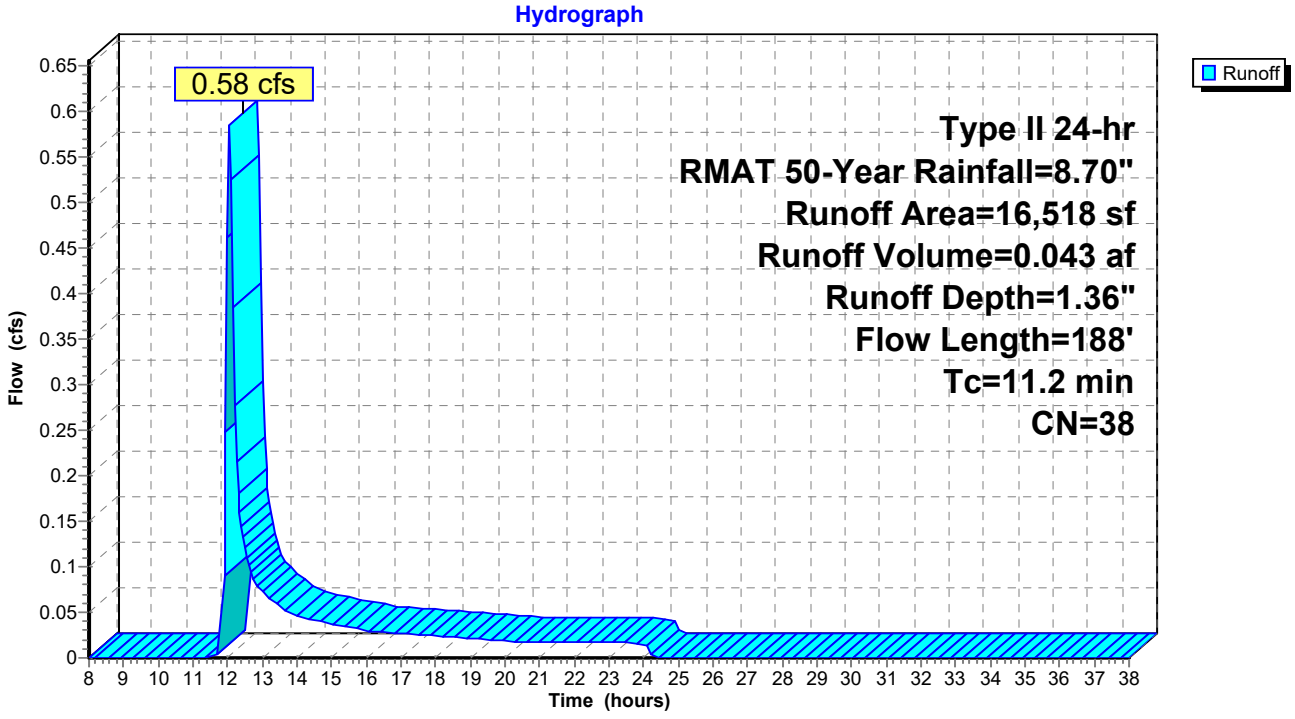
Runoff = 0.58 cfs @ 12.06 hrs, Volume= 0.043 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

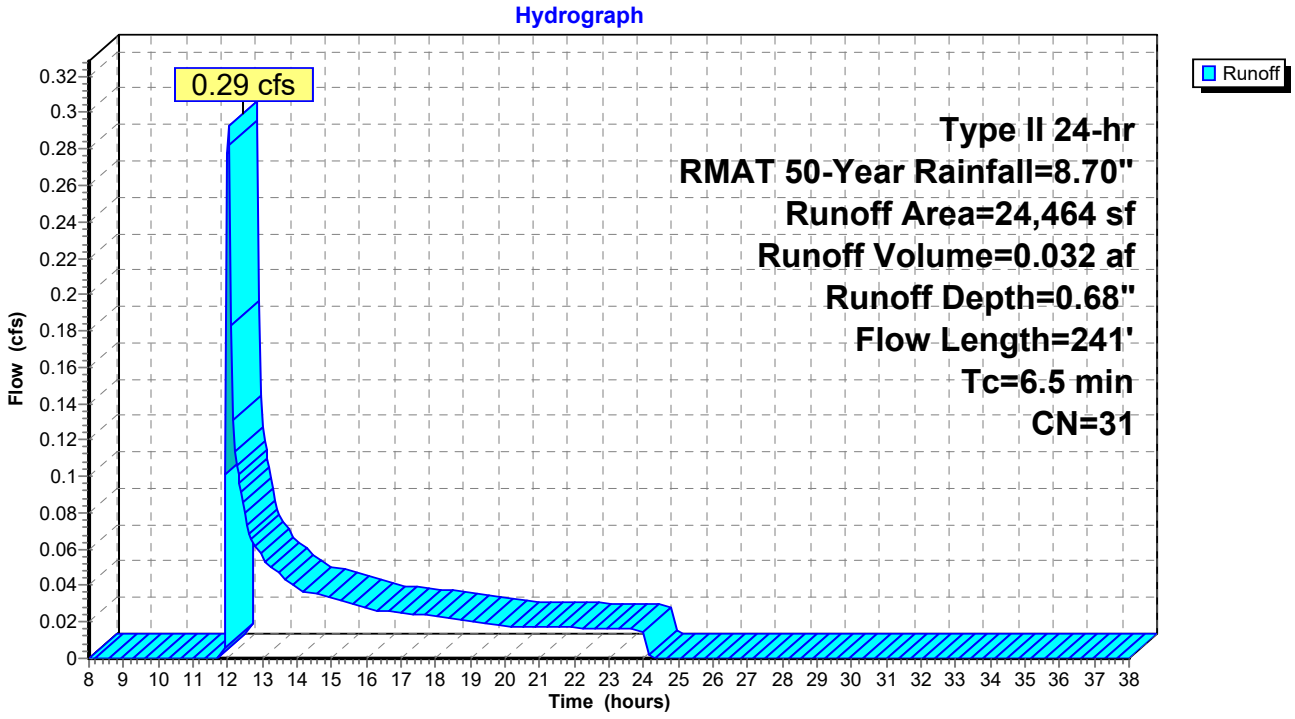
Runoff = 0.29 cfs @ 12.03 hrs, Volume= 0.032 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

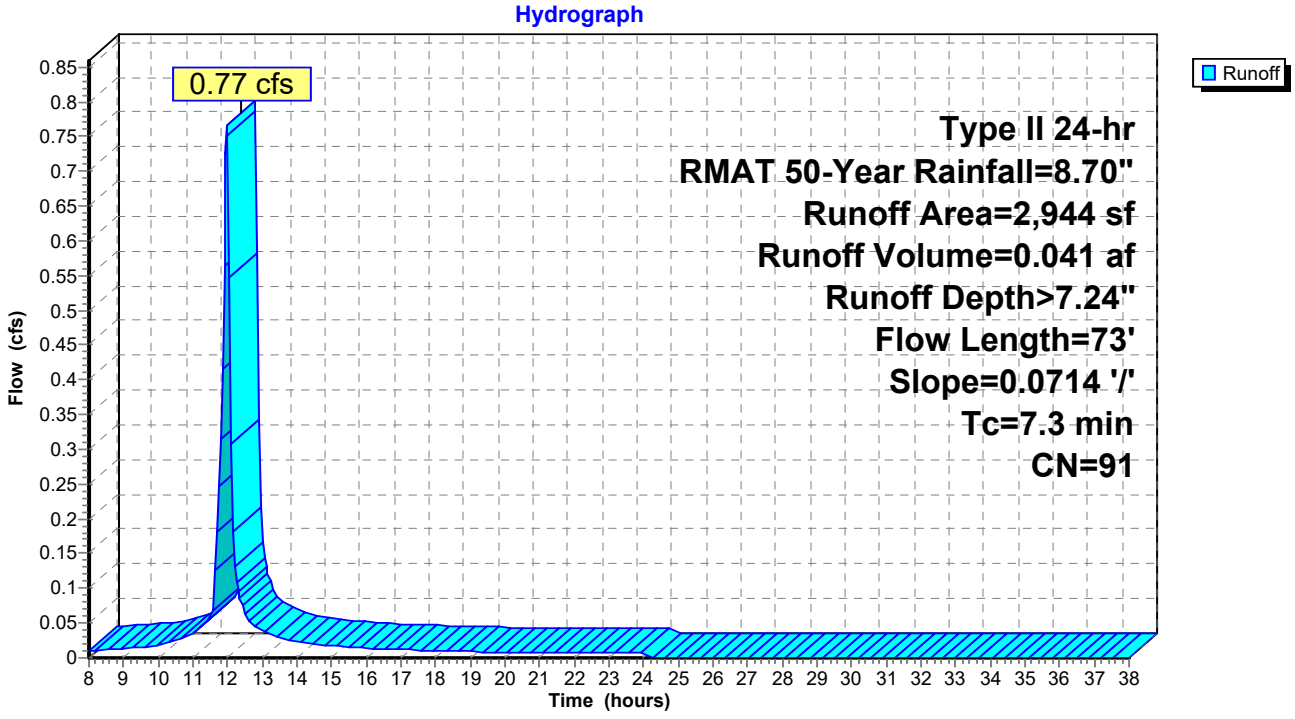
Runoff = 0.77 cfs @ 11.98 hrs, Volume= 0.041 af, Depth> 7.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

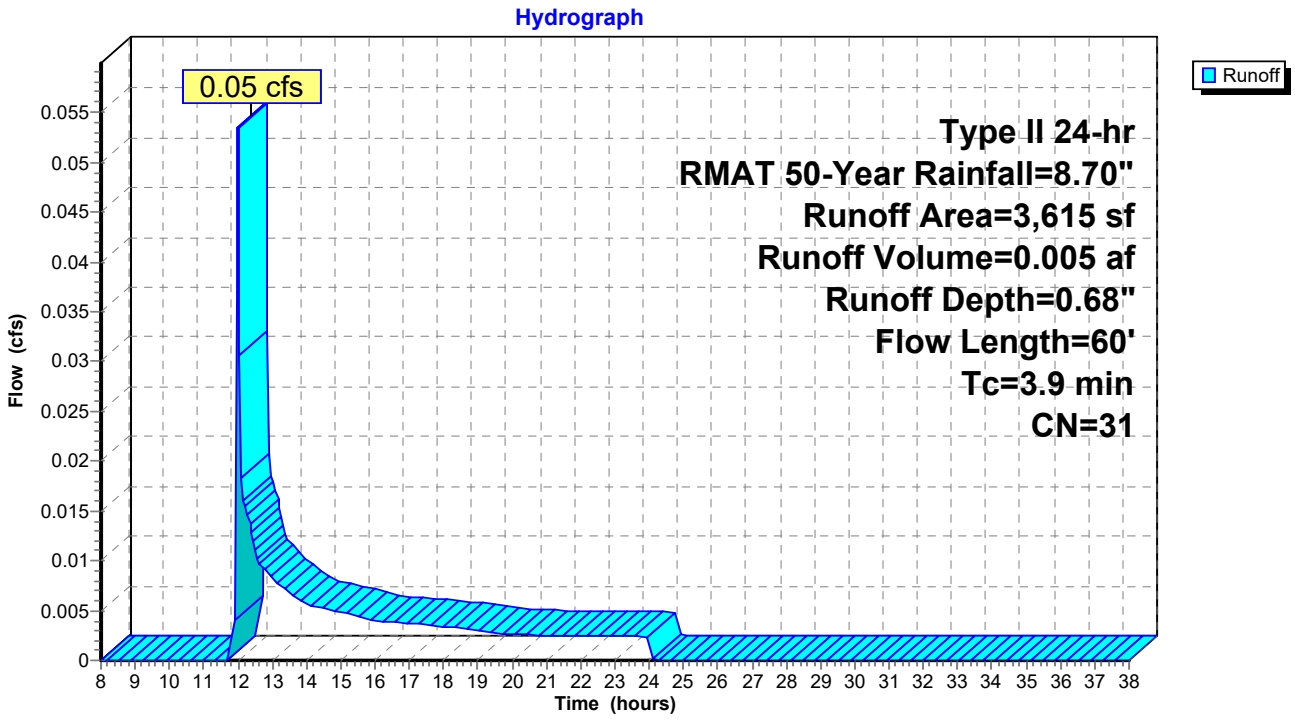
Runoff = 0.05 cfs @ 12.00 hrs, Volume= 0.005 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

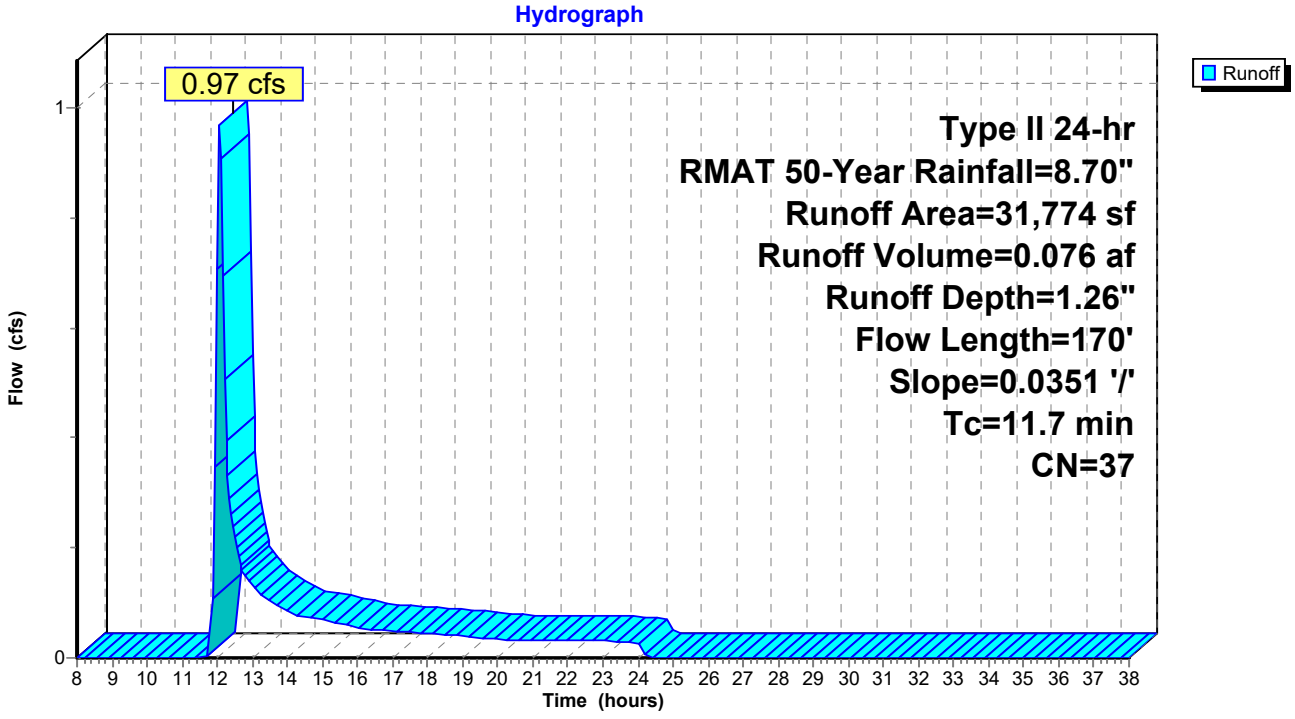
Runoff = 0.97 cfs @ 12.07 hrs, Volume= 0.076 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

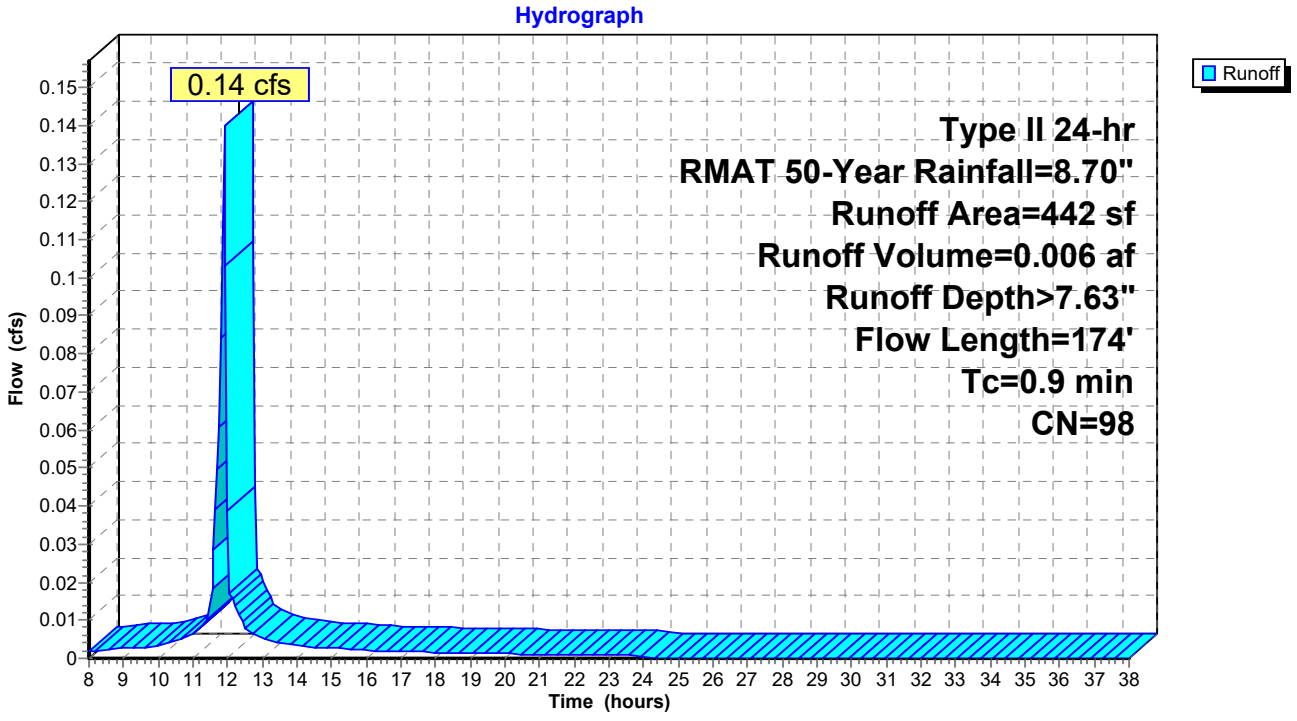
Runoff = 0.14 cfs @ 11.90 hrs, Volume= 0.006 af, Depth> 7.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

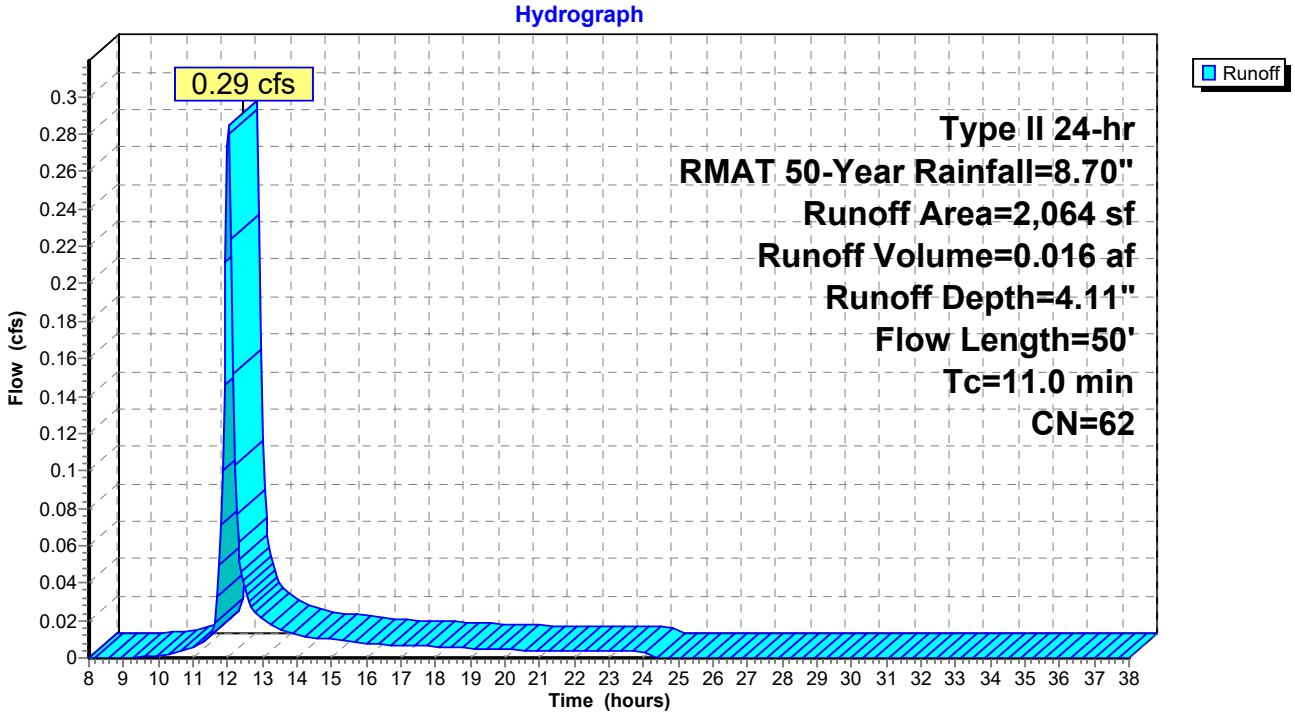
Runoff = 0.29 cfs @ 12.03 hrs, Volume= 0.016 af, Depth= 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

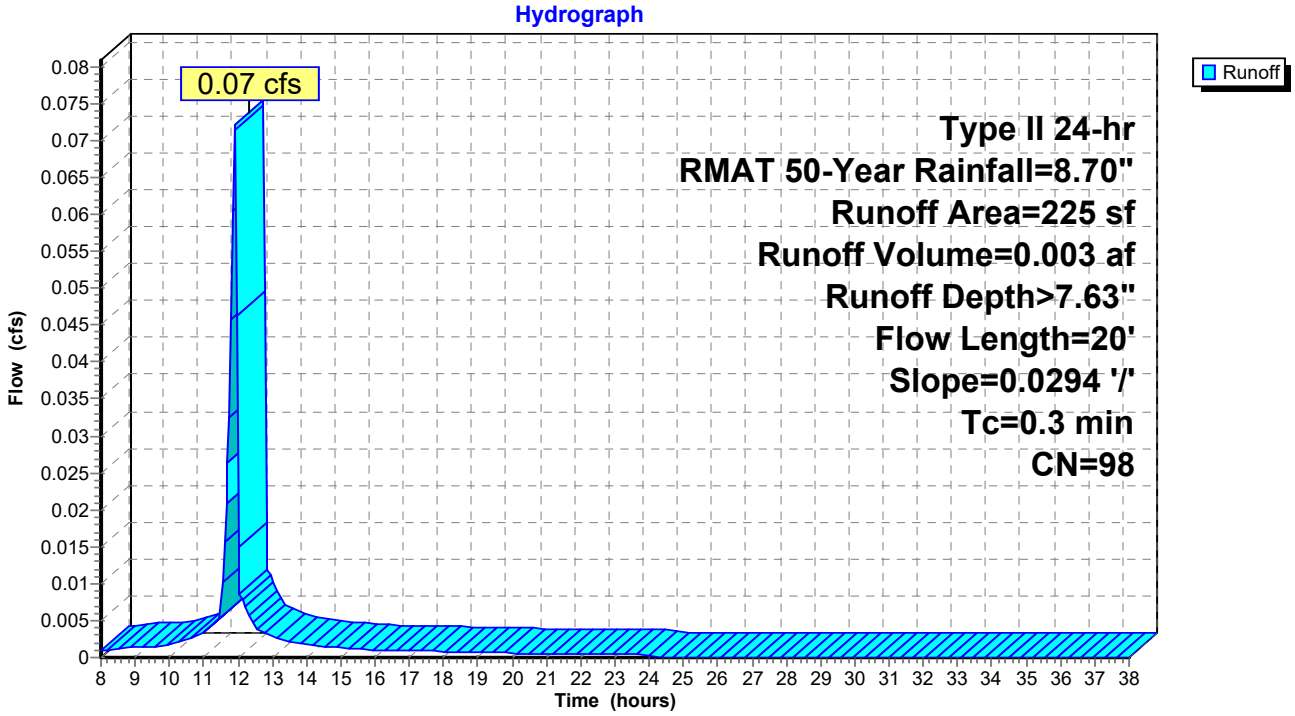
Runoff = 0.07 cfs @ 11.89 hrs, Volume= 0.003 af, Depth> 7.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Appendix H – Proposed Conditions HydroCAD Model Results



Subcat Reach Pond Link

Routing Diagram for BFD_Proposed
Prepared by H2Olson Engineering, Inc, Printed 6/9/2026
HydroCAD® 10.20-9a s/n 14216 © 2026 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type II 24-hr		Default	24.00	1	3.39	2
2	10-Year	Type II 24-hr		Default	24.00	1	4.95	2
3	25-Year	Type II 24-hr		Default	24.00	1	5.92	2
4	100-Year	Type II 24-hr		Default	24.00	1	7.41	2
5	RMAT 50-Year	Type II 24-hr		Default	24.00	1	8.70	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.500	39	>75% Grass cover, Good, HSG A (1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 3.1, 4.1, 4.2, 5.2)
0.285	30	Brush, Good, HSG A (1.1, 1.2, 1.3, 1.9, 3.1, 4.1, 4.2)
0.220	98	Paved parking, HSG A (1.3, 1.7, 1.8, 1.9, 5.1, 5.2, 6.1)
0.093	98	Roofs, HSG A (1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.7, 1.8)
2.097	**47**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.097	HSG A	1.1, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.097		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
1.500	0.000	0.000	0.000	0.000	1.500	>75% Grass cover, Good	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 3.1, 4.1, 4.2, 5.2
0.285	0.000	0.000	0.000	0.000	0.285	Brush, Good	1.1, 1.2, 1.3, 1.9, 3.1, 4.1, 4.2
0.220	0.000	0.000	0.000	0.000	0.220	Paved parking	1.3, 1.7, 1.8, 1.9, 5.1, 5.2, 6.1
0.093	0.000	0.000	0.000	0.000	0.093	Roofs	1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.7, 1.8
2.097	**0.000**	**0.000**	**0.000**	**0.000**	**2.097**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	1.10	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
2	1.10	0.00	0.00	17.0	1.0000	0.025	6.0	6.0	0.0	
3	1.10	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
4	1.11	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
5	1.11	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
6	1.11	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
7	1.12	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
8	1.12	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
9	1.12	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
10	1.13	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
11	1.13	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
12	1.13	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
13	1.14	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
14	1.14	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
15	1.14	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
16	1.15	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
17	1.15	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
18	1.15	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
19	1.7	0.00	0.00	17.0	0.0005	0.025	10.0	3.5	0.0	
20	1.7	0.00	0.00	17.0	1.0000	0.025	6.0	6.0	0.0	
21	1.7	0.00	0.00	22.0	0.1060	0.013	0.0	6.0	0.0	
22	1.8	0.00	0.00	17.0	0.0005	0.025	10.0	3.5	0.0	
23	1.8	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
24	1.8	0.00	0.00	31.0	0.0750	0.025	0.0	6.0	0.0	
25	1P	65.10	60.46	12.0	0.3867	0.013	0.0	12.0	0.0	
26	2P	65.10	60.46	43.0	0.1079	0.013	0.0	12.0	0.0	
27	3P	59.21	57.80	184.0	0.0077	0.013	0.0	8.0	0.0	
28	4P	59.75	59.54	130.0	0.0016	0.013	0.0	12.0	0.0	
29	4P	60.22	57.65	221.0	0.0116	0.013	0.0	6.0	0.0	
30	5P	59.15	57.65	86.0	0.0174	0.013	0.0	12.0	0.0	
31	7P	57.20	57.09	6.5	0.0169	0.011	24.0	6.0	0.0	
32	8P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
33	9P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
34	10P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
35	11P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
36	12P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
37	13P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	

Notes Listing (all nodes)

Line#	Node Number	Notes
1	1.4	Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.
2	1.5	Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.00 cfs 0.000 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.00 cfs 0.000 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=0.25"
Flow Length=165' Tc=0.9 min CN=53 Runoff=0.06 cfs 0.005 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.24 cfs 0.011 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.24 cfs 0.012 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=0.31"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=0.05 cfs 0.005 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=0.38"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.02 cfs 0.001 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.03 cfs 0.001 af

Pond 1P: Catch Basin Peak Elev=65.31' Storage=188 cf Inflow=0.24 cfs 0.011 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.23 cfs 0.007 af

Pond 2P: Catch Basin Peak Elev=65.31' Storage=188 cf Inflow=0.24 cfs 0.012 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.24 cfs 0.008 af

Pond 3P: Rain Garden Peak Elev=59.33' Storage=13 cf Inflow=0.05 cfs 0.005 af
Outflow=0.04 cfs 0.005 af

Pond 4P: Flow Splitter Peak Elev=60.24' Storage=3 cf Inflow=0.48 cfs 0.015 af
Primary=0.47 cfs 0.015 af Secondary=0.00 cfs 0.000 af Outflow=0.48 cfs 0.015 af

Pond 5P: Oil/Grit Separator Peak Elev=59.24' Storage=302 cf Inflow=0.47 cfs 0.015 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=0.05 cfs 0.008 af

Pond 6P: Sediment Forebay Peak Elev=57.35' Storage=246 cf Inflow=0.08 cfs 0.013 af
Outflow=0.02 cfs 0.008 af

Pond 7P: Infiltration Basin Peak Elev=56.00' Storage=4 cf Inflow=0.02 cfs 0.008 af
Discarded=0.02 cfs 0.008 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.008 af

Pond 8P: Dry Well 1 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 9P: Dry Well 2 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 10P: Dry Well 3 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 11P: Dry Well 4 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 12P: Dry Well 5 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 13P: Dry Well 6 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 14P: Infiltration Trench 1 Peak Elev=50.07' Storage=7 cf Inflow=0.06 cfs 0.005 af
Discarded=0.05 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.005 af

Pond 15P: Infiltration Trench 2 Peak Elev=63.00' Storage=0 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.057 af Average Runoff Depth = 0.33"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 0.06 cfs @ 11.95 hrs, Volume= 0.005 af, Depth= 0.25"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.00 cfs @ 24.04 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.24 cfs @ 11.91 hrs, Volume= 0.011 af, Depth= 3.16"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.24 cfs @ 11.91 hrs, Volume= 0.012 af, Depth= 3.16"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.005 af, Depth= 0.31"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.06 cfs @ 11.91 hrs, Volume= 0.003 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.02 cfs @ 12.07 hrs, Volume= 0.001 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.03 cfs @ 11.90 hrs, Volume= 0.001 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.24 cfs @ 11.91 hrs, Volume= 0.011 af
Outflow = 0.23 cfs @ 11.91 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.3 min
Primary = 0.23 cfs @ 11.91 hrs, Volume= 0.007 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.31' @ 11.91 hrs Surf.Area= 40 sf Storage= 188 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 196.9 min calculated for 0.007 af (64% of inflow)
Center-of-Mass det. time= 92.1 min (838.7 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.22 cfs @ 11.91 hrs HW=65.31' (Free Discharge)
1=Culvert (Inlet Controls 0.22 cfs @ 1.93 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.24 cfs @ 11.91 hrs, Volume= 0.012 af
Outflow = 0.24 cfs @ 11.91 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.2 min
Primary = 0.24 cfs @ 11.91 hrs, Volume= 0.008 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.31' @ 11.91 hrs Surf.Area= 40 sf Storage= 188 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 193.6 min calculated for 0.007 af (64% of inflow)
Center-of-Mass det. time= 90.3 min (836.9 - 746.6)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.23 cfs @ 11.91 hrs HW=65.31' (Free Discharge)
1=Culvert (Inlet Controls 0.23 cfs @ 1.94 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 0.31" for 2-Year event
Inflow = 0.05 cfs @ 12.08 hrs, Volume= 0.005 af
Outflow = 0.04 cfs @ 12.13 hrs, Volume= 0.005 af, Atten= 15%, Lag= 3.2 min
Primary = 0.04 cfs @ 12.13 hrs, Volume= 0.005 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.33' @ 12.13 hrs Surf.Area= 200 sf Storage= 13 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 20.7 min calculated for 0.005 af (99% of inflow)
Center-of-Mass det. time= 13.9 min (963.0 - 949.2)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 12.13 hrs HW=59.33' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.04 cfs @ 1.44 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 2.02" for 2-Year event
Inflow = 0.48 cfs @ 11.91 hrs, Volume= 0.015 af
Outflow = 0.48 cfs @ 11.91 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min
Primary = 0.47 cfs @ 11.91 hrs, Volume= 0.015 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.00 cfs @ 11.91 hrs, Volume= 0.000 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.24' @ 11.91 hrs Surf.Area= 3 sf Storage= 3 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 2.3 min calculated for 0.015 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (838.4 - 837.8)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.47 cfs @ 11.91 hrs HW=60.24' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.47 cfs @ 1.79 fps)

Secondary OutFlow Max=0.00 cfs @ 11.91 hrs HW=60.24' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.00 cfs @ 0.53 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 2.02" for 2-Year event
Inflow = 0.47 cfs @ 11.91 hrs, Volume= 0.015 af
Outflow = 0.05 cfs @ 12.22 hrs, Volume= 0.008 af, Atten= 90%, Lag= 18.5 min
Primary = 0.05 cfs @ 12.22 hrs, Volume= 0.008 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.24' @ 12.22 hrs Surf.Area= 71 sf Storage= 302 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 231.3 min calculated for 0.008 af (54% of inflow)
Center-of-Mass det. time= 110.4 min (948.8 - 838.4)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.04 cfs @ 12.22 hrs HW=59.24' (Free Discharge)
1=Culvert (Barrel Controls 0.04 cfs @ 1.82 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 0.45" for 2-Year event
Inflow = 0.08 cfs @ 12.20 hrs, Volume= 0.013 af
Outflow = 0.02 cfs @ 14.25 hrs, Volume= 0.008 af, Atten= 79%, Lag= 122.9 min
Primary = 0.02 cfs @ 14.25 hrs, Volume= 0.008 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.35' @ 14.25 hrs Surf.Area= 306 sf Storage= 246 cf

Plug-Flow detention time= 292.5 min calculated for 0.008 af (58% of inflow)
Center-of-Mass det. time= 138.7 min (1,093.3 - 954.6)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=0.01 cfs @ 14.25 hrs HW=57.35' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 0.01 cfs @ 0.31 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 0.20" for 2-Year event
Inflow = 0.02 cfs @ 14.25 hrs, Volume= 0.008 af
Outflow = 0.02 cfs @ 14.40 hrs, Volume= 0.008 af, Atten= 2%, Lag= 8.9 min
Discarded = 0.02 cfs @ 14.40 hrs, Volume= 0.008 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 56.00' @ 14.40 hrs Surf.Area= 600 sf Storage= 4 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 3.9 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (1,097.6 - 1,093.7)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.11 cfs @ 14.40 hrs HW=56.00' (Free Discharge)
1=Exfiltration (Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=56.00' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 0.25" for 2-Year event
Inflow = 0.06 cfs @ 11.95 hrs, Volume= 0.005 af
Outflow = 0.05 cfs @ 11.98 hrs, Volume= 0.005 af, Atten= 28%, Lag= 2.1 min
Discarded = 0.05 cfs @ 11.98 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 50.07' @ 11.98 hrs Surf.Area= 234 sf Storage= 7 cf

Plug-Flow detention time= 2.2 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 2.1 min (959.2 - 957.1)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.05 cfs @ 11.98 hrs HW=50.07' (Free Discharge)
1=Exfiltration (Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=50.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 24.04 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.06 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.9 min
Discarded = 0.00 cfs @ 24.06 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 63.00' @ 24.06 hrs Surf.Area= 135 sf Storage= 0 cf

Plug-Flow detention time= 1.4 min calculated for 0.000 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (1,331.0 - 1,329.6)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 24.06 hrs HW=63.00' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=0.16"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.00 cfs 0.001 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=0.16"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.00 cfs 0.001 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=0.84"
Flow Length=165' Tc=0.9 min CN=53 Runoff=0.38 cfs 0.016 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.01 cfs 0.004 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.01 cfs 0.005 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.00 cfs 0.002 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.35 cfs 0.017 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.35 cfs 0.017 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=0.96"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=0.25 cfs 0.017 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=0.10"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.00 cfs 0.001 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=0.13"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.01 cfs 0.004 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=0.13"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.00 cfs 0.001 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.08 cfs 0.004 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=1.08"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.07 cfs 0.004 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.04 cfs 0.002 af

Pond 1P: Catch Basin Peak Elev=65.36' Storage=190 cf Inflow=0.35 cfs 0.017 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.34 cfs 0.013 af

Pond 2P: Catch Basin Peak Elev=65.36' Storage=190 cf Inflow=0.35 cfs 0.017 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.35 cfs 0.013 af

Pond 3P: Rain Garden Peak Elev=59.51' Storage=29 cf Inflow=0.25 cfs 0.017 af
Outflow=0.25 cfs 0.017 af

Pond 4P: Flow Splitter Peak Elev=60.33' Storage=3 cf Inflow=0.70 cfs 0.026 af
Primary=0.66 cfs 0.026 af Secondary=0.04 cfs 0.000 af Outflow=0.70 cfs 0.026 af

Pond 5P: Oil/Grit Separator Peak Elev=59.51' Storage=322 cf Inflow=0.66 cfs 0.026 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=0.65 cfs 0.019 af

Pond 6P: Sediment Forebay Peak Elev=57.44' Storage=276 cf Inflow=0.73 cfs 0.036 af
Outflow=0.43 cfs 0.031 af

Pond 7P: Infiltration Basin Peak Elev=56.24' Storage=187 cf Inflow=0.43 cfs 0.032 af
Discarded=0.13 cfs 0.032 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.032 af

Pond 8P: Dry Well 1 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 9P: Dry Well 2 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 10P: Dry Well 3 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 11P: Dry Well 4 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 12P: Dry Well 5 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 13P: Dry Well 6 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 14P: Infiltration Trench 1 Peak Elev=51.49' Storage=139 cf Inflow=0.38 cfs 0.016 af
Discarded=0.07 cfs 0.016 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.016 af

Pond 15P: Infiltration Trench 2 Peak Elev=63.01' Storage=0 cf Inflow=0.00 cfs 0.002 af
Discarded=0.00 cfs 0.002 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.002 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.124 af Average Runoff Depth = 0.71"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af, Depth= 0.16"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.00 cfs @ 12.45 hrs, Volume= 0.001 af, Depth= 0.16"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 0.38 cfs @ 11.92 hrs, Volume= 0.016 af, Depth= 0.84"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.01 cfs @ 12.44 hrs, Volume= 0.004 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.01 cfs @ 12.45 hrs, Volume= 0.005 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.00 cfs @ 12.65 hrs, Volume= 0.002 af, Depth= 0.19"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.35 cfs @ 11.91 hrs, Volume= 0.017 af, Depth= 4.71"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.35 cfs @ 11.91 hrs, Volume= 0.017 af, Depth= 4.71"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 0.25 cfs @ 12.05 hrs, Volume= 0.017 af, Depth= 0.96"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.00 cfs @ 15.06 hrs, Volume= 0.001 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.01 cfs @ 13.43 hrs, Volume= 0.004 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.00 cfs @ 13.80 hrs, Volume= 0.001 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.08 cfs @ 11.91 hrs, Volume= 0.004 af, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.07 cfs @ 12.04 hrs, Volume= 0.004 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.04 cfs @ 11.90 hrs, Volume= 0.002 af, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.35 cfs @ 11.91 hrs, Volume= 0.017 af
Outflow = 0.34 cfs @ 11.91 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.3 min
Primary = 0.34 cfs @ 11.91 hrs, Volume= 0.013 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.36' @ 11.91 hrs Surf.Area= 40 sf Storage= 190 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 164.0 min calculated for 0.013 af (76% of inflow)
Center-of-Mass det. time= 75.0 min (814.4 - 739.4)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.34 cfs @ 11.91 hrs HW=65.35' (Free Discharge)
1=Culvert (Inlet Controls 0.34 cfs @ 2.14 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.35 cfs @ 11.91 hrs, Volume= 0.017 af
Outflow = 0.35 cfs @ 11.91 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.2 min
Primary = 0.35 cfs @ 11.91 hrs, Volume= 0.013 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.36' @ 11.91 hrs Surf.Area= 40 sf Storage= 190 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 161.8 min calculated for 0.013 af (76% of inflow)
Center-of-Mass det. time= 73.9 min (813.4 - 739.5)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.35 cfs @ 11.91 hrs HW=65.36' (Free Discharge)
1=Culvert (Inlet Controls 0.35 cfs @ 2.16 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 0.96" for 10-Year event
Inflow = 0.25 cfs @ 12.05 hrs, Volume= 0.017 af
Outflow = 0.25 cfs @ 12.07 hrs, Volume= 0.017 af, Atten= 1%, Lag= 1.0 min
Primary = 0.25 cfs @ 12.07 hrs, Volume= 0.017 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.51' @ 12.07 hrs Surf.Area= 200 sf Storage= 29 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 9.0 min calculated for 0.017 af (100% of inflow)
Center-of-Mass det. time= 6.6 min (902.5 - 896.0)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.25 cfs @ 12.07 hrs HW=59.50' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.25 cfs @ 2.44 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 3.58" for 10-Year event
Inflow = 0.70 cfs @ 11.91 hrs, Volume= 0.026 af
Outflow = 0.70 cfs @ 11.91 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min
Primary = 0.66 cfs @ 11.91 hrs, Volume= 0.026 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.04 cfs @ 11.91 hrs, Volume= 0.000 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.33' @ 11.91 hrs Surf.Area= 3 sf Storage= 3 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 1.5 min calculated for 0.026 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (814.3 - 813.9)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.65 cfs @ 11.91 hrs HW=60.33' (Free Discharge)
1=Culvert (Barrel Controls 0.65 cfs @ 1.98 fps)

Secondary OutFlow Max=0.04 cfs @ 11.91 hrs HW=60.33' (Free Discharge)
2=Culvert (Barrel Controls 0.04 cfs @ 1.67 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 3.54" for 10-Year event
Inflow = 0.66 cfs @ 11.91 hrs, Volume= 0.026 af
Outflow = 0.65 cfs @ 11.92 hrs, Volume= 0.019 af, Atten= 1%, Lag= 0.2 min
Primary = 0.65 cfs @ 11.92 hrs, Volume= 0.019 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.51' @ 11.92 hrs Surf.Area= 71 sf Storage= 322 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 134.1 min calculated for 0.019 af (73% of inflow)
Center-of-Mass det. time= 42.8 min (857.9 - 815.1)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.64 cfs @ 11.92 hrs HW=59.51' (Free Discharge)
1=Culvert (Inlet Controls 0.64 cfs @ 2.55 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 1.24" for 10-Year event
Inflow = 0.73 cfs @ 11.92 hrs, Volume= 0.036 af
Outflow = 0.43 cfs @ 12.02 hrs, Volume= 0.031 af, Atten= 41%, Lag= 5.7 min
Primary = 0.43 cfs @ 12.02 hrs, Volume= 0.031 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.44' @ 12.02 hrs Surf.Area= 327 sf Storage= 276 cf

Plug-Flow detention time= 105.1 min calculated for 0.031 af (85% of inflow)
Center-of-Mass det. time= 32.4 min (913.3 - 880.9)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=0.42 cfs @ 12.02 hrs HW=57.44' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 0.42 cfs @ 1.01 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 0.85" for 10-Year event
Inflow = 0.43 cfs @ 12.02 hrs, Volume= 0.032 af
Outflow = 0.13 cfs @ 12.35 hrs, Volume= 0.032 af, Atten= 69%, Lag= 20.4 min
Discarded = 0.13 cfs @ 12.35 hrs, Volume= 0.032 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 56.24' @ 12.35 hrs Surf.Area= 690 sf Storage= 187 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 9.0 min calculated for 0.032 af (100% of inflow)
Center-of-Mass det. time= 9.0 min (927.4 - 918.4)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.13 cfs @ 12.35 hrs HW=56.24' (Free Discharge)
1=Exfiltration (Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=56.00' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 0.84" for 10-Year event
Inflow = 0.38 cfs @ 11.92 hrs, Volume= 0.016 af
Outflow = 0.07 cfs @ 12.03 hrs, Volume= 0.016 af, Atten= 83%, Lag= 6.6 min
Discarded = 0.07 cfs @ 12.03 hrs, Volume= 0.016 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 51.49' @ 12.03 hrs Surf.Area= 234 sf Storage= 139 cf

Plug-Flow detention time= 13.0 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 13.0 min (908.0 - 895.0)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.07 cfs @ 12.03 hrs HW=51.49' (Free Discharge)
1=Exfiltration (Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=50.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 0.15" for 10-Year event
Inflow = 0.00 cfs @ 12.65 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 12.67 hrs, Volume= 0.002 af, Atten= 0%, Lag= 1.3 min
Discarded = 0.00 cfs @ 12.67 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 63.01' @ 12.67 hrs Surf.Area= 135 sf Storage= 0 cf

Plug-Flow detention time= 1.4 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (1,036.2 - 1,034.8)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 12.67 hrs HW=63.01' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=0.37"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.02 cfs 0.003 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=0.37"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.01 cfs 0.002 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=1.32"
Flow Length=165' Tc=0.9 min CN=53 Runoff=0.63 cfs 0.026 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=0.42"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.06 cfs 0.008 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=0.42"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.07 cfs 0.010 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=0.42"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.02 cfs 0.005 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.41 cfs 0.020 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.42 cfs 0.021 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=1.47"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=0.42 cfs 0.026 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=0.28"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.01 cfs 0.003 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.04 cfs 0.010 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.01 cfs 0.003 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.10 cfs 0.005 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=1.63"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.11 cfs 0.006 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.05 cfs 0.002 af

Pond 1P: Catch Basin Peak Elev=65.38' Storage=191 cf Inflow=0.41 cfs 0.020 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.41 cfs 0.016 af

Pond 2P: Catch Basin Peak Elev=65.38' Storage=191 cf Inflow=0.42 cfs 0.021 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.42 cfs 0.017 af

Pond 3P: Rain Garden Peak Elev=59.60' Storage=37 cf Inflow=0.42 cfs 0.026 af
Outflow=0.42 cfs 0.026 af

Pond 4P: Flow Splitter Peak Elev=60.38' Storage=3 cf Inflow=0.84 cfs 0.033 af
Primary=0.76 cfs 0.033 af Secondary=0.08 cfs 0.001 af Outflow=0.84 cfs 0.033 af

Pond 5P: Oil/Grit Separator Peak Elev=59.54' Storage=324 cf Inflow=0.76 cfs 0.033 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=0.75 cfs 0.026 af

Pond 6P: Sediment Forebay Peak Elev=57.51' Storage=300 cf Inflow=0.97 cfs 0.054 af
Outflow=0.94 cfs 0.048 af

Pond 7P: Infiltration Basin Peak Elev=56.68' Storage=540 cf Inflow=0.95 cfs 0.051 af
Discarded=0.17 cfs 0.051 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.051 af

Pond 8P: Dry Well 1 Peak Elev=67.67' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 9P: Dry Well 2 Peak Elev=67.67' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 10P: Dry Well 3 Peak Elev=67.65' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 11P: Dry Well 4 Peak Elev=67.62' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 12P: Dry Well 5 Peak Elev=67.73' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 13P: Dry Well 6 Peak Elev=67.70' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 14P: Infiltration Trench 1 Peak Elev=53.05' Storage=285 cf Inflow=0.63 cfs 0.026 af
Discarded=0.09 cfs 0.026 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.026 af

Pond 15P: Infiltration Trench 2 Peak Elev=63.03' Storage=2 cf Inflow=0.02 cfs 0.005 af
Discarded=0.02 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.005 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.184 af Average Runoff Depth = 1.05"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.02 cfs @ 12.02 hrs, Volume= 0.003 af, Depth= 0.37"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.01 cfs @ 12.03 hrs, Volume= 0.002 af, Depth= 0.37"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 0.63 cfs @ 11.92 hrs, Volume= 0.026 af, Depth= 1.32"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.06 cfs @ 12.08 hrs, Volume= 0.008 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.07 cfs @ 12.08 hrs, Volume= 0.010 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.02 cfs @ 12.28 hrs, Volume= 0.005 af, Depth= 0.42"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.41 cfs @ 11.91 hrs, Volume= 0.020 af, Depth= 5.68"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.42 cfs @ 11.91 hrs, Volume= 0.021 af, Depth= 5.68"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 0.42 cfs @ 12.04 hrs, Volume= 0.026 af, Depth= 1.47"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.01 cfs @ 12.39 hrs, Volume= 0.003 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.04 cfs @ 12.12 hrs, Volume= 0.010 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.01 cfs @ 12.55 hrs, Volume= 0.003 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.10 cfs @ 11.91 hrs, Volume= 0.005 af, Depth= 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.11 cfs @ 12.04 hrs, Volume= 0.006 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.05 cfs @ 11.90 hrs, Volume= 0.002 af, Depth= 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.41 cfs @ 11.91 hrs, Volume= 0.020 af
Outflow = 0.41 cfs @ 11.91 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.2 min
Primary = 0.41 cfs @ 11.91 hrs, Volume= 0.016 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.38' @ 11.91 hrs Surf.Area= 40 sf Storage= 191 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 151.5 min calculated for 0.016 af (80% of inflow)
Center-of-Mass det. time= 69.6 min (806.1 - 736.5)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.40 cfs @ 11.91 hrs HW=65.38' (Free Discharge)
1=Culvert (Inlet Controls 0.40 cfs @ 2.25 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.42 cfs @ 11.91 hrs, Volume= 0.021 af
Outflow = 0.42 cfs @ 11.91 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.1 min
Primary = 0.42 cfs @ 11.91 hrs, Volume= 0.017 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.38' @ 11.91 hrs Surf.Area= 40 sf Storage= 191 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 149.5 min calculated for 0.017 af (80% of inflow)
Center-of-Mass det. time= 68.6 min (805.2 - 736.6)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.41 cfs @ 11.91 hrs HW=65.38' (Free Discharge)
1=Culvert (Inlet Controls 0.41 cfs @ 2.26 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 1.47" for 25-Year event
Inflow = 0.42 cfs @ 12.04 hrs, Volume= 0.026 af
Outflow = 0.42 cfs @ 12.06 hrs, Volume= 0.026 af, Atten= 1%, Lag= 0.7 min
Primary = 0.42 cfs @ 12.06 hrs, Volume= 0.026 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.60' @ 12.06 hrs Surf.Area= 200 sf Storage= 37 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 6.7 min calculated for 0.026 af (100% of inflow)
Center-of-Mass det. time= 5.1 min (885.0 - 879.9)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.42 cfs @ 12.06 hrs HW=59.60' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.42 cfs @ 2.81 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 4.55" for 25-Year event
Inflow = 0.84 cfs @ 11.91 hrs, Volume= 0.033 af
Outflow = 0.84 cfs @ 11.91 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 11.91 hrs, Volume= 0.033 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.08 cfs @ 11.91 hrs, Volume= 0.001 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.38' @ 11.91 hrs Surf.Area= 3 sf Storage= 3 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 0.9 min calculated for 0.033 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (805.9 - 805.6)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.75 cfs @ 11.91 hrs HW=60.38' (Free Discharge)
1=Culvert (Barrel Controls 0.75 cfs @ 2.07 fps)

Secondary OutFlow Max=0.07 cfs @ 11.91 hrs HW=60.38' (Free Discharge)
2=Culvert (Barrel Controls 0.07 cfs @ 2.06 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 4.47" for 25-Year event
Inflow = 0.76 cfs @ 11.91 hrs, Volume= 0.033 af
Outflow = 0.75 cfs @ 11.91 hrs, Volume= 0.026 af, Atten= 1%, Lag= 0.2 min
Primary = 0.75 cfs @ 11.91 hrs, Volume= 0.026 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.54' @ 11.91 hrs Surf.Area= 71 sf Storage= 324 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 112.9 min calculated for 0.026 af (79% of inflow)
Center-of-Mass det. time= 32.6 min (840.0 - 807.4)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.75 cfs @ 11.91 hrs HW=59.54' (Free Discharge)
1=Culvert (Inlet Controls 0.75 cfs @ 2.65 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 1.83" for 25-Year event
Inflow = 0.97 cfs @ 11.92 hrs, Volume= 0.054 af
Outflow = 0.94 cfs @ 11.95 hrs, Volume= 0.048 af, Atten= 3%, Lag= 1.5 min
Primary = 0.94 cfs @ 11.95 hrs, Volume= 0.048 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.51' @ 11.95 hrs Surf.Area= 342 sf Storage= 300 cf

Plug-Flow detention time= 73.1 min calculated for 0.048 af (90% of inflow)
Center-of-Mass det. time= 20.0 min (884.5 - 864.6)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=0.92 cfs @ 11.95 hrs HW=57.51' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 0.92 cfs @ 1.30 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 1.35" for 25-Year event
Inflow = 0.95 cfs @ 11.95 hrs, Volume= 0.051 af
Outflow = 0.17 cfs @ 12.41 hrs, Volume= 0.051 af, Atten= 82%, Lag= 27.7 min
Discarded = 0.17 cfs @ 12.41 hrs, Volume= 0.051 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 56.68' @ 12.41 hrs Surf.Area= 864 sf Storage= 540 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 23.6 min calculated for 0.051 af (100% of inflow)
Center-of-Mass det. time= 23.6 min (913.7 - 890.1)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.17 cfs @ 12.41 hrs HW=56.68' (Free Discharge)
1=Exfiltration (Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=56.00' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 68%, Lag= 5.9 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.67' @ 12.03 hrs Surf.Area= 35 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 18.0 min (756.5 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.67' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 68%, Lag= 5.9 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.67' @ 12.03 hrs Surf.Area= 35 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 18.0 min (756.5 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.67' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 68%, Lag= 5.8 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.65' @ 12.03 hrs Surf.Area= 37 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.9 min (756.4 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.65' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 67%, Lag= 5.8 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.62' @ 12.03 hrs Surf.Area= 42 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= 17.9 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.9 min (756.4 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.61' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 69%, Lag= 6.0 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.73' @ 12.03 hrs Surf.Area= 30 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 18.0 min (756.5 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.72' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 69%, Lag= 5.9 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.70' @ 12.03 hrs Surf.Area= 32 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 18.0 min (756.5 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.69' (Free Discharge)
└**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 1.32" for 25-Year event
Inflow = 0.63 cfs @ 11.92 hrs, Volume= 0.026 af
Outflow = 0.09 cfs @ 12.14 hrs, Volume= 0.026 af, Atten= 86%, Lag= 13.5 min
Discarded = 0.09 cfs @ 12.14 hrs, Volume= 0.026 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 53.05' @ 12.14 hrs Surf.Area= 234 sf Storage= 285 cf

Plug-Flow detention time= 24.6 min calculated for 0.026 af (100% of inflow)
Center-of-Mass det. time= 24.6 min (901.7 - 877.1)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.09 cfs @ 12.14 hrs HW=53.05' (Free Discharge)
1=Exfiltration (Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=50.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 0.34" for 25-Year event
Inflow = 0.02 cfs @ 12.28 hrs, Volume= 0.005 af
Outflow = 0.02 cfs @ 12.30 hrs, Volume= 0.005 af, Atten= 1%, Lag= 1.5 min
Discarded = 0.02 cfs @ 12.30 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 63.03' @ 12.30 hrs Surf.Area= 135 sf Storage= 2 cf

Plug-Flow detention time= 1.4 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (980.6 - 979.2)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 12.30 hrs HW=63.03' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=0.84"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.11 cfs 0.007 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=0.84"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.06 cfs 0.004 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=2.19"
Flow Length=165' Tc=0.9 min CN=53 Runoff=1.08 cfs 0.042 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.23 cfs 0.018 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.28 cfs 0.023 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.08 cfs 0.011 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.52 cfs 0.026 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.53 cfs 0.026 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=2.39"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=0.72 cfs 0.042 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=0.69"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.05 cfs 0.006 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.24 cfs 0.024 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.04 cfs 0.008 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.12 cfs 0.006 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=2.59"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.18 cfs 0.010 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.06 cfs 0.003 af

Pond 1P: Catch Basin Peak Elev=65.42' Storage=193 cf Inflow=0.52 cfs 0.026 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.52 cfs 0.022 af

Pond 2P: Catch Basin Peak Elev=65.42' Storage=193 cf Inflow=0.53 cfs 0.026 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.53 cfs 0.022 af

Pond 3P: Rain Garden Peak Elev=59.75' Storage=49 cf Inflow=0.72 cfs 0.042 af
Outflow=0.71 cfs 0.042 af

Pond 4P: Flow Splitter Peak Elev=60.44' Storage=4 cf Inflow=1.05 cfs 0.044 af
Primary=0.91 cfs 0.043 af Secondary=0.15 cfs 0.001 af Outflow=1.05 cfs 0.044 af

Pond 5P: Oil/Grit Separator Peak Elev=59.58' Storage=326 cf Inflow=0.91 cfs 0.043 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=0.90 cfs 0.036 af

Pond 6P: Sediment Forebay Peak Elev=57.56' Storage=316 cf Inflow=1.38 cfs 0.083 af
Outflow=1.36 cfs 0.077 af

Pond 7P: Infiltration Basin Peak Elev=57.27' Storage=1,123 cf Inflow=1.43 cfs 0.084 af
Discarded=0.22 cfs 0.081 af Primary=0.15 cfs 0.004 af Outflow=0.38 cfs 0.084 af

Pond 8P: Dry Well 1 Peak Elev=70.18' Storage=75 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.05 cfs 0.000 af Outflow=0.09 cfs 0.007 af

Pond 9P: Dry Well 2 Peak Elev=70.18' Storage=75 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.05 cfs 0.000 af Outflow=0.09 cfs 0.007 af

Pond 10P: Dry Well 3 Peak Elev=69.81' Storage=76 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.007 af

Pond 11P: Dry Well 4 Peak Elev=70.24' Storage=78 cf Inflow=0.13 cfs 0.007 af
Discarded=0.05 cfs 0.007 af Primary=0.11 cfs 0.000 af Outflow=0.16 cfs 0.007 af

Pond 12P: Dry Well 5 Peak Elev=70.28' Storage=73 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.17 cfs 0.001 af Outflow=0.20 cfs 0.007 af

Pond 13P: Dry Well 6 Peak Elev=70.24' Storage=74 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.12 cfs 0.000 af Outflow=0.16 cfs 0.007 af

Pond 14P: Infiltration Trench 1 Peak Elev=55.63' Storage=527 cf Inflow=1.08 cfs 0.042 af
Discarded=0.13 cfs 0.041 af Primary=0.45 cfs 0.002 af Outflow=0.58 cfs 0.042 af

Pond 15P: Infiltration Trench 2 Peak Elev=64.15' Storage=62 cf Inflow=0.11 cfs 0.011 af
Discarded=0.04 cfs 0.011 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.011 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.297 af Average Runoff Depth = 1.70"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.11 cfs @ 11.99 hrs, Volume= 0.007 af, Depth= 0.84"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.06 cfs @ 12.00 hrs, Volume= 0.004 af, Depth= 0.84"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 1.08 cfs @ 11.92 hrs, Volume= 0.042 af, Depth= 2.19"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.23 cfs @ 12.05 hrs, Volume= 0.018 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.28 cfs @ 12.05 hrs, Volume= 0.023 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.08 cfs @ 12.22 hrs, Volume= 0.011 af, Depth= 0.92"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.52 cfs @ 11.91 hrs, Volume= 0.026 af, Depth= 7.17"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.53 cfs @ 11.91 hrs, Volume= 0.026 af, Depth= 7.17"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 0.72 cfs @ 12.04 hrs, Volume= 0.042 af, Depth= 2.39"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.05 cfs @ 12.11 hrs, Volume= 0.006 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.24 cfs @ 12.07 hrs, Volume= 0.024 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.04 cfs @ 12.39 hrs, Volume= 0.008 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.12 cfs @ 11.91 hrs, Volume= 0.006 af, Depth= 7.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.18 cfs @ 12.04 hrs, Volume= 0.010 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.06 cfs @ 11.90 hrs, Volume= 0.003 af, Depth= 7.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.52 cfs @ 11.91 hrs, Volume= 0.026 af
Outflow = 0.52 cfs @ 11.91 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.2 min
Primary = 0.52 cfs @ 11.91 hrs, Volume= 0.022 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.42' @ 11.91 hrs Surf.Area= 40 sf Storage= 193 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 135.1 min calculated for 0.022 af (84% of inflow)
Center-of-Mass det. time= 63.0 min (796.3 - 733.2)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.50 cfs @ 11.91 hrs HW=65.41' (Free Discharge)
1=Culvert (Inlet Controls 0.50 cfs @ 2.38 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.53 cfs @ 11.91 hrs, Volume= 0.026 af
Outflow = 0.53 cfs @ 11.91 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.1 min
Primary = 0.53 cfs @ 11.91 hrs, Volume= 0.022 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.42' @ 11.91 hrs Surf.Area= 40 sf Storage= 193 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 133.1 min calculated for 0.022 af (84% of inflow)
Center-of-Mass det. time= 62.1 min (795.5 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.52 cfs @ 11.91 hrs HW=65.42' (Free Discharge)
1=Culvert (Inlet Controls 0.52 cfs @ 2.40 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 2.39" for 100-Year event
Inflow = 0.72 cfs @ 12.04 hrs, Volume= 0.042 af
Outflow = 0.71 cfs @ 12.05 hrs, Volume= 0.042 af, Atten= 1%, Lag= 0.7 min
Primary = 0.71 cfs @ 12.05 hrs, Volume= 0.042 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.75' @ 12.05 hrs Surf.Area= 200 sf Storage= 49 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 4.9 min calculated for 0.042 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (867.9 - 863.9)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.71 cfs @ 12.05 hrs HW=59.75' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.71 cfs @ 3.19 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 6.03" for 100-Year event
Inflow = 1.05 cfs @ 11.91 hrs, Volume= 0.044 af
Outflow = 1.05 cfs @ 11.91 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min
Primary = 0.91 cfs @ 11.91 hrs, Volume= 0.043 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.15 cfs @ 11.91 hrs, Volume= 0.001 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.44' @ 11.91 hrs Surf.Area= 3 sf Storage= 4 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 1.0 min calculated for 0.044 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (796.2 - 795.9)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.89 cfs @ 11.91 hrs HW=60.44' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.89 cfs @ 2.18 fps)

Secondary OutFlow Max=0.14 cfs @ 11.91 hrs HW=60.44' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.14 cfs @ 2.48 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 5.86" for 100-Year event
Inflow = 0.91 cfs @ 11.91 hrs, Volume= 0.043 af
Outflow = 0.90 cfs @ 11.91 hrs, Volume= 0.036 af, Atten= 1%, Lag= 0.2 min
Primary = 0.90 cfs @ 11.91 hrs, Volume= 0.036 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.58' @ 11.91 hrs Surf.Area= 71 sf Storage= 326 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 95.9 min calculated for 0.036 af (84% of inflow)
Center-of-Mass det. time= 27.1 min (825.7 - 798.5)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.88 cfs @ 11.91 hrs HW=59.58' (Free Discharge)
1=Culvert (Inlet Controls 0.88 cfs @ 2.78 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 2.81" for 100-Year event
Inflow = 1.38 cfs @ 11.92 hrs, Volume= 0.083 af
Outflow = 1.36 cfs @ 11.94 hrs, Volume= 0.077 af, Atten= 1%, Lag= 0.8 min
Primary = 1.36 cfs @ 11.94 hrs, Volume= 0.077 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.56' @ 11.94 hrs Surf.Area= 353 sf Storage= 316 cf

Plug-Flow detention time= 49.3 min calculated for 0.077 af (93% of inflow)
Center-of-Mass det. time= 12.4 min (862.5 - 850.1)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=1.35 cfs @ 11.94 hrs HW=57.56' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 1.35 cfs @ 1.47 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 2.22" for 100-Year event
Inflow = 1.43 cfs @ 11.94 hrs, Volume= 0.084 af
Outflow = 0.38 cfs @ 12.26 hrs, Volume= 0.084 af, Atten= 74%, Lag= 19.1 min
Discarded = 0.22 cfs @ 12.26 hrs, Volume= 0.081 af
Primary = 0.15 cfs @ 12.26 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.27' @ 12.26 hrs Surf.Area= 1,113 sf Storage= 1,123 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 40.8 min calculated for 0.084 af (100% of inflow)
Center-of-Mass det. time= 40.8 min (908.8 - 868.0)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.22 cfs @ 12.26 hrs HW=57.27' (Free Discharge)
1=Exfiltration (Controls 0.22 cfs)

Primary OutFlow Max=0.15 cfs @ 12.26 hrs HW=57.27' (Free Discharge)
2=Culvert (Inlet Controls 0.15 cfs @ 1.07 fps)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.09 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 30%, Lag= 1.9 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.05 cfs @ 11.96 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.18' @ 11.96 hrs Surf.Area= 25 sf Storage= 75 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 29.5 min calculated for 0.007 af (98% of inflow)
Center-of-Mass det. time= 18.0 min (753.3 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.18' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.17' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.04 cfs @ 1.07 fps)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.09 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 30%, Lag= 1.9 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.05 cfs @ 11.96 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.18' @ 11.96 hrs Surf.Area= 25 sf Storage= 75 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 29.5 min calculated for 0.007 af (98% of inflow)
Center-of-Mass det. time= 18.0 min (753.3 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.18' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.17' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.04 cfs @ 1.07 fps)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af, Atten= 68%, Lag= 1.5 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 69.81' @ 11.97 hrs Surf.Area= 25 sf Storage= 76 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 40.5 min calculated for 0.007 af (97% of inflow)
Center-of-Mass det. time= 18.7 min (754.0 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=69.63' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.16 cfs @ 11.99 hrs, Volume= 0.007 af, Atten= 0%, Lag= 3.1 min
Discarded = 0.05 cfs @ 11.98 hrs, Volume= 0.007 af
Primary = 0.11 cfs @ 11.99 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.24' @ 11.98 hrs Surf.Area= 25 sf Storage= 78 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 17.0 min (752.3 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.05 cfs @ 11.98 hrs HW=70.24' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.09 cfs @ 11.99 hrs HW=70.23' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.09 cfs @ 1.44 fps)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.20 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 0%, Lag= 2.0 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.17 cfs @ 11.97 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.28' @ 11.96 hrs Surf.Area= 25 sf Storage= 73 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 15.7 min (751.0 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.28' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.14 cfs @ 11.97 hrs HW=70.27' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.14 cfs @ 1.65 fps)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.16 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 0%, Lag= 2.0 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.12 cfs @ 11.97 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.24' @ 11.96 hrs Surf.Area= 25 sf Storage= 74 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 16.5 min (751.8 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.24' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.10 cfs @ 11.97 hrs HW=70.23' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.10 cfs @ 1.47 fps)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 2.19" for 100-Year event
Inflow = 1.08 cfs @ 11.92 hrs, Volume= 0.042 af
Outflow = 0.58 cfs @ 11.98 hrs, Volume= 0.042 af, Atten= 46%, Lag= 4.1 min
Discarded = 0.13 cfs @ 11.99 hrs, Volume= 0.041 af
Primary = 0.45 cfs @ 11.98 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 55.63' @ 11.99 hrs Surf.Area= 234 sf Storage= 527 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 35.4 min (895.1 - 859.7)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.13 cfs @ 11.99 hrs HW=55.59' (Free Discharge)
1=Exfiltration (Controls 0.13 cfs)

Primary OutFlow Max=0.39 cfs @ 11.98 hrs HW=55.60' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Weir Controls 0.39 cfs @ 1.01 fps)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 0.76" for 100-Year event
Inflow = 0.11 cfs @ 11.97 hrs, Volume= 0.011 af
Outflow = 0.04 cfs @ 12.61 hrs, Volume= 0.011 af, Atten= 67%, Lag= 38.9 min
Discarded = 0.04 cfs @ 12.61 hrs, Volume= 0.011 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 64.15' @ 12.61 hrs Surf.Area= 135 sf Storage= 62 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 9.8 min (940.3 - 930.5)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.04 cfs @ 12.61 hrs HW=64.15' (Free Discharge)
1=Exfiltration (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=1.36"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.22 cfs 0.012 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=1.36"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.11 cfs 0.006 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=3.04"
Flow Length=165' Tc=0.9 min CN=53 Runoff=1.51 cfs 0.059 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=1.46"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.43 cfs 0.028 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=1.46"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.54 cfs 0.036 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=1.46"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.16 cfs 0.017 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.61 cfs 0.030 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.62 cfs 0.031 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=3.27"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=1.00 cfs 0.057 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=1.15"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.12 cfs 0.011 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=1.26"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.52 cfs 0.039 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=1.26"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.08 cfs 0.013 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.14 cfs 0.007 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=3.51"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.25 cfs 0.014 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.07 cfs 0.004 af

Pond 1P: Catch Basin Peak Elev=65.45' Storage=194 cf Inflow=0.61 cfs 0.030 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.61 cfs 0.026 af

Pond 2P: Catch Basin Peak Elev=65.45' Storage=194 cf Inflow=0.62 cfs 0.031 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.62 cfs 0.027 af

Pond 3P: Rain Garden Peak Elev=59.90' Storage=61 cf Inflow=1.00 cfs 0.057 af
Outflow=0.99 cfs 0.057 af

Pond 4P: Flow Splitter Peak Elev=60.49' Storage=4 cf Inflow=1.23 cfs 0.053 af
Primary=1.02 cfs 0.051 af Secondary=0.21 cfs 0.002 af Outflow=1.23 cfs 0.053 af

Pond 5P: Oil/Grit Separator Peak Elev=59.61' Storage=329 cf Inflow=1.02 cfs 0.051 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=1.01 cfs 0.045 af

Pond 6P: Sediment Forebay Peak Elev=57.60' Storage=330 cf Inflow=1.77 cfs 0.110 af
Outflow=1.75 cfs 0.104 af

Pond 7P: Infiltration Basin Peak Elev=57.43' Storage=1,314 cf Inflow=1.92 cfs 0.116 af
Discarded=0.24 cfs 0.095 af Primary=0.87 cfs 0.021 af Outflow=1.11 cfs 0.116 af

Pond 8P: Dry Well 1 Peak Elev=70.15' Storage=75 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.007 af Primary=0.03 cfs 0.000 af Outflow=0.07 cfs 0.008 af

Pond 9P: Dry Well 2 Peak Elev=70.15' Storage=75 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.007 af Primary=0.03 cfs 0.000 af Outflow=0.07 cfs 0.008 af

Pond 10P: Dry Well 3 Peak Elev=70.21' Storage=76 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.008 af Primary=0.08 cfs 0.000 af Outflow=0.13 cfs 0.008 af

Pond 11P: Dry Well 4 Peak Elev=70.31' Storage=78 cf Inflow=0.16 cfs 0.008 af
Discarded=0.05 cfs 0.008 af Primary=0.21 cfs 0.001 af Outflow=0.26 cfs 0.009 af

Pond 12P: Dry Well 5 Peak Elev=70.22' Storage=73 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.007 af Primary=0.09 cfs 0.001 af Outflow=0.12 cfs 0.008 af

Pond 13P: Dry Well 6 Peak Elev=70.17' Storage=74 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.007 af Primary=0.04 cfs 0.000 af Outflow=0.08 cfs 0.008 af

Pond 14P: Infiltration Trench 1 Peak Elev=55.72' Storage=536 cf Inflow=1.51 cfs 0.059 af
Discarded=0.13 cfs 0.049 af Primary=1.47 cfs 0.009 af Outflow=1.60 cfs 0.058 af

Pond 15P: Infiltration Trench 2 Peak Elev=66.00' Storage=162 cf Inflow=0.16 cfs 0.018 af
Discarded=0.05 cfs 0.018 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.018 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.413 af Average Runoff Depth = 2.37"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.22 cfs @ 11.98 hrs, Volume= 0.012 af, Depth= 1.36"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.11 cfs @ 11.99 hrs, Volume= 0.006 af, Depth= 1.36"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 1.51 cfs @ 11.91 hrs, Volume= 0.059 af, Depth= 3.04"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.43 cfs @ 12.04 hrs, Volume= 0.028 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.54 cfs @ 12.04 hrs, Volume= 0.036 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.16 cfs @ 12.20 hrs, Volume= 0.017 af, Depth= 1.46"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.61 cfs @ 11.91 hrs, Volume= 0.030 af, Depth= 8.46"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.62 cfs @ 11.91 hrs, Volume= 0.031 af, Depth= 8.46"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 1.00 cfs @ 12.04 hrs, Volume= 0.057 af, Depth= 3.27"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 0.011 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.52 cfs @ 12.06 hrs, Volume= 0.039 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.08 cfs @ 12.34 hrs, Volume= 0.013 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.14 cfs @ 11.91 hrs, Volume= 0.007 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.25 cfs @ 12.03 hrs, Volume= 0.014 af, Depth= 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.07 cfs @ 11.90 hrs, Volume= 0.004 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.61 cfs @ 11.91 hrs, Volume= 0.030 af
Outflow = 0.61 cfs @ 11.91 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.2 min
Primary = 0.61 cfs @ 11.91 hrs, Volume= 0.026 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.45' @ 11.91 hrs Surf.Area= 40 sf Storage= 194 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 123.8 min calculated for 0.026 af (86% of inflow)
Center-of-Mass det. time= 58.2 min (789.4 - 731.2)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.60 cfs @ 11.91 hrs HW=65.44' (Free Discharge)
1=Culvert (Inlet Controls 0.60 cfs @ 2.50 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.62 cfs @ 11.91 hrs, Volume= 0.031 af
Outflow = 0.62 cfs @ 11.91 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.1 min
Primary = 0.62 cfs @ 11.91 hrs, Volume= 0.027 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.45' @ 11.91 hrs Surf.Area= 40 sf Storage= 194 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 121.7 min calculated for 0.027 af (87% of inflow)
Center-of-Mass det. time= 57.2 min (788.6 - 731.3)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.61 cfs @ 11.91 hrs HW=65.45' (Free Discharge)
1=Culvert (Inlet Controls 0.61 cfs @ 2.51 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 3.27" for RMAT 50-Year event
Inflow = 1.00 cfs @ 12.04 hrs, Volume= 0.057 af
Outflow = 0.99 cfs @ 12.05 hrs, Volume= 0.057 af, Atten= 1%, Lag= 0.8 min
Primary = 0.99 cfs @ 12.05 hrs, Volume= 0.057 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.90' @ 12.05 hrs Surf.Area= 400 sf Storage= 61 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 4.1 min calculated for 0.057 af (100% of inflow)
Center-of-Mass det. time= 3.4 min (857.6 - 854.3)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.98 cfs @ 12.05 hrs HW=59.90' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.98 cfs @ 3.39 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 7.32" for RMAT 50-Year event
Inflow = 1.23 cfs @ 11.91 hrs, Volume= 0.053 af
Outflow = 1.23 cfs @ 11.91 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min
Primary = 1.02 cfs @ 11.91 hrs, Volume= 0.051 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.21 cfs @ 11.91 hrs, Volume= 0.002 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.49' @ 11.91 hrs Surf.Area= 3 sf Storage= 4 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 0.8 min calculated for 0.053 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (789.3 - 789.0)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=1.01 cfs @ 11.91 hrs HW=60.49' (Free Discharge)
1=Culvert (Barrel Controls 1.01 cfs @ 2.26 fps)

Secondary OutFlow Max=0.20 cfs @ 11.91 hrs HW=60.49' (Free Discharge)
2=Culvert (Barrel Controls 0.20 cfs @ 2.74 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 7.05" for RMAT 50-Year event
Inflow = 1.02 cfs @ 11.91 hrs, Volume= 0.051 af
Outflow = 1.01 cfs @ 11.91 hrs, Volume= 0.045 af, Atten= 1%, Lag= 0.2 min
Primary = 1.01 cfs @ 11.91 hrs, Volume= 0.045 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.61' @ 11.91 hrs Surf.Area= 71 sf Storage= 329 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 87.3 min calculated for 0.045 af (87% of inflow)
Center-of-Mass det. time= 26.0 min (818.1 - 792.1)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.00 cfs @ 11.91 hrs HW=59.61' (Free Discharge)
1=Culvert (Inlet Controls 1.00 cfs @ 2.87 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 3.74" for RMAT 50-Year event
Inflow = 1.77 cfs @ 11.93 hrs, Volume= 0.110 af
Outflow = 1.75 cfs @ 11.94 hrs, Volume= 0.104 af, Atten= 1%, Lag= 0.7 min
Primary = 1.75 cfs @ 11.94 hrs, Volume= 0.104 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.60' @ 11.94 hrs Surf.Area= 362 sf Storage= 330 cf

Plug-Flow detention time= 38.3 min calculated for 0.104 af (95% of inflow)
Center-of-Mass det. time= 9.6 min (851.4 - 841.8)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=1.75 cfs @ 11.94 hrs HW=57.60' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 1.75 cfs @ 1.60 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 3.06" for RMAT 50-Year event
Inflow = 1.92 cfs @ 11.95 hrs, Volume= 0.116 af
Outflow = 1.11 cfs @ 12.11 hrs, Volume= 0.116 af, Atten= 42%, Lag= 9.9 min
Discarded = 0.24 cfs @ 12.11 hrs, Volume= 0.095 af
Primary = 0.87 cfs @ 12.11 hrs, Volume= 0.021 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.43' @ 12.11 hrs Surf.Area= 1,185 sf Storage= 1,314 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 37.0 min calculated for 0.116 af (100% of inflow)
Center-of-Mass det. time= 37.0 min (893.7 - 856.7)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.24 cfs @ 12.11 hrs HW=57.43' (Free Discharge)
1=Exfiltration (Controls 0.24 cfs)

Primary OutFlow Max=0.87 cfs @ 12.11 hrs HW=57.43' (Free Discharge)
2=Culvert (Inlet Controls 0.87 cfs @ 1.91 fps)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.07 cfs @ 11.95 hrs, Volume= 0.008 af, Atten= 56%, Lag= 0.7 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.007 af
Primary = 0.03 cfs @ 11.95 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.15' @ 11.94 hrs Surf.Area= 25 sf Storage= 75 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 62.6 min calculated for 0.008 af (92% of inflow)
Center-of-Mass det. time= 19.1 min (752.4 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.15' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.02 cfs @ 11.95 hrs HW=70.15' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.02 cfs @ 0.85 fps)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.07 cfs @ 11.95 hrs, Volume= 0.008 af, Atten= 56%, Lag= 0.7 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.007 af
Primary = 0.03 cfs @ 11.95 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.15' @ 11.94 hrs Surf.Area= 25 sf Storage= 75 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 62.6 min calculated for 0.008 af (92% of inflow)
Center-of-Mass det. time= 19.1 min (752.4 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.15' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.02 cfs @ 11.95 hrs HW=70.15' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.02 cfs @ 0.85 fps)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.13 cfs @ 11.95 hrs, Volume= 0.008 af, Atten= 18%, Lag= 0.8 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.008 af
Primary = 0.08 cfs @ 11.95 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.21' @ 11.94 hrs Surf.Area= 25 sf Storage= 76 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 41.9 min calculated for 0.008 af (96% of inflow)
Center-of-Mass det. time= 17.8 min (751.1 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.21' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.07 cfs @ 11.95 hrs HW=70.21' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.07 cfs @ 1.32 fps)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.26 cfs @ 11.95 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.9 min
Discarded = 0.05 cfs @ 11.94 hrs, Volume= 0.008 af
Primary = 0.21 cfs @ 11.95 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.31' @ 11.94 hrs Surf.Area= 25 sf Storage= 78 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 14.9 min (748.2 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.05 cfs @ 11.94 hrs HW=70.31' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.18 cfs @ 11.95 hrs HW=70.30' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.18 cfs @ 1.81 fps)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.12 cfs @ 11.94 hrs, Volume= 0.008 af, Atten= 21%, Lag= 0.1 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.007 af
Primary = 0.09 cfs @ 11.94 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.22' @ 11.94 hrs Surf.Area= 25 sf Storage= 73 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= 36.5 min calculated for 0.008 af (97% of inflow)
Center-of-Mass det. time= 17.3 min (750.5 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.22' (Free Discharge)
└**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.08 cfs @ 11.94 hrs HW=70.22' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.08 cfs @ 1.39 fps)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.08 cfs @ 11.94 hrs, Volume= 0.008 af, Atten= 47%, Lag= 0.3 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.007 af
Primary = 0.04 cfs @ 11.94 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.17' @ 11.94 hrs Surf.Area= 25 sf Storage= 74 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= 56.3 min calculated for 0.008 af (94% of inflow)
Center-of-Mass det. time= 18.6 min (751.8 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.17' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.17' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.04 cfs @ 1.05 fps)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 3.04" for RMAT 50-Year event
Inflow = 1.51 cfs @ 11.91 hrs, Volume= 0.059 af
Outflow = 1.60 cfs @ 11.93 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.8 min
Discarded = 0.13 cfs @ 11.92 hrs, Volume= 0.049 af
Primary = 1.47 cfs @ 11.93 hrs, Volume= 0.009 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 55.72' @ 11.92 hrs Surf.Area= 234 sf Storage= 536 cf

Plug-Flow detention time= 37.1 min calculated for 0.058 af (99% of inflow)
Center-of-Mass det. time= 33.1 min (882.5 - 849.4)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.13 cfs @ 11.92 hrs HW=55.72' (Free Discharge)
1=Exfiltration (Controls 0.13 cfs)

Primary OutFlow Max=1.29 cfs @ 11.93 hrs HW=55.71' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Weir Controls 1.29 cfs @ 1.51 fps)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 1.21" for RMAT 50-Year event
Inflow = 0.16 cfs @ 12.20 hrs, Volume= 0.018 af
Outflow = 0.05 cfs @ 12.66 hrs, Volume= 0.018 af, Atten= 66%, Lag= 27.9 min
Discarded = 0.05 cfs @ 12.66 hrs, Volume= 0.018 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 66.00' @ 12.66 hrs Surf.Area= 135 sf Storage= 162 cf

Plug-Flow detention time= 23.1 min calculated for 0.018 af (100% of inflow)
Center-of-Mass det. time= 23.0 min (932.7 - 909.7)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

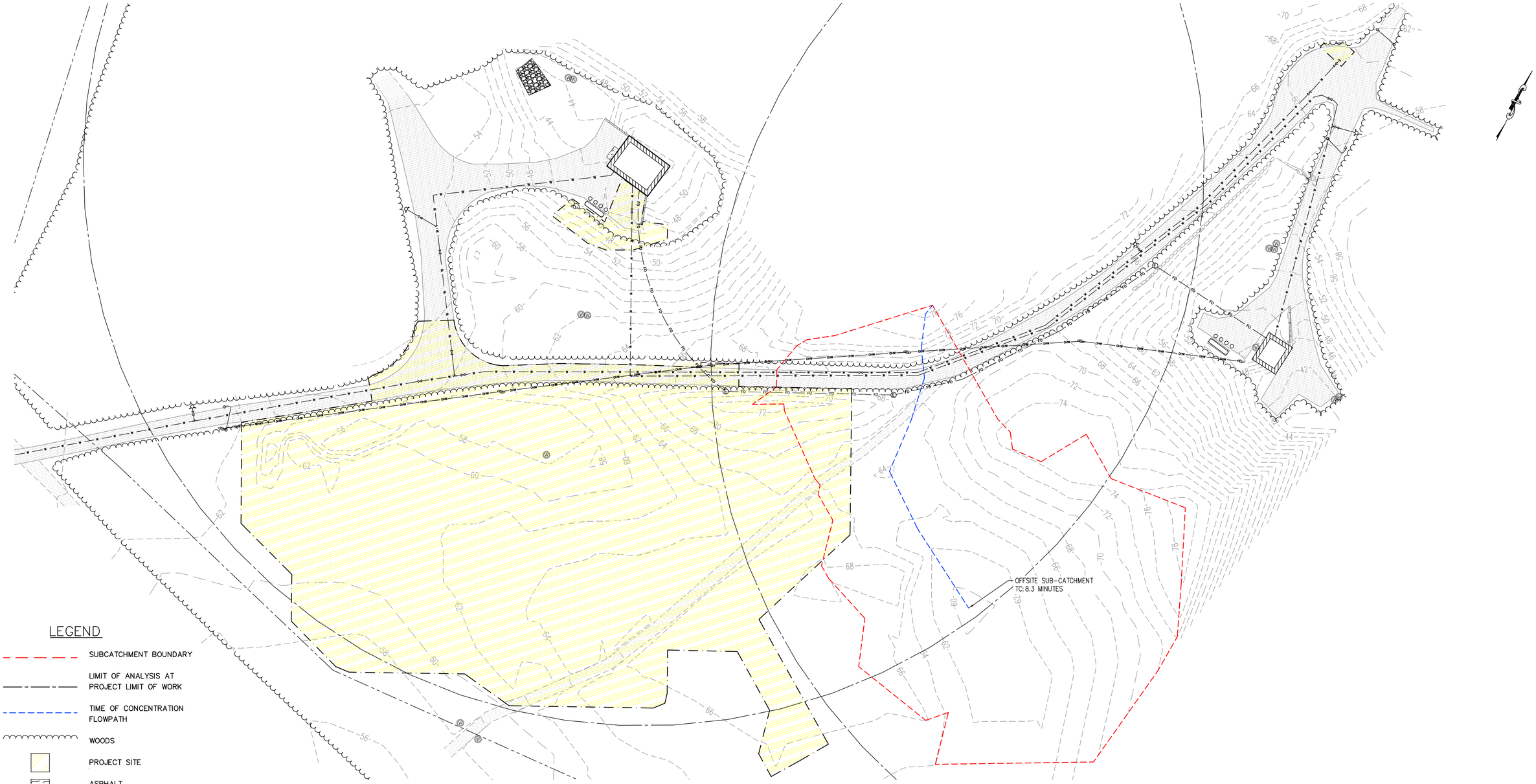
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.05 cfs @ 12.66 hrs HW=66.00' (Free Discharge)
1=Exfiltration (Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Appendix I – 100-Year 24-Hour Storm Offsite Analysis



LEGEND

- SUBCATCHMENT BOUNDARY
- LIMIT OF ANALYSIS AT PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT

PLAN VIEW

SCALE: 1" = 35'

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
EXISTING OFFSITE SUBCATCHMENT PLAN

DRAWING NO.:
AI-1

SHEET NO. 1 OF 3

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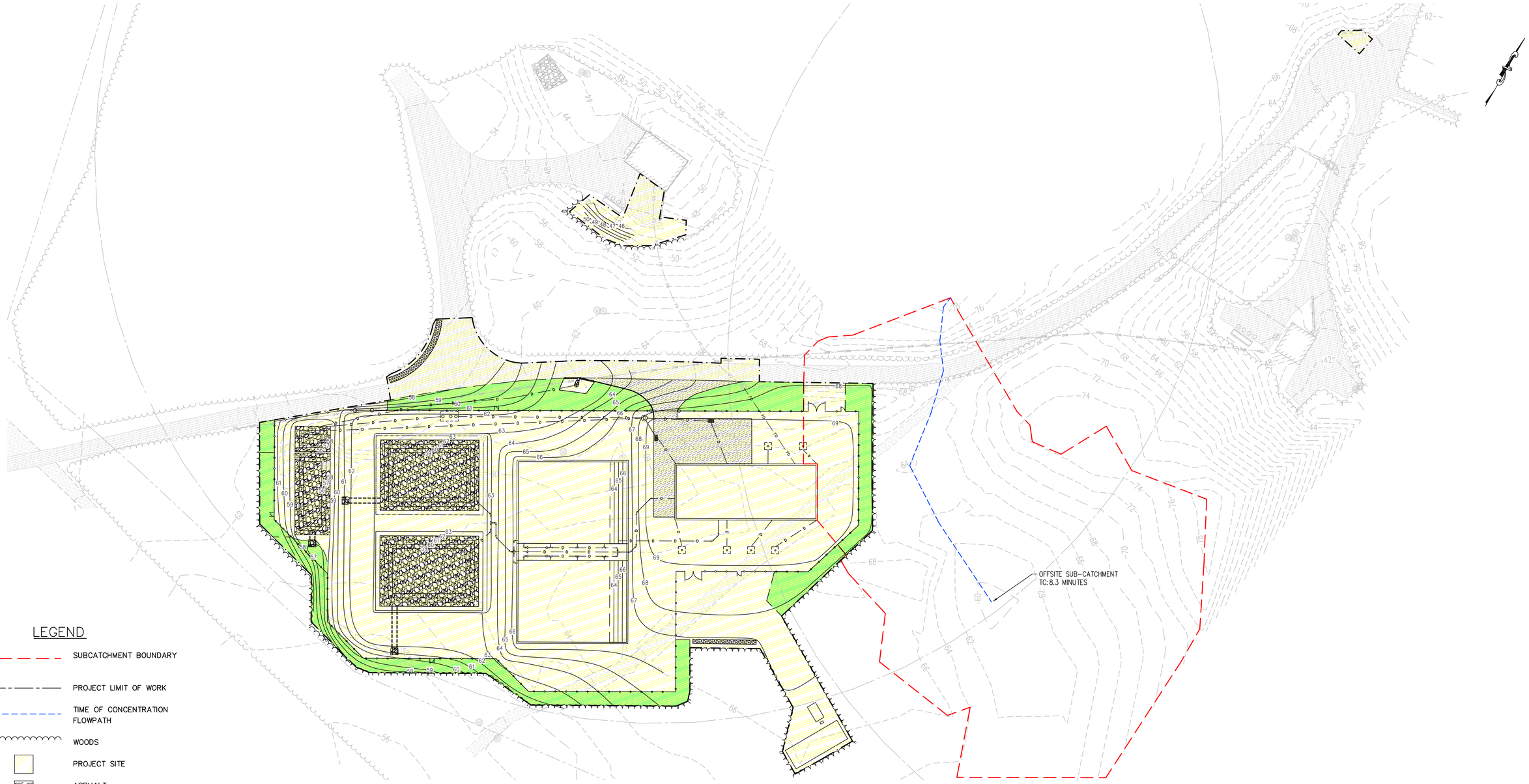

LEGEND

- SUBCATCHMENT BOUNDARY
- PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT
- BRUSH

PLAN VIEW

SCALE: 1" = 35'

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
PROPOSED OFFFSITE SUBCATCHMENT PLAN

DRAWING NO.:
AI-2

SHEET NO. 2 OF 2

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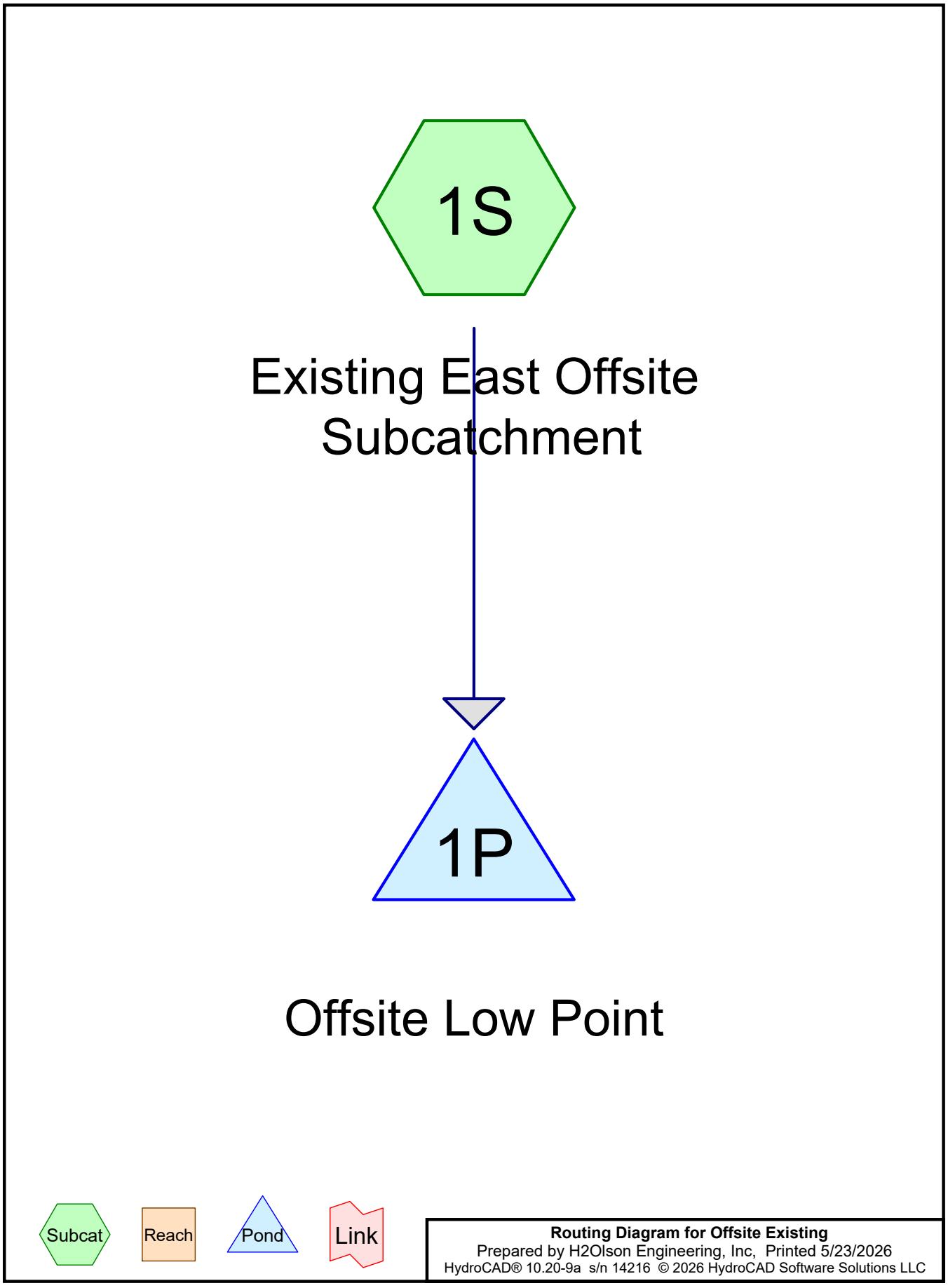


Routing Diagram for Offsite Existing
Prepared by H2Olson Engineering, Inc, Printed 5/23/2026
HydroCAD® 10.20-9a s/n 14216 © 2026 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "BFD_Proposed (2).hcp"

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.016	49	50-75% Grass cover, Fair, HSG A (1S)
0.043	98	Paved parking, HSG A (1S)
1.357	30	Woods, Good, HSG A (1S)
1.416	**32**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.416	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.416		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.016	0.000	0.000	0.000	0.000	0.016	50-75% Grass cover, Fair	1S
0.043	0.000	0.000	0.000	0.000	0.043	Paved parking	1S
1.357	0.000	0.000	0.000	0.000	1.357	Woods, Good	1S
1.416	**0.000**	**0.000**	**0.000**	**0.000**	**1.416**	**TOTAL AREA**	

Time span=0.00-38.00 hrs, dt=0.05 hrs, 761 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing East Offsite Runoff Area=61,662 sf 3.02% Impervious Runoff Depth=0.41"
Flow Length=60' Tc=3.9 min CN=32 Runoff=0.30 cfs 0.048 af

Pond 1P: Offsite Low Point Peak Elev=60.10' Storage=63 cf Inflow=0.30 cfs 0.048 af
Outflow=0.13 cfs 0.048 af

Total Runoff Area = 1.416 ac Runoff Volume = 0.048 af Average Runoff Depth = 0.41"
96.98% Pervious = 1.373 ac 3.02% Impervious = 0.043 ac

Summary for Subcatchment 1S: Existing East Offsite Subcatchment

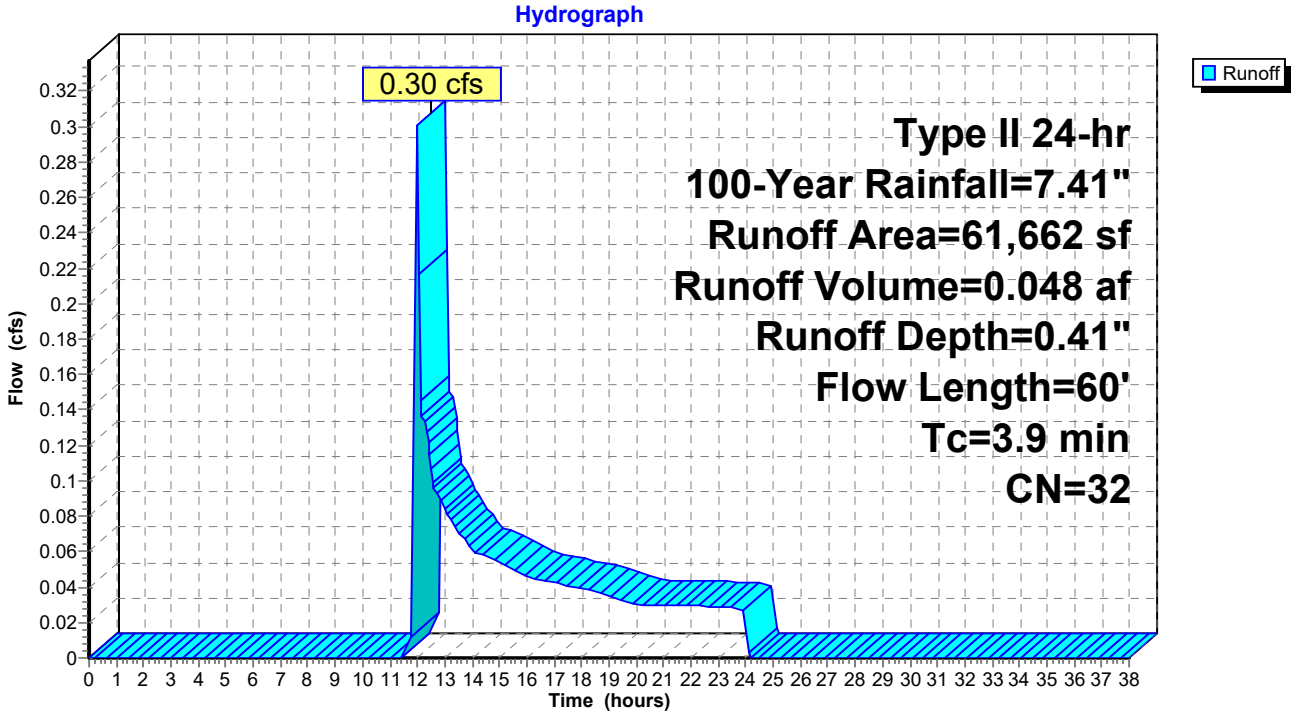
Runoff = 0.30 cfs @ 12.01 hrs, Volume= 0.048 af, Depth= 0.41"
Routed to Pond 1P : Offsite Low Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
59,124	30	Woods, Good, HSG A
678	49	50-75% Grass cover, Fair, HSG A
1,860	98	Paved parking, HSG A
61,662	32	Weighted Average
59,802		96.98% Pervious Area
1,860		3.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 1S: Existing East Offsite Subcatchment



Summary for Pond 1P: Offsite Low Point

Inflow Area = 1.416 ac, 3.02% Impervious, Inflow Depth = 0.41" for 100-Year event
Inflow = 0.30 cfs @ 12.01 hrs, Volume= 0.048 af
Outflow = 0.13 cfs @ 12.31 hrs, Volume= 0.048 af, Atten= 56%, Lag= 17.8 min
Discarded = 0.13 cfs @ 12.31 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs
Peak Elev= 60.10' @ 12.31 hrs Surf.Area= 682 sf Storage= 63 cf

Plug-Flow detention time= 2.6 min calculated for 0.048 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (987.1 - 984.4)

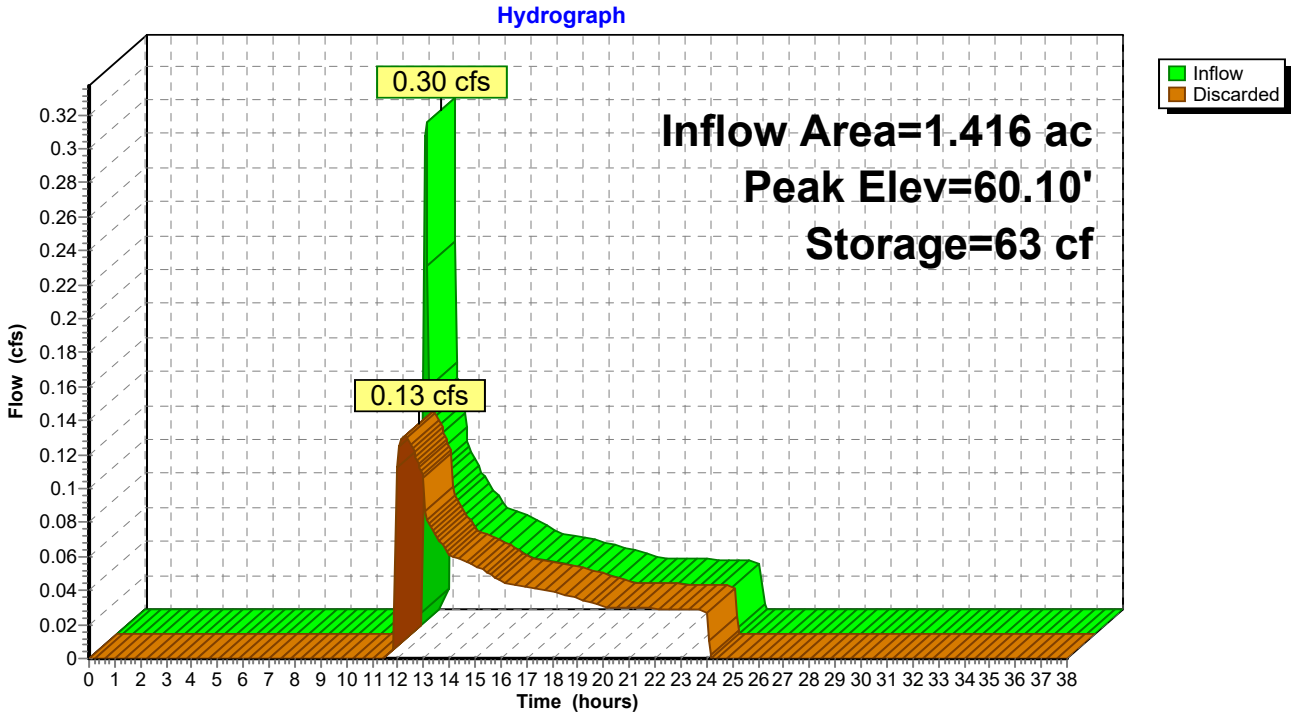
Volume	Invert	Avail.Storage	Storage Description
#1	60.00'	6,363 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

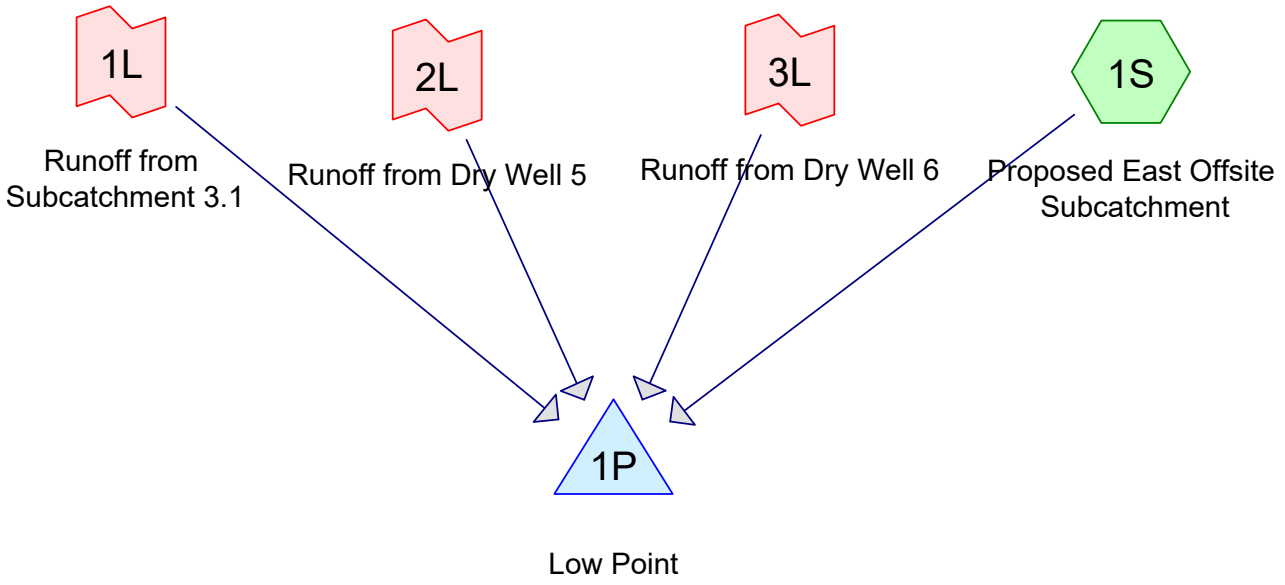
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
60.00	526	0	0	526
62.00	7,088	6,363	6,363	7,099

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'

Discarded OutFlow Max=0.13 cfs @ 12.31 hrs HW=60.10' (Free Discharge)
↑**1=Exfiltration** (Controls 0.13 cfs)

Pond 1P: Offsite Low Point





Subcat Reach Pond Link

Routing Diagram for Offsite
Prepared by H2Olson Engineering, Inc, Printed 5/27/2026
HydroCAD® 10.20-9a s/n 14216 © 2026 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.080	39	>75% Grass cover, Good, HSG A (1S)
0.033	30	Brush, Good, HSG A (1S)
0.043	98	Paved parking, HSG A (1S)
1.260	30	Woods, Good, HSG A (1S)
1.416	**33**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.416	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.416		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.080	0.000	0.000	0.000	0.000	0.080	>75% Grass cover, Good	1S
0.033	0.000	0.000	0.000	0.000	0.033	Brush, Good	1S
0.043	0.000	0.000	0.000	0.000	0.043	Paved parking	1S
1.260	0.000	0.000	0.000	0.000	1.260	Woods, Good	1S
1.416	**0.000**	**0.000**	**0.000**	**0.000**	**1.416**	**TOTAL AREA**	

Time span=0.00-38.00 hrs, dt=0.05 hrs, 761 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Proposed East Offsite Runoff Area=61,662 sf 3.02% Impervious Runoff Depth=0.47"
Flow Length=252' Tc=8.3 min CN=33 Runoff=0.35 cfs 0.056 af

Pond 1P: Low Point Peak Elev=60.36' Storage=295 cf Inflow=0.50 cfs 0.072 af
Outflow=0.22 cfs 0.072 af

Link 1L: Runoff Imported from BFD_Proposed Subcat 3.1 Hydrograph Table 5.23.csv Inflow=0.02 cfs 0.005 af
Primary=0.02 cfs 0.005 af

Link 2L: Primary Imported from BFD_Proposed Pond 12P Hydrograph Table5.27.csv Inflow=0.08 cfs 0.007 af
Primary=0.08 cfs 0.007 af

Link 3L: Primary Imported from BFD_Proposed Pond 13P Hydrograph Table5.27.csv Inflow=0.06 cfs 0.005 af
Primary=0.06 cfs 0.005 af

Total Runoff Area = 1.416 ac Runoff Volume = 0.056 af Average Runoff Depth = 0.47"
96.98% Pervious = 1.373 ac 3.02% Impervious = 0.043 ac

Summary for Subcatchment 1S: Proposed East Offsite Subcatchment

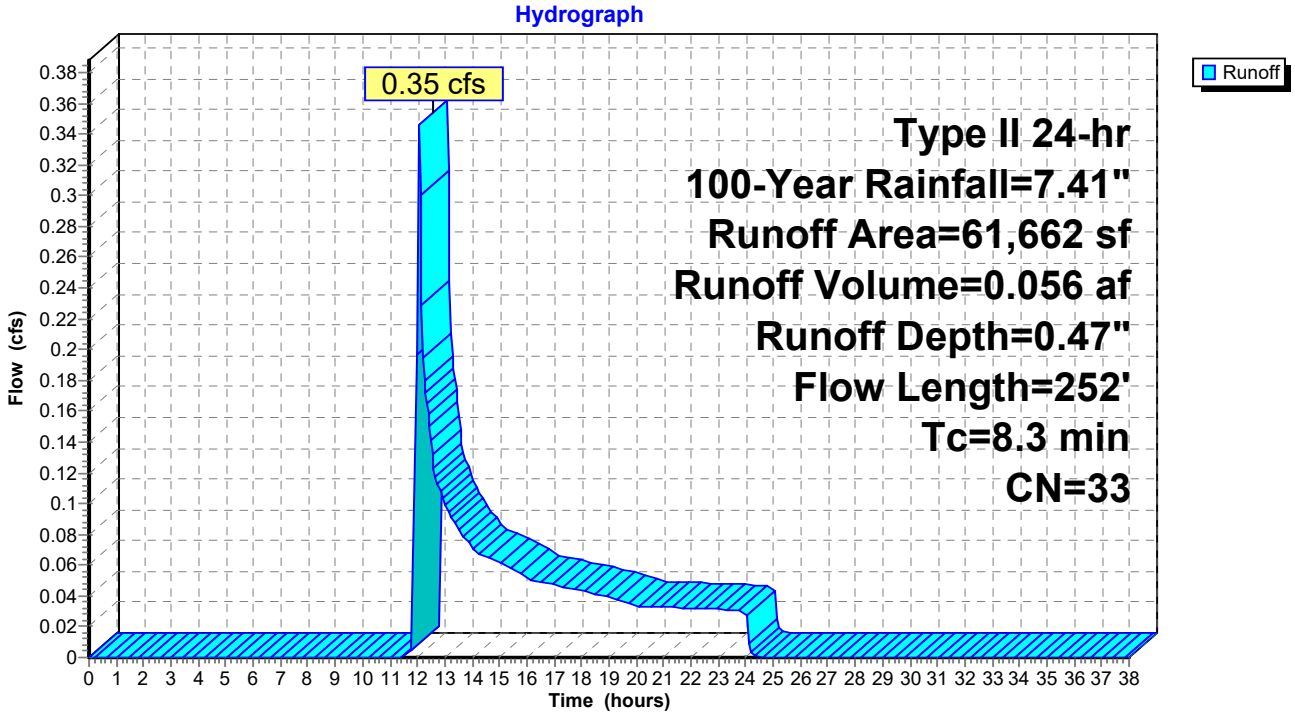
Runoff = 0.35 cfs @ 12.06 hrs, Volume= 0.056 af, Depth= 0.47"
Routed to Pond 1P : Low Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
1,860	98	Paved parking, HSG A
54,868	30	Woods, Good, HSG A
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
61,662	33	Weighted Average
59,802		96.98% Pervious Area
1,860		3.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.3265	0.21		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	12	0.0080	1.82		**Shallow Concentrated Flow, Road** Paved Kv= 20.3 fps
4.3	190	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.3	252	Total			

Subcatchment 1S: Proposed East Offsite Subcatchment



Summary for Pond 1P: Low Point

Inflow Area = 1.416 ac, 3.02% Impervious, Inflow Depth = 0.61" for 100-Year event
Inflow = 0.50 cfs @ 12.06 hrs, Volume= 0.072 af
Outflow = 0.22 cfs @ 12.51 hrs, Volume= 0.072 af, Atten= 55%, Lag= 26.8 min
Discarded = 0.22 cfs @ 12.51 hrs, Volume= 0.072 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs
Peak Elev= 60.36' @ 12.51 hrs Surf.Area= 1,154 sf Storage= 295 cf

Plug-Flow detention time= 7.6 min calculated for 0.072 af (100% of inflow)
Center-of-Mass det. time= 7.6 min (931.8 - 924.2)

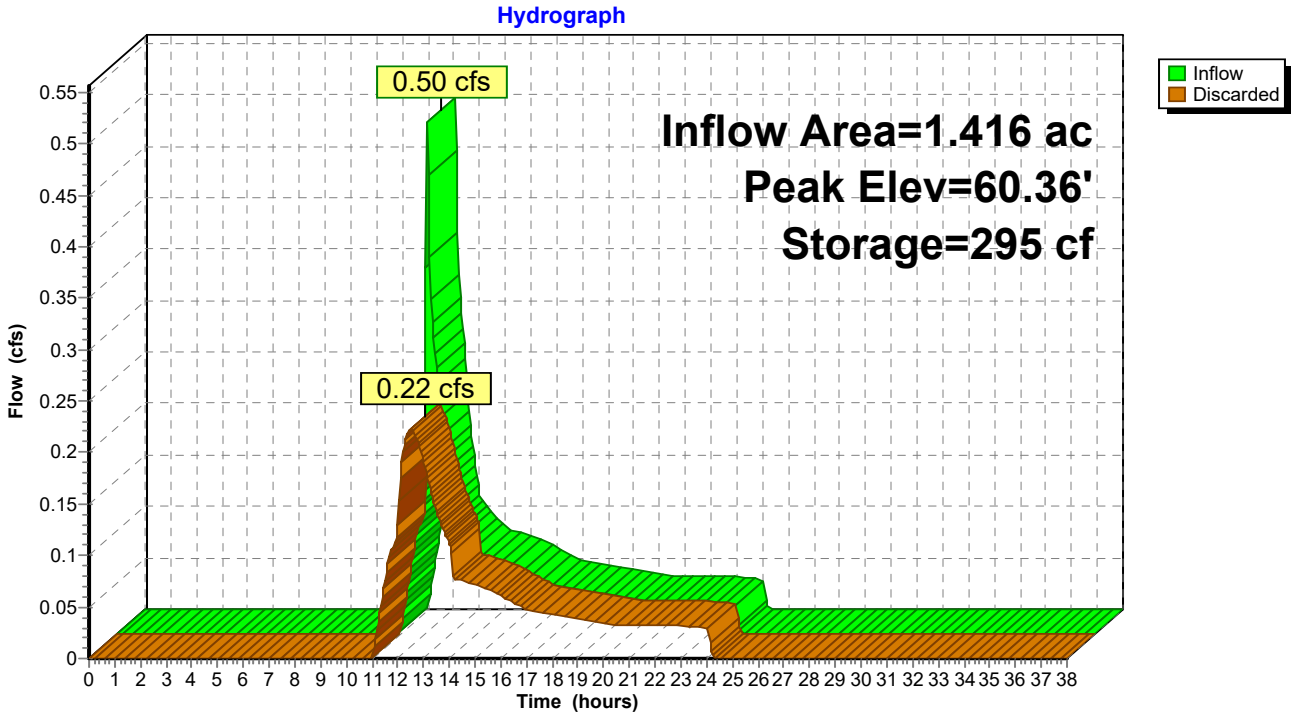
Volume	Invert	Avail.Storage	Storage Description
#1	60.00'	6,363 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
60.00	526	0	0	526
62.00	7,088	6,363	6,363	7,099

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'

Discarded OutFlow Max=0.22 cfs @ 12.51 hrs HW=60.36' (Free Discharge)
↑**1=Exfiltration** (Controls 0.22 cfs)

Pond 1P: Low Point



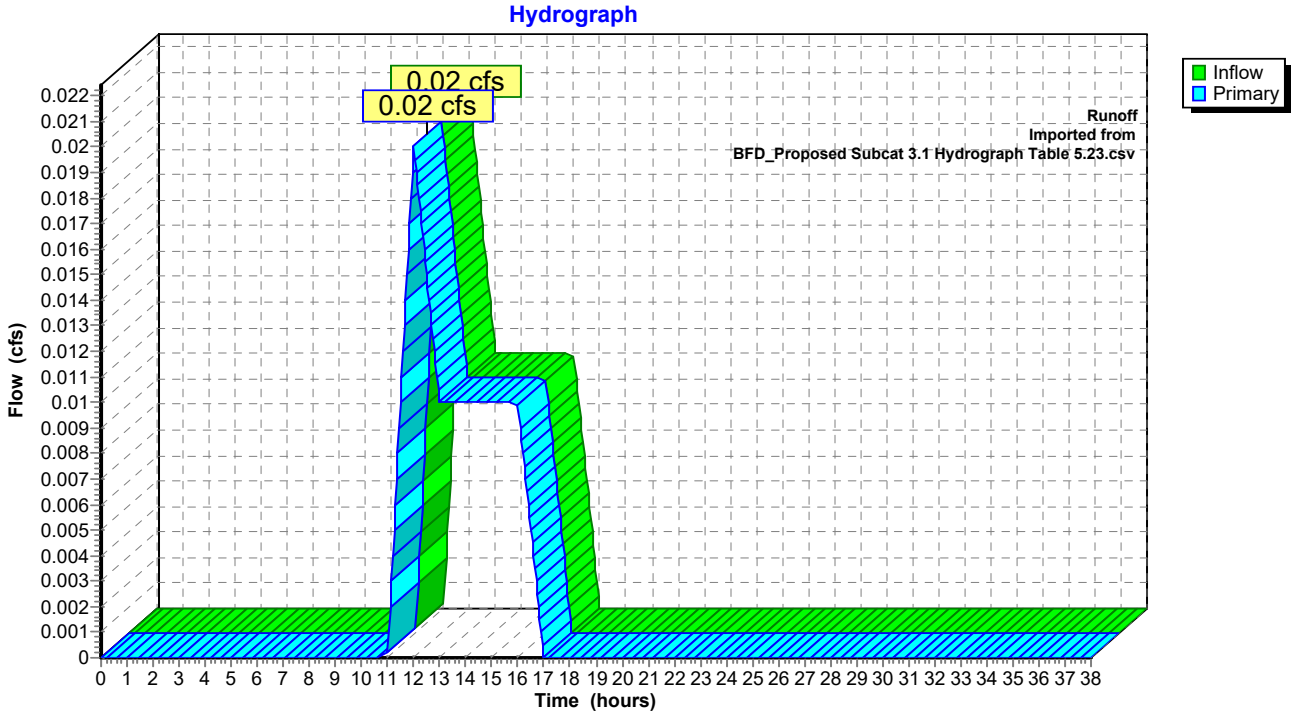
Summary for Link 1L: Runoff from Subcatchment 3.1

Inflow = 0.02 cfs @ 12.01 hrs, Volume= 0.005 af
Primary = 0.02 cfs @ 12.01 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 1P : Low Point

Primary outflow = Inflow, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs

Runoff Imported from BFD_Proposed Subcat 3.1 Hydrograph Table 5.23.csv

Link 1L: Runoff from Subcatchment 3.1



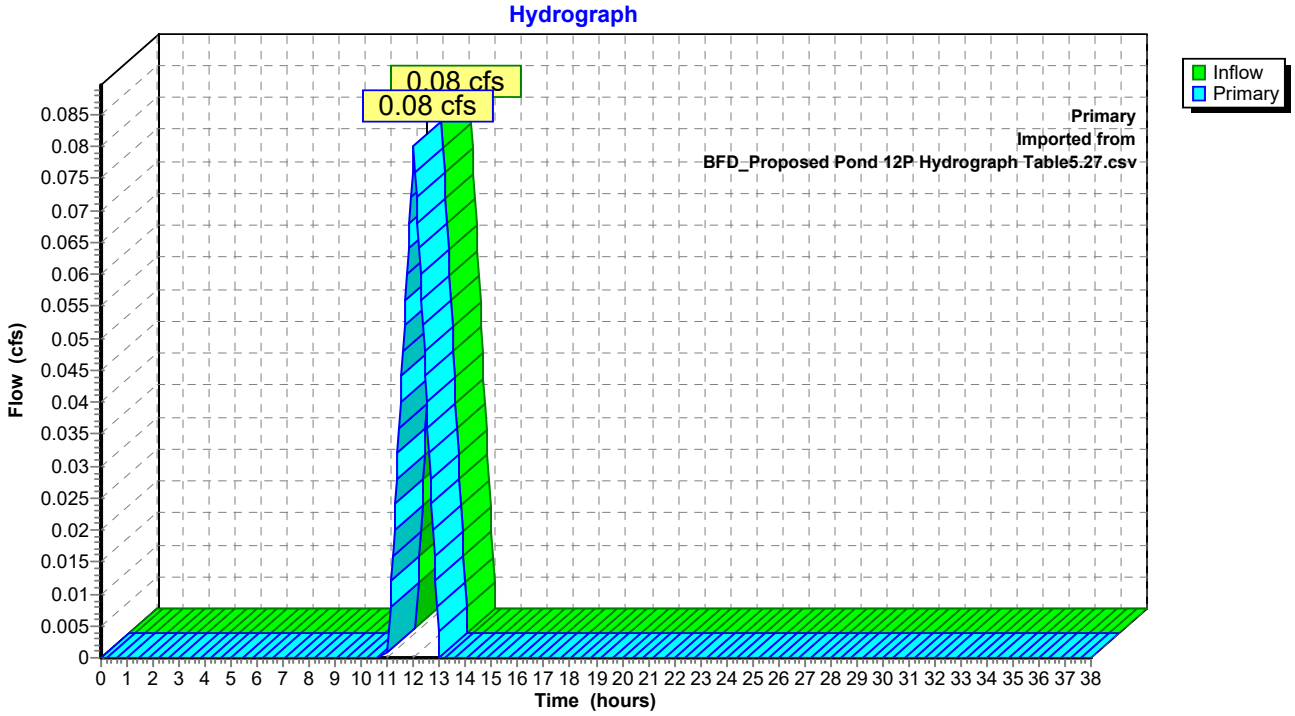
Summary for Link 2L: Runoff from Dry Well 5

Inflow = 0.08 cfs @ 12.00 hrs, Volume= 0.007 af
Primary = 0.08 cfs @ 12.00 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 1P : Low Point

Primary outflow = Inflow, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs

Primary Imported from BFD_Proposed Pond 12P Hydrograph Table5.27.csv

Link 2L: Runoff from Dry Well 5



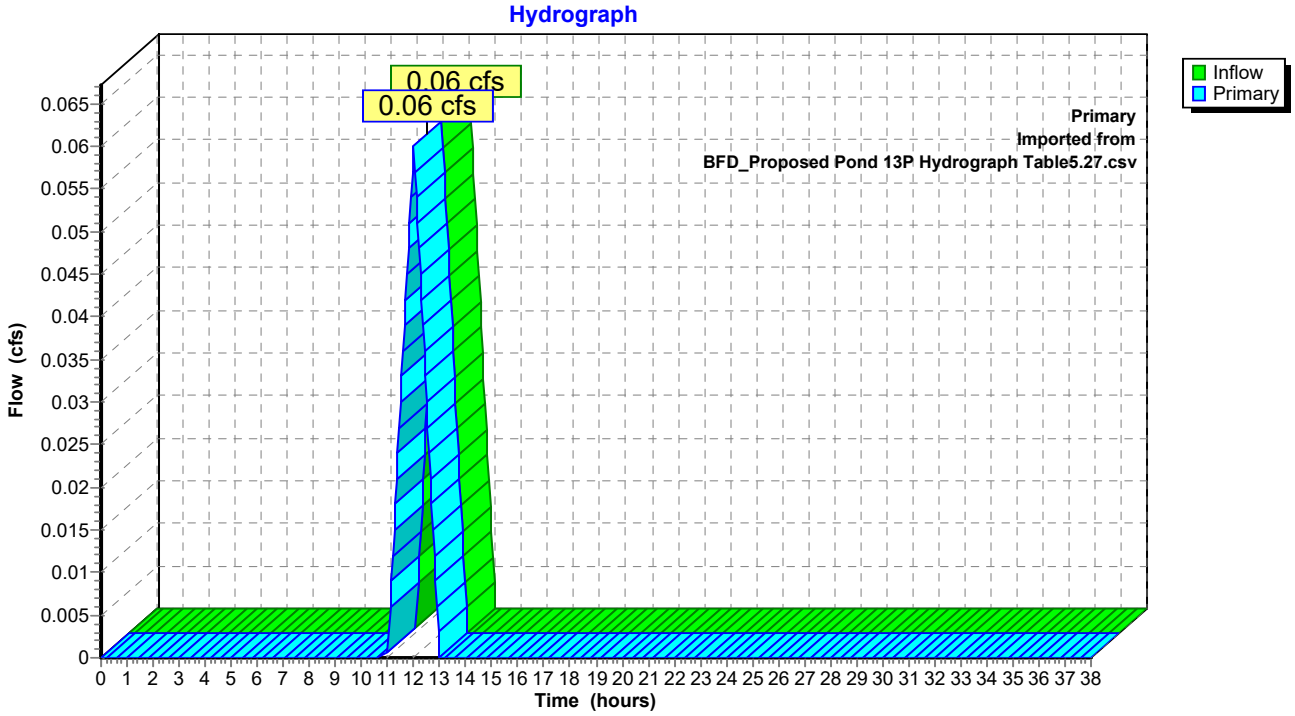
Summary for Link 3L: Runoff from Dry Well 6

Inflow = 0.06 cfs @ 12.00 hrs, Volume= 0.005 af
Primary = 0.06 cfs @ 12.00 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 1P : Low Point

Primary outflow = Inflow, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs

Primary Imported from BFD_Proposed Pond 13P Hydrograph Table5.27.csv

Link 3L: Runoff from Dry Well 6



Appendix J – Supplemental Calculations

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Standards 3 and 4 Calculations	SHEET:	1
CALCULATED BY:	GAC		

Required Recharge Volume (Rv) and Water Quality Volume (VWQ)

Rv = Impervious Area x Runoff Depth***
*VWQ = Impervious Area x Runoff Depth****

**Volume calculated using the static method as per the Stormwater Management Standards.*
***A Runoff Depth of 0.6 inches is used as per the Stormwater Management Standards.*
****A Runoff Depth of 1.0 inches is used as per the Stormwater Management Standards.*

Total Recharge and Water Quality Volumes

Area on Site	Soil Group	Impervious Area (sf)
Pre-Development		
Existing Pavement	HSG A	5,628
Post-Development		
Existing Pavement	HSG A	5,628
New Pavement	HSG A	3,962
Water Treatment Building	HSG A	4,040
Total Impervious Area	HSG A	13,630
Net Change		+7,167

Impervious Area Draining to Proposed Infiltration BMPs

Infiltration BMP	Impervious Area (sf)
Infiltration Basin	6,621
Dry Wells Combined	3,030
Total	9,651

Adjusted Minimum Total Recharge Volume

Total Recharge Volume (cf)	681
Total Impervious Area / Impervious Area Draining to Infiltration BMPs	1.41
Adjusted Total Recharge Volume (cf)	962
Percentage of Site's Impervious Area Directed to Infiltration BMPs	71%

Total Recharge Volume Required:	962 cf
Total Recharge Volume Provided:	1,214 cf

Total Water Quality Volume Required:	1,136 cf
Total Water Quality Volume Provided:	2,282 cf

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Standards 3 and 4 Calculations	SHEET:	2
CALCULATED BY:	GAC		

Deep Sump Catch Basins - 1P and 2P

Water Quality Volume Required = Impervious Area x 1 in x (1 ft/12 in)

Required Water Quality Volume

Catch Basin	Sub-Catchment Draining to BMP	Impervious Area Within Sub-Catchment (sf)	Total Impervious Area Draining to BMP (sf)	Required Volume (cf)
1P	1.7	1,878	1,878	157
2P	1.8	1,927	1,927	161

Provided Water Quality Storage

Catch Basin	Bottom Area (sf)	Sump Depth (ft)	Provided Volume (cf)
1P	41	4.5	180
2P	41	4.5	180

Filtering Rain Garden - 3P

Water Quality Volume Required = Impervious Area x 1 in x (1 ft/12 in)
Water Quality Volume provided includes storage from both the ponding area and the pore space from the soil media.

Required Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Volume (cf)
1.9	2,816	235

Provided Water Quality Storage

Bottom Area (sf)	Ponding Depth (ft)	Soil Depth (ft)	Soil Voids	Provided Volume (cf)
200	0.5	2	40%	260

Drawdown

Drawdown Time = Rv /(K x 1ft/12in x Area)

Rv (cf)	260
K (in/hr)	8.27
Area (sf)	200
Drawdown (hr)	1.89

Oil/Grit Separator - 5P

Water Quality Volume Required = Impervious Area x (400 cf/1acre) x (1acre/43,560 sf)

Required Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Volume (cf)
1.7, 1.8, 1.9	3,805	125

Provided Water Quality Storage

Water Depth (ft)	Bottom Area (sf)	Provided Volume (cf)
5	71	294

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Standards 3 and 4 Calculations	SHEET:	3
CALCULATED BY:	GAC		

Sediment Forebay - 6P

Water Quality Volume Required = Impervious Area x 0.1 in x 0.083 ft/in

Required Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Volume (cf)
1.2, 1.7, 1.8, 1.9	6,621	114

Provided Water Quality Storage

Water Depth (ft)	Bottom Area (sf)	Provided Volume (cf)
2	78	154

Drawdown

Drawdown Time = Rv /(K x 1ft/12in x Area)

Rv (cf)	154
K (in/hr)	8.27
Area (sf)	78
Drawdown (hr)	2.86

Infiltration Basin - 7P

Water Quality Volume Required = Impervious Area x 1 in x (1 ft/12 in)
Recharge Volume Required = Impervious Area x 0.6 in x (1 ft/12 in)

Required Recharge and Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Recharge Volume (cf)	Required Water Quality Volume (cf)
1.1, 1.2, 1.7, 1.8, 1.9	0	530	552

Provided Water Quality and Water Recharge Storage

Water Depth (ft)	Bottom Area (sf)	Provided Volume (cf)
2	598	794

Drawdown

Drawdown Time = Rv /(K x 1ft/12in x Area)

Rv (cf)	794
K (in/hr)	8.27
Area (sf)	598
Drawdown (hr)	1.93

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Standards 3 and 4 Calculations	SHEET:	4
CALCULATED BY:	GAC		

Dry Wells - 8P, 9P, 10P, 11P, 12P, 13P

Water Quality Volume Required = Impervious Area x 1 in x (1 ft/12 in)
Recharge Volume Required = Impervious Area x 0.6 in x (1 ft/12 in)

Required Recharge and Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Recharge Volume (cf)	Required Water Quality Volume (cf)
1.10	505	25	42
1.11	505	25	42
1.12	505	25	42
1.13	505	25	42
1.14	505	25	42
1.15	505	25	42

Provided Water Quality and Water Recharge Storage

Dry Well	Water Depth (ft)	Bottom Area (sf)	Voids	Provided Volume (cf)
8P	7	25	40%	70
9P	7	25	40%	70
10P	7	25	40%	70
11P	7	25	40%	70
12P	7	25	40%	70
13P	7	25	40%	70
			Total	420

Drawdown

Drawdown Time = Rv /(K x 1ft/12in x Area)

Rv (cf)	70
K (in/hr)	8.27
Area (sf)	25
Drawdown (hr)	4.06

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Closed Drainage System Calculations	SHEET:	1
CALCULATED BY:	GAC		

Closed Drainage System Capacity

Start Node	Stop Node	Length (ft)	Slope	n	Pipe (in)	Capacity* (cfs)	Velocity* (fps)
Catch Basin 1	Flow Splitter	12	0.387	0.013	12	0.40	2.25
Catch Basin 2	Flow Splitter	43	0.108	0.013	12	0.41	2.26
Rain Garden	Sediment Forebay	184	0.008	0.013	8	0.42	2.81
Flow Splitter	Oil/Grit	130	0.002	0.013	12	0.75	2.07
Flow Splitter	Sediment Forebay	221	0.012	0.013	6	0.07	2.06
Oil/Grit	Sediment Forebay	78	0.017	0.013	12	0.75	2.65

**Calculations perfomed for the 24-hour 25-year storm.*

PROJECT NAME: Barnstable Fire District Wells 3&4 WTP
DESCRIPTION: Estimated High Groundwater Calculations
CALCULATED BY: GAC

DATE: 6/1/2026
SHEET: 1

Estimated High Groundwater

Test Location	Grade (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)
Boring B-1	64	-	-
Boring B-2	62	30	32
Boring B-3	60	-	-
Boring B-4	63	-	-
Boring B-5	60	26	34
Test Pit Resid-1	61	-	-
Test Pit Resid-2	61	-	-
Test Pit SW-1	62	-	-

Index Observation Well	Groundwater Adjustment (ft)	Depth to Estimated High Groundwater (ft)	Estimated High Groundwater Elevation (ft)
A1W-247R	5.30	21	39

Depth to Esitmated High Groundwater = Site Depth to Groudwater - Groundwater Adjustment*
**26 feet was used as the Site Depth to Groundwater*

Calculations perfomed as per Cape Cod Comission's Technical Bulletin 92-001, "Estimation of High Groundwater Levels for Construction and Land Use Planning" (revised in 2006)

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Train 1: WTP Roof and New Pavement

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Oil Grit Separator	0.25	0.75	0.19	0.56
Sediment Forebay	0.00	0.56	0.00	0.56
Infiltration Basin	0.80	0.56	0.45	0.11
	0.00	0.11	0.00	0.11

Total TSS Removal = 89%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BFD Wells 3&4 WTP
Prepared By: GAC
Date: 6/1/2026

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Train 2: New and Existing Pavement

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Filtering Rain Garden	**0.00**	**1.00**	**0.00**	**1.00**
Sediment Forebay	**0.00**	**1.00**	**0.00**	**1.00**
Infiltration Basin	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BFD Wells 3&4 WTP
Prepared By: GAC
Date: 6/1/2026

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Train 3: WTP Roof

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Dry Well	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

Total TSS Removal = 80%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BFD Wells 3&4 WTP
Prepared By: GAC
Date: 6/1/2026

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

NOAA Atlas 14, Volume 10, Version 3
Location name: Hyannis, Massachusetts, USA*
Latitude: 41.6831°, Longitude: -70.3204°
Elevation: 57 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.267 (0.219-0.323)	0.337 (0.276-0.409)	0.452 (0.369-0.551)	0.548 (0.444-0.672)	0.679 (0.529-0.874)	0.776 (0.592-1.02)	0.881 (0.649-1.21)	1.01 (0.687-1.40)	1.20 (0.781-1.72)	1.36 (0.861-1.99)
10-min	0.378 (0.310-0.458)	0.477 (0.391-0.580)	0.640 (0.523-0.780)	0.775 (0.629-0.950)	0.961 (0.750-1.24)	1.10 (0.837-1.45)	1.25 (0.919-1.72)	1.43 (0.975-1.98)	1.70 (1.10-2.44)	1.92 (1.22-2.82)
15-min	0.445 (0.365-0.539)	0.562 (0.461-0.682)	0.753 (0.615-0.918)	0.912 (0.740-1.12)	1.13 (0.882-1.46)	1.29 (0.985-1.71)	1.47 (1.08-2.02)	1.68 (1.15-2.34)	1.99 (1.30-2.87)	2.26 (1.44-3.32)
30-min	0.660 (0.542-0.801)	0.830 (0.681-1.01)	1.11 (0.904-1.35)	1.34 (1.08-1.64)	1.66 (1.29-2.14)	1.89 (1.44-2.50)	2.15 (1.58-2.95)	2.45 (1.68-3.41)	2.92 (1.90-4.20)	3.31 (2.10-4.86)
60-min	0.876 (0.719-1.06)	1.10 (0.901-1.33)	1.46 (1.20-1.78)	1.77 (1.43-2.16)	2.18 (1.70-2.81)	2.49 (1.90-3.29)	2.83 (2.08-3.89)	3.23 (2.21-4.49)	3.84 (2.50-5.53)	4.36 (2.77-6.40)
2-hr	1.23 (1.01-1.48)	1.53 (1.26-1.84)	2.02 (1.66-2.44)	2.42 (1.98-2.95)	2.98 (2.34-3.81)	3.40 (2.61-4.44)	3.84 (2.86-5.24)	4.39 (3.03-6.04)	5.22 (3.44-7.44)	5.94 (3.81-8.62)
3-hr	1.47 (1.22-1.76)	1.81 (1.50-2.18)	2.38 (1.96-2.86)	2.84 (2.33-3.45)	3.49 (2.76-4.44)	3.97 (3.06-5.16)	4.48 (3.35-6.07)	5.11 (3.55-6.98)	6.06 (4.02-8.57)	6.88 (4.45-9.91)
6-hr	1.92 (1.61-2.29)	2.34 (1.95-2.79)	3.02 (2.51-3.62)	3.59 (2.96-4.32)	4.37 (3.47-5.49)	4.94 (3.84-6.35)	5.56 (4.19-7.43)	6.30 (4.42-8.51)	7.41 (4.97-10.3)	8.34 (5.45-11.8)
12-hr	2.42 (2.03-2.86)	2.89 (2.43-3.42)	3.66 (3.06-4.36)	4.31 (3.58-5.15)	5.19 (4.16-6.46)	5.86 (4.58-7.42)	6.56 (4.95-8.60)	7.35 (5.22-9.81)	8.50 (5.77-11.7)	9.45 (6.24-13.2)
24-hr	2.87 (2.43-3.38)	3.39 (2.87-3.99)	4.24 (3.57-5.01)	4.95 (4.14-5.87)	5.92 (4.77-7.28)	6.65 (5.23-8.32)	7.41 (5.62-9.56)	8.24 (5.91-10.9)	9.40 (6.46-12.8)	10.3 (6.90-14.3)
2-day	3.27 (2.79-3.82)	3.82 (3.26-4.47)	4.73 (4.01-5.55)	5.48 (4.62-6.46)	6.52 (5.29-7.94)	7.31 (5.79-9.04)	8.12 (6.20-10.3)	8.98 (6.51-11.7)	10.2 (7.06-13.6)	11.1 (7.50-15.1)
3-day	3.54 (3.03-4.12)	4.11 (3.51-4.78)	5.03 (4.28-5.87)	5.80 (4.90-6.80)	6.85 (5.58-8.29)	7.66 (6.09-9.42)	8.48 (6.51-10.7)	9.35 (6.83-12.1)	10.6 (7.39-14.0)	11.5 (7.84-15.6)
4-day	3.78 (3.24-4.38)	4.35 (3.73-5.05)	5.28 (4.51-6.14)	6.05 (5.13-7.07)	7.11 (5.82-8.57)	7.91 (6.33-9.70)	8.74 (6.75-11.0)	9.64 (7.06-12.4)	10.9 (7.64-14.4)	11.9 (8.11-16.0)
7-day	4.42 (3.81-5.09)	4.99 (4.30-5.76)	5.94 (5.10-6.87)	6.72 (5.73-7.80)	7.79 (6.42-9.32)	8.61 (6.93-10.5)	9.45 (7.35-11.8)	10.3 (7.65-13.2)	11.6 (8.22-15.2)	12.6 (8.67-16.7)
10-day	5.02 (4.34-5.76)	5.61 (4.85-6.45)	6.58 (5.67-7.59)	7.39 (6.33-8.56)	8.51 (7.03-10.1)	9.36 (7.56-11.3)	10.2 (7.97-12.6)	11.1 (8.28-14.1)	12.4 (8.83-16.1)	13.3 (9.27-17.6)
20-day	6.83 (5.96-7.80)	7.53 (6.55-8.59)	8.66 (7.51-9.91)	9.60 (8.28-11.0)	10.9 (9.07-12.8)	11.9 (9.67-14.2)	12.9 (10.1-15.7)	13.9 (10.4-17.3)	15.1 (10.9-19.3)	16.0 (11.3-20.8)
30-day	8.41 (7.36-9.55)	9.19 (8.03-10.4)	10.5 (9.12-11.9)	11.5 (9.99-13.2)	13.0 (10.9-15.2)	14.1 (11.5-16.7)	15.2 (12.0-18.3)	16.3 (12.3-20.2)	17.5 (12.8-22.3)	18.4 (13.0-23.8)
45-day	10.4 (9.17-11.8)	11.3 (9.94-12.8)	12.8 (11.2-14.5)	14.0 (12.2-15.9)	15.7 (13.2-18.2)	17.0 (13.9-19.9)	18.2 (14.4-21.7)	19.3 (14.8-23.8)	20.7 (15.2-26.0)	21.5 (15.4-27.5)
60-day	12.2 (10.7-13.8)	13.2 (11.6-14.9)	14.8 (13.0-16.7)	16.1 (14.1-18.3)	17.9 (15.1-20.7)	19.4 (16.0-22.7)	20.8 (16.4-24.6)	21.9 (16.8-26.9)	23.3 (17.2-29.2)	24.2 (17.4-30.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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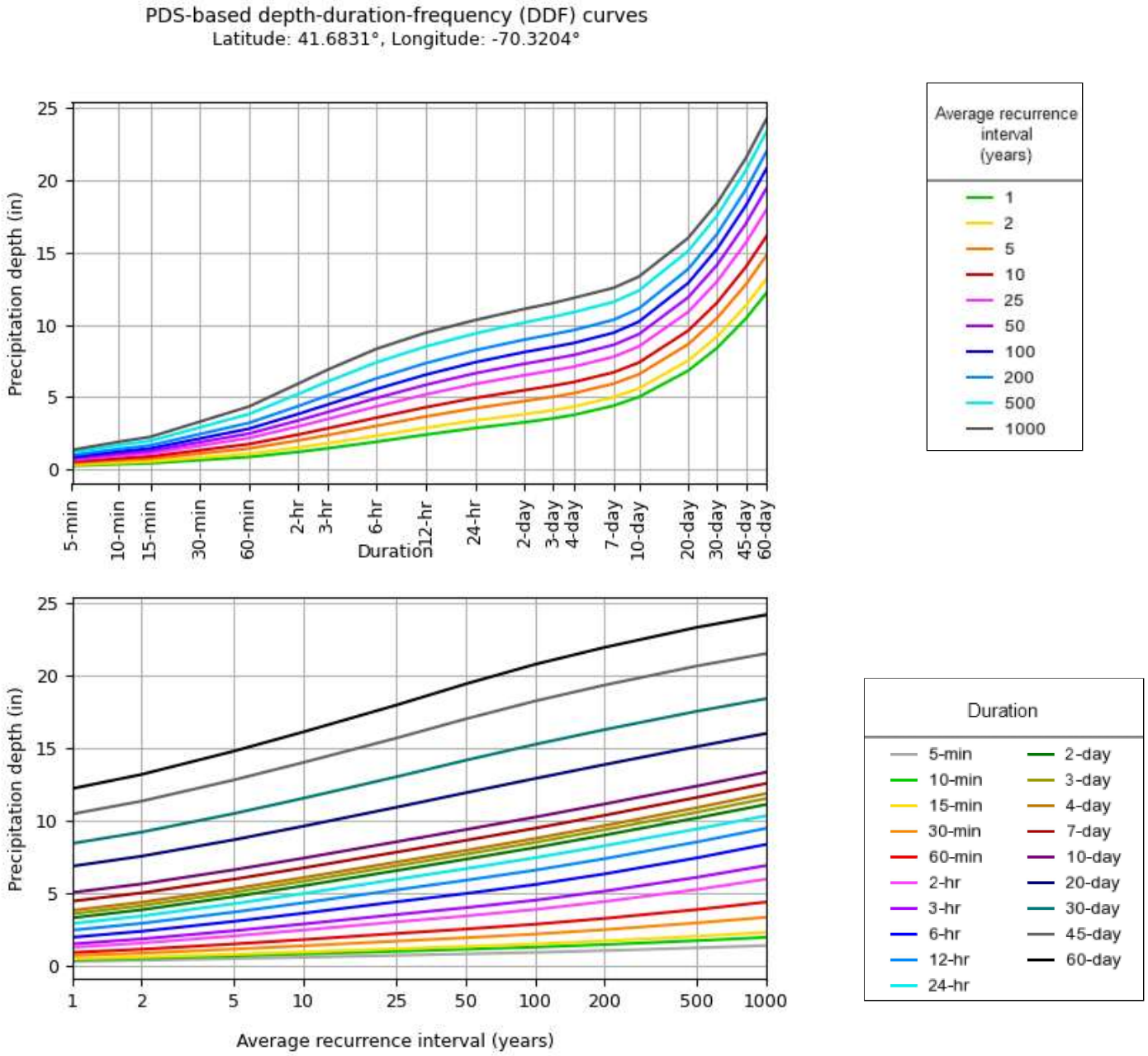
PF graphical



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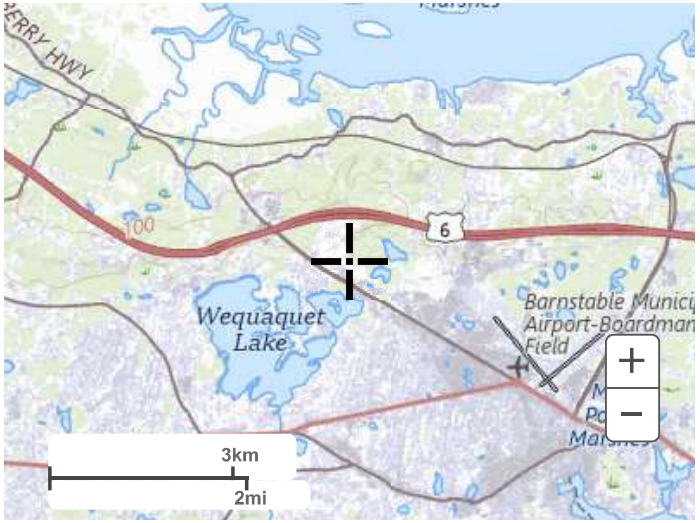
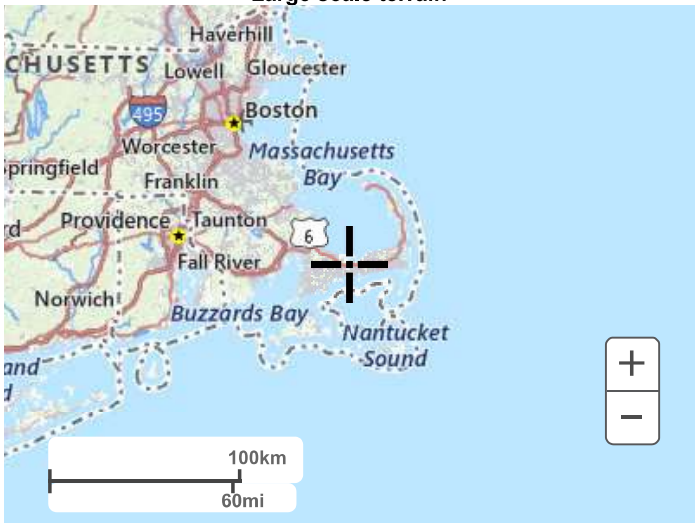
Maps & aerials

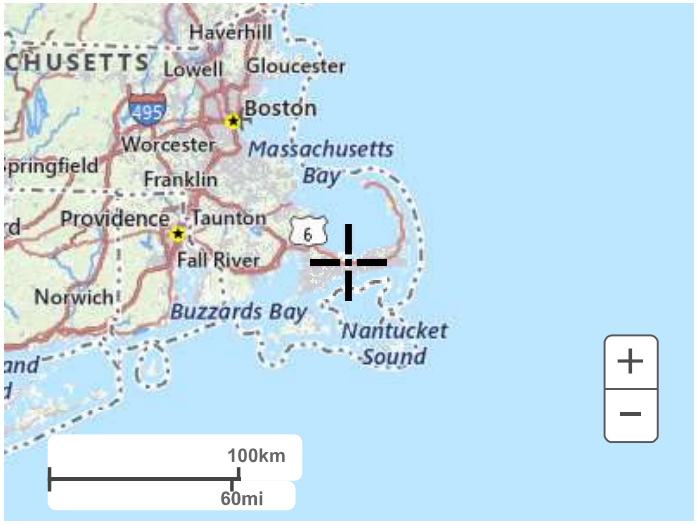
Small scale terrain



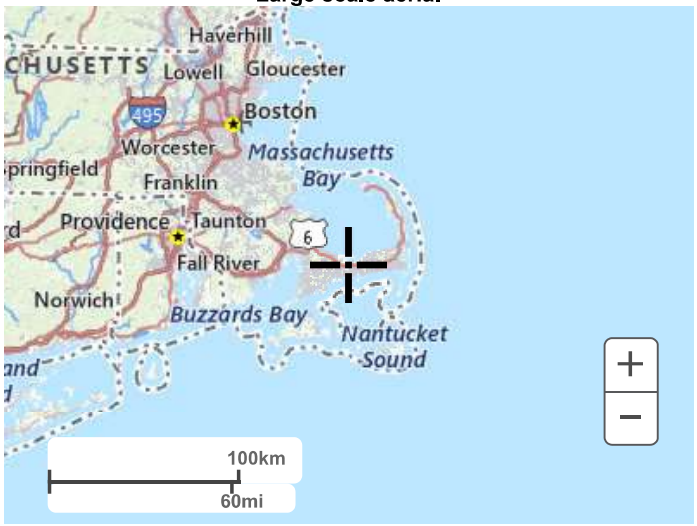
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Climate Resilience Design Standards Tool Project Report

Barnstable Fire District Wells 3&4 WTP
Date Created: 3/4/2026 3:17:12 PM
Created By: GCordeiro
Date Report Generated: 5/7/2026 7:02:11 PM
Tool Version: Version 1.4
Project Contact Information: Steve Olson (sco@h2olsonengineering.com)

Project Summary

Link to Project

Estimated Capital Cost: $17800000.00
End of Useful Life Year: 2060
Project within mapped Environmental Justice neighborhood: Yes

Ecosystem Service Benefits	Scores
Project Score	Moderate
Exposure	**Scores**
Sea Level Rise/Storm Surge	Not Exposed
Extreme Precipitation - Stormwater Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	Not Exposed
Extreme Heat	High Exposure



Asset Preliminary Climate Risk Rating Summary

Number of Assets: 1

Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Stormwater Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
Facility Building	Low Risk	High Risk	Low Risk	High Risk

Climate Resilience Design Standards Summary

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
Sea Level Rise/Storm Surge					
Facility Building					
Extreme Precipitation					
Facility Building	2070			50-yr (2%)	Tier 3
Extreme Heat					
Facility Building	2070		90th		Tier 3

Scoring Rationale - Project Exposure Score

The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. The rationale behind the exposure rating is provided below.

Sea Level Rise/Storm Surge

This project received a "Not Exposed" because of the following:

- Not located within the predicted mean high water shoreline by 2030
- No historic coastal flooding at project site
- Not located within the Massachusetts Coast Flood Risk Model (MC-FRM)

Extreme Precipitation - Stormwater Flooding

This project received a "High Exposure" because of the following:

- Increased impervious area
- Maximum annual daily rainfall exceeds 10 inches within the overall project's useful life
- No historic flooding at project site
- Existing impervious area of the project site is less than 10%

Extreme Precipitation - Riverine Flooding

This project received a "Not Exposed" because of the following:

- No historic riverine flooding at project site
- The project is not within a mapped FEMA floodplain [outside of the Massachusetts Coast Flood Risk Model (MC-FRM)]
- Project is more than 500ft from a waterbody
- Project is not likely susceptible to riverine erosion

Extreme Heat

This project received a "High Exposure" because of the following:

- Not located within 100 ft of existing water body
- Increased impervious area
- Existing trees are being removed as part of the proposed project
- Existing impervious area of the project site is less than 10%
- 10 to 30 day increase in days over 90 deg. F within project's useful life

Scoring Rationale - Asset Preliminary Climate Risk Rating

A Preliminary Climate Risk Rating is determined for each infrastructure and building asset by considering the overall project Exposure Score and responses to Step 4 questions provided by the user in the Tool. Natural Resource assets do not receive a risk rating. The following factors are what influenced the risk ratings for each asset.

Asset - Facility Building
Primary asset criticality factors influencing risk ratings for this asset:

- Asset must be operable at all times, even during natural hazard event
- Less than 10,000 people would be directly affected by the loss/inoperability of the asset
- The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
- Inoperability of the asset would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses
- Inoperability is likely to significantly impact other facilities, assets, or buildings and will likely affect their ability to operate
- Spills and/or releases of hazardous materials would be relatively easy to clean up

Project Climate Resilience Design Standards Output

Climate Resilience Design Standards and Guidance are recommended for each asset and climate parameter. The Design Standards for each climate parameter include the following: recommended planning horizon (target and/or intermediate), recommended return period (Sea Level Rise/Storm Surge and Precipitation) or percentile (Heat), and a list of applicable design criteria that are likely to be affected by climate change. Some design criteria have numerical values associated with the recommended return period and planning horizon, while others have tiered methodologies with step-by-step instructions on how to estimate design values given the other recommended design standards.

Asset: Facility Building — Building/Facility

Sea Level Rise/Storm Surge — Low Risk

Applicable Design Criteria

Projected Tidal Datums: NOT APPLICABLE

Projected Water Surface Elevation: NOT APPLICABLE

Projected Wave Action Water Elevation: NOT APPLICABLE

Projected Wave Heights: NOT APPLICABLE

Projected Duration of Flooding: NOT APPLICABLE

Projected Design Flood Velocity: NOT APPLICABLE

Projected Scour & Erosion: NOT APPLICABLE

Extreme Precipitation — High Risk

Target Planning Horizon: 2070
Return Period: 50-yr (2%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

The projected values, standards, and guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence.

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Facility Building	2070	50-Year (2%)	8.7	Downloadable Methodology PDF

Projected Riverine Peak Discharge & Peak Flood Elevation: NOT APPLICABLE

Extreme Heat — High Risk

Target Planning Horizon: 2070
Percentile: 90th Percentile

LIMITATIONS: The recommended standards are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Applicable Design Criteria

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Annual Average Temperature [°F]	Projected Summer Average Temperature [°F]	Projected Winter Average Temperature [°F]
Facility Building	2070	90th	60.65	78.47	42.71

LIMITATIONS: The recommended Standards for Projected Average Annual/Summer/Winter Temperature are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Growing Degree Days: NOT APPLICABLE

Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Days with Max Temp >95°F (days)	Projected Days with Max Temp >90°F (days)	Projected Days with Max Temp <32°F (days)
Facility Building	2070	90th	9	35	42

LIMITATIONS: The recommended Standards for ProjectedÂ Days per Year with Max Temp >95Â°F, >90Â°F, <32Â°F are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Number of Heat Waves Per Year (events)	Projected Average Heat Wave Duration (days)
Facility Building	2070	90th	0	4

LIMITATIONS: The recommended Standards for ProjectedÂ Number of Heat Waves Per Year and Average Heat Wave DurationÂ are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Cooling Degree Days (base = 65°) (degree days)	Projected Heating Degree Days (base = 65°) (degree days)
Facility Building	2070	90th	1749	3338

LIMITATIONS: The recommended Standards for ProjectedÂ Cooling Degree Days and Heating Degree DaysÂ are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Heat Index: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Project Inputs

Core Project Information

Name:	Barnstable Fire District Wells 3&4 WTP
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2060
Location of Project:	Barnstable
Estimated Capital Cost:	$17,800,000
Who is the Submitting Entity?	Private Other H2Olson Engineering Inc. Steve Olson (sco@h2olsonengineering.com)
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Permitting
Is climate resiliency a core objective of this project?	No
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	Yes
Brief Project Description:	The main goals of the project are to increase the drinking water capacity of the Barnstable Fire District and improve the water quality at Well 3 and Well 4. The project includes the construction of a new water treatment plant, a paved access driveway, two sand filters and two infiltration basins for the treatment of water treatment residuals, a septic system, stormwater best management practices (BMPs), new yard piping, new overhead electrical lines, new underground fiberoptic lines, two new generators, three new propane tanks, yard fencing, and three new water hydrants. The project will require Massachusetts Historical Commission Review (completed), MESA Project Review with NHESP (completed), a MEPA Secretary's Certificate, coverage under the NPDES Construction General Permit, MassDEP drinking water permit (WS 24), a Title 5 Permit, a local stormwater management permit, and a local building permit.

Project Ecosystem Service Benefits

Factors Influencing Output

- ✓ Project reduces storm damage
- ✓ Project protects public water supply
- ✓ Project recharges groundwater
- ✓ Project filters stormwater using green infrastructure
- ✓ Project improves water quality
- ✓ Project prevents pollution

Factors to Improve Output

- ✓ Incorporate nature-based solutions that may provide flood protection
- ✓ Incorporate strategies that reduce carbon emissions
- ✓ Incorporate nature-based solutions that sequester carbon carbon
- ✓ Increase biodiversity, protect critical habitat for species, manage invasive populations, and/or provide connectivity to other habitats
- ✓ Preserve, enhance, and/or restore coastal shellfish habitats
- ✓ Incorporate vegetation that provides pollinator habitat
- ✓ Identify opportunities to remediate existing sources of pollution
- ✓ Provide opportunities for passive and/or active recreation through open space
- ✓ Increase plants, trees, and/or other vegetation to provide oxygen production
- ✓ Mitigate atmospheric greenhouse gas concentrations and other toxic air pollutants through nature-based solutions
- ✓ Incorporate education and/or protect cultural resources as part of your project

Is the primary purpose of this project ecological restoration?

No

Project Benefits

Provides flood protection through nature-based solutions	No
Reduces storm damage	Yes
Recharges groundwater	Yes
Protects public water supply	Yes
Filters stormwater using green infrastructure	Yes
Improves water quality	Yes
Promotes decarbonization	No

Enables carbon sequestration	No
Provides oxygen production	No
Improves air quality	No
Prevents pollution	Yes
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	No
Protects land containing shellfish	No
Provides pollinator habitat	No
Provides recreation	No
Provides cultural resources/education	No

Project Climate Hazard Exposure

Is the primary purpose of this project ecological restoration?	No
Does the project site have a history of coastal flooding?	No
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	No
Does the project site have a history of riverine flooding?	No
Does the project result in a net increase in impervious area of the site?	Yes
Are existing trees being removed as part of the proposed project?	Yes

Project Assets

Asset: Facility Building
Asset Type: Typically Unoccupied
Asset Sub-Type: Water treatment plant (potable water)
Construction Type: New Construction
Construction Year: 2030
Useful Life: 30

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Building must be accessible/operable at all times, even during natural hazard event

Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.
Impacts would be limited to local area and/or municipality

Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.
Less than 10,000 people

Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the building/facility would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses

If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?
Spills and/or releases of hazardous materials would be relatively easy to clean up

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Significant – Inoperability is likely to impact other facilities, assets, or buildings and will likely affect their ability to operate

If this building/facility was damaged beyond repair, how much would it approximately cost to replace?
Between $10 million and $30 million

Is this a recreational facility which can be vacated during a natural hazard event?
No

If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?
Some alternative programs and/or services are available to support the community

If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
Impact on natural resources can be mitigated naturally

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?
Loss of building may reduce the ability to maintain some government services, while a majority of services will still exist.

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?
Loss of confidence in government agency

Report Comments

N/A

ATTACHMENT F

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Massachusetts Environmental Policy Act (MEPA) Office MEPA Office 100 Cambridge Street, Suite 900 Boston, MA 02114	MEPA@mass.gov	Electronic Copy
Department of Environmental Protection, Boston Office Commissioner's Office One Winter Street Boston, MA 02108	helena.boccadoro@mass.gov	Electronic Copy
DEP/Southeastern Regional Office Attn: MEPA Coordinator 20 Riverside Drive Lakeville, MA 02347	george.zoto@mass.gov jonathan.hobill@mass.gov	Electronic Copy
Massachusetts Department of Transportation – Boston Public/Private Development Unit 10 Park Plaza, Suite #4150 Boston, MA 02116	MassDOTPPDU@dot.state.ma.us	Electronic Copy
Massachusetts Department of Transportation – District Office District #5 Attn: MEPA Coordinator 1000 County Street Taunton, MA 02780	Cindy.McConarty@dot.state.ma.us	Electronic Copy
MA Historical Commission Attn: The MA Archives Building 220 Morrissey Boulevard Boston, MA 02125		Hard Copy
Cape Cod Commission (CCC)	ksenatori@capecodcommission.org regulatory@capecodcommission.org	Electronic Copy
Town Council Town of Barnstable 367 Main Street Hyannis, MA 02601	cynthia.lovell@barnstable.gov	Electronic Copy
Planning Board Town of Barnstable 367 Main Street Hyannis MA 02601	james.kupfer@barnstable.gov karen.pina@barnstable.gov	Electronic Copy
Conservation Commission Town of Barnstable 230 South Street Hyannis MA 02601	edwin.hoopes@barnstable.gov	Electronic Copy

Addressee	Email	Submission Format
Public Health Division Town of Barnstable 200 Main Street Hyannis MA 02601	thomas.mckean@barnstable.gov	Electronic Copy
MEPA Office Attn: EEA EJ Director 100 Cambridge Street, Suite 900 Boston, MA 02144	MEPA-EJ@mass.gov	Electronic Copy
Department of Public Health Director of Environmental Health 250 Washington Street Boston, MA 02115	dphtoxicology@massmail.state.ma.us	Electronic Copy

ATTACHMENT G

RMAT CRDS Output Report

Climate Resilience Design Standards Tool Project Report

Barnstable Fire District Wells 3&4 WTP
Date Created: 3/4/2026 3:17:12 PM
Created By: GCordeiro
Date Report Generated: 5/7/2026 7:02:11 PM
Tool Version: Version 1.4
Project Contact Information: Steve Olson (sco@h2olsonengineering.com)

Project Summary

Link to Project

Estimated Capital Cost: $17800000.00
End of Useful Life Year: 2060
Project within mapped Environmental Justice neighborhood: Yes

Ecosystem Service Benefits	Scores
Project Score	Moderate
Exposure	**Scores**
Sea Level Rise/Storm Surge	Not Exposed
Extreme Precipitation - Stormwater Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	Not Exposed
Extreme Heat	High Exposure



Asset Preliminary Climate Risk Rating Summary

Number of Assets: 1

Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Stormwater Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
Facility Building	Low Risk	High Risk	Low Risk	High Risk

Climate Resilience Design Standards Summary

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
Sea Level Rise/Storm Surge					
Facility Building					
Extreme Precipitation					
Facility Building	2070			50-yr (2%)	Tier 3
Extreme Heat					
Facility Building	2070		90th		Tier 3

Scoring Rationale - Project Exposure Score

The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. The rationale behind the exposure rating is provided below.

Sea Level Rise/Storm Surge

This project received a "Not Exposed" because of the following:

- Not located within the predicted mean high water shoreline by 2030
- No historic coastal flooding at project site
- Not located within the Massachusetts Coast Flood Risk Model (MC-FRM)

Extreme Precipitation - Stormwater Flooding

This project received a "High Exposure" because of the following:

- Increased impervious area
- Maximum annual daily rainfall exceeds 10 inches within the overall project's useful life
- No historic flooding at project site
- Existing impervious area of the project site is less than 10%

Extreme Precipitation - Riverine Flooding

This project received a "Not Exposed" because of the following:

- No historic riverine flooding at project site
- The project is not within a mapped FEMA floodplain [outside of the Massachusetts Coast Flood Risk Model (MC-FRM)]
- Project is more than 500ft from a waterbody
- Project is not likely susceptible to riverine erosion

Extreme Heat

This project received a "High Exposure" because of the following:

- Not located within 100 ft of existing water body
- Increased impervious area
- Existing trees are being removed as part of the proposed project
- Existing impervious area of the project site is less than 10%
- 10 to 30 day increase in days over 90 deg. F within project's useful life

Scoring Rationale - Asset Preliminary Climate Risk Rating

A Preliminary Climate Risk Rating is determined for each infrastructure and building asset by considering the overall project Exposure Score and responses to Step 4 questions provided by the user in the Tool. Natural Resource assets do not receive a risk rating. The following factors are what influenced the risk ratings for each asset.

Asset - Facility Building
Primary asset criticality factors influencing risk ratings for this asset:

- Asset must be operable at all times, even during natural hazard event
- Less than 10,000 people would be directly affected by the loss/inoperability of the asset
- The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
- Inoperability of the asset would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses
- Inoperability is likely to significantly impact other facilities, assets, or buildings and will likely affect their ability to operate
- Spills and/or releases of hazardous materials would be relatively easy to clean up

Project Climate Resilience Design Standards Output

Climate Resilience Design Standards and Guidance are recommended for each asset and climate parameter. The Design Standards for each climate parameter include the following: recommended planning horizon (target and/or intermediate), recommended return period (Sea Level Rise/Storm Surge and Precipitation) or percentile (Heat), and a list of applicable design criteria that are likely to be affected by climate change. Some design criteria have numerical values associated with the recommended return period and planning horizon, while others have tiered methodologies with step-by-step instructions on how to estimate design values given the other recommended design standards.

Asset: Facility Building — Building/Facility

Sea Level Rise/Storm Surge — Low Risk

Applicable Design Criteria

Projected Tidal Datums: NOT APPLICABLE

Projected Water Surface Elevation: NOT APPLICABLE

Projected Wave Action Water Elevation: NOT APPLICABLE

Projected Wave Heights: NOT APPLICABLE

Projected Duration of Flooding: NOT APPLICABLE

Projected Design Flood Velocity: NOT APPLICABLE

Projected Scour & Erosion: NOT APPLICABLE

Extreme Precipitation — High Risk

Target Planning Horizon: 2070
Return Period: 50-yr (2%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

The projected values, standards, and guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence.

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Facility Building	2070	50-Year (2%)	8.7	Downloadable Methodology PDF

Projected Riverine Peak Discharge & Peak Flood Elevation: NOT APPLICABLE

Extreme Heat — High Risk

Target Planning Horizon: 2070
Percentile: 90th Percentile

LIMITATIONS: The recommended standards are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Applicable Design Criteria

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Annual Average Temperature [°F]	Projected Summer Average Temperature [°F]	Projected Winter Average Temperature [°F]
Facility Building	2070	90th	60.65	78.47	42.71

LIMITATIONS: The recommended Standards for Projected Average Annual/Summer/Winter Temperature are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Growing Degree Days: NOT APPLICABLE

Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Days with Max Temp >95°F (days)	Projected Days with Max Temp >90°F (days)	Projected Days with Max Temp <32°F (days)
Facility Building	2070	90th	9	35	42

LIMITATIONS: The recommended Standards for ProjectedÂ Days per Year with Max Temp >95Â°F, >90Â°F, <32Â°F are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Number of Heat Waves Per Year (events)	Projected Average Heat Wave Duration (days)
Facility Building	2070	90th	0	4

LIMITATIONS: The recommended Standards for ProjectedÂ Number of Heat Waves Per Year and Average Heat Wave DurationÂ are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Cooling Degree Days (base = 65°) (degree days)	Projected Heating Degree Days (base = 65°) (degree days)
Facility Building	2070	90th	1749	3338

LIMITATIONS: The recommended Standards for ProjectedÂ Cooling Degree Days and Heating Degree DaysÂ are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Heat Index: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Project Inputs

Core Project Information

Name:	Barnstable Fire District Wells 3&4 WTP
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2060
Location of Project:	Barnstable
Estimated Capital Cost:	$17,800,000
Who is the Submitting Entity?	Private Other H2Olson Engineering Inc. Steve Olson (sco@h2olsonengineering.com)
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Permitting
Is climate resiliency a core objective of this project?	No
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	Yes
Brief Project Description:	The main goals of the project are to increase the drinking water capacity of the Barnstable Fire District and improve the water quality at Well 3 and Well 4. The project includes the construction of a new water treatment plant, a paved access driveway, two sand filters and two infiltration basins for the treatment of water treatment residuals, a septic system, stormwater best management practices (BMPs), new yard piping, new underground electrical lines, new underground fiberoptic lines, two new generators, three new propane tanks, yard fencing, and three new water hydrants. The project will require Massachusetts Historical Commission Review (completed), MESA Project Review with NHESP (completed), a MEPA Secretary's Certificate, coverage under the NPDES Construction General Permit, MassDEP drinking water permit (WS 24), a Title 5 Permit, a local stormwater management permit, and a local building permit.

Project Ecosystem Service Benefits

Factors Influencing Output

- ✓ Project reduces storm damage
- ✓ Project protects public water supply
- ✓ Project recharges groundwater
- ✓ Project filters stormwater using green infrastructure
- ✓ Project improves water quality
- ✓ Project prevents pollution

Factors to Improve Output

- ✓ Incorporate nature-based solutions that may provide flood protection
- ✓ Incorporate strategies that reduce carbon emissions
- ✓ Incorporate nature-based solutions that sequester carbon carbon
- ✓ Increase biodiversity, protect critical habitat for species, manage invasive populations, and/or provide connectivity to other habitats
- ✓ Preserve, enhance, and/or restore coastal shellfish habitats
- ✓ Incorporate vegetation that provides pollinator habitat
- ✓ Identify opportunities to remediate existing sources of pollution
- ✓ Provide opportunities for passive and/or active recreation through open space
- ✓ Increase plants, trees, and/or other vegetation to provide oxygen production
- ✓ Mitigate atmospheric greenhouse gas concentrations and other toxic air pollutants through nature-based solutions
- ✓ Incorporate education and/or protect cultural resources as part of your project

Is the primary purpose of this project ecological restoration?

No

Project Benefits

Provides flood protection through nature-based solutions	No
Reduces storm damage	Yes
Recharges groundwater	Yes
Protects public water supply	Yes
Filters stormwater using green infrastructure	Yes
Improves water quality	Yes
Promotes decarbonization	No

Enables carbon sequestration	No
Provides oxygen production	No
Improves air quality	No
Prevents pollution	Yes
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	No
Protects land containing shellfish	No
Provides pollinator habitat	No
Provides recreation	No
Provides cultural resources/education	No

Project Climate Hazard Exposure

Is the primary purpose of this project ecological restoration?	No
Does the project site have a history of coastal flooding?	No
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	No
Does the project site have a history of riverine flooding?	No
Does the project result in a net increase in impervious area of the site?	Yes
Are existing trees being removed as part of the proposed project?	Yes

Project Assets

Asset: Facility Building
Asset Type: Typically Unoccupied
Asset Sub-Type: Water treatment plant (potable water)
Construction Type: New Construction
Construction Year: 2030
Useful Life: 30

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Building must be accessible/operable at all times, even during natural hazard event

Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.
Impacts would be limited to local area and/or municipality

Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.
Less than 10,000 people

Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the building/facility would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses

If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?
Spills and/or releases of hazardous materials would be relatively easy to clean up

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Significant – Inoperability is likely to impact other facilities, assets, or buildings and will likely affect their ability to operate

If this building/facility was damaged beyond repair, how much would it approximately cost to replace?
Between $10 million and $30 million

Is this a recreational facility which can be vacated during a natural hazard event?
No

If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?
Some alternative programs and/or services are available to support the community

If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
Impact on natural resources can be mitigated naturally

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?
Loss of building may reduce the ability to maintain some government services, while a majority of services will still exist.

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?
Loss of confidence in government agency

Report Comments

N/A

ATTACHMENT H

Environmental Justice Documentation

Environmental Justice Screening Form

Project Name	Barnstable Fire District Wells 3&4 Water Treatment Plant
Anticipated Date of MEPA Filing	April 30, 2026
Proponent Name	Barnstable Fire District Water Department
Contact Information (e.g., consultant)	Stephen Olson, P.E. sco@h2olsonengineering.com 508-375-7007
Public website for project or other physical location where project materials can be obtained (if available)	10 Riverside Drive Suite #103 Lakeville, MA 02347
Municipality and Zip Code for Project (if known)	Barnstable, MA 02630
Project Type* (list all that apply)	Water Supply – Treatment/conveyance
Is the project site within a mapped 100-year FEMA flood plain? Y/N/ unknown	No
Estimated GHG emissions of conditioned spaces (click **here** for GHG Estimation tool)	5.46 tpy (tons per year)

Project Description

1. Provide a brief project description, including overall size of the project site and square footage of proposed buildings and structures if known.

The proposed project involves the construction of a new water treatment plant at 1660 Route 132 in Barnstable, Massachusetts. The new building will be located on the same property as Well 3 and Well 4, two wells owned and operated by the Barnstable Fire District Water Department to supply water to the Barnstable Fire District service zone located within the Town of Barnstable. Construction will include the new 3,800-square-foot water treatment plant building, two concrete sand filters and associated infiltration basins for treatment residuals, a Title 5 compliant septic system for the facility restroom, propane fueled emergency generators, and associated yard piping. The total size of the project site is approximately 90,000 square feet.

2. List anticipated MEPA review thresholds (301 CMR 11.03) (if known)

301 CMR 11.03(4)(b)4. – Construction of a New drinking water treatment plant with a Capacity of 1,000,000 or more gpd.

3. List all anticipated state, local and federal permits needed for the project (if known)

MEPA Secretary's Certificate (EEOEA)
Massachusetts Historical Commission Review - Completed
MESA Project Review (NHESP) - Completed
Title 5 Permit (MassDEP)

Local Building Permit (Town of Barnstable)
Site Plan Review (Town of Barnstable)
NPDES Construction General Permit (USEPA)
BRP WS 24 – Approval to Construct a Water Treatment Facility of 1 million Gallons per Day or Greater (MassDEP)

4. Identify EJ populations and characteristics (Minority, Income, English Isolation) within 5 miles of project site (can attach map identifying 5-mile radius from EJ Maps Viewer in lieu of narrative)

EJ populations within 5 miles of the project site include block groups identified for Minority, Income, and English Isolation. Languages identified within 5 miles of the project site include Portuguese and Portuguese Creole. A map depicting this information is attached to this form.

5. Identify any municipality or census tract meeting the definition of "vulnerable health EJ criteria" in the DPH EJ Tool located in whole or in part within a 1 mile radius of the project site.

According to the DPH EJ Tool, there are no census tracts within 1 mile of the project site, or within the Town of Barnstable, that meet the definition of "vulnerable health EJ criteria".

6. Identify potential short-term and long-term environmental and public health impacts that may affect EJ Populations and any anticipated mitigation.

The construction is not anticipated to result in any short-term public health impacts. Construction period impacts including noise, dust, and emissions are only expected to impact areas immediately adjacent to the Site, which comprises of a dense, wooded area and the Hyannis Golf Course, and will be mitigated in accordance with local, state, and federal requirements.

Long term public health impacts associated with the Project include a slight increase in GHG emissions compared to the existing Well 3 and Well 4 Pumping and Treatment facilities due to the increase in size and power requirements for the building and treatment equipment. Mitigation for this potential increase in GHG emissions includes adherence to the 2024 International Energy Conservation Code.

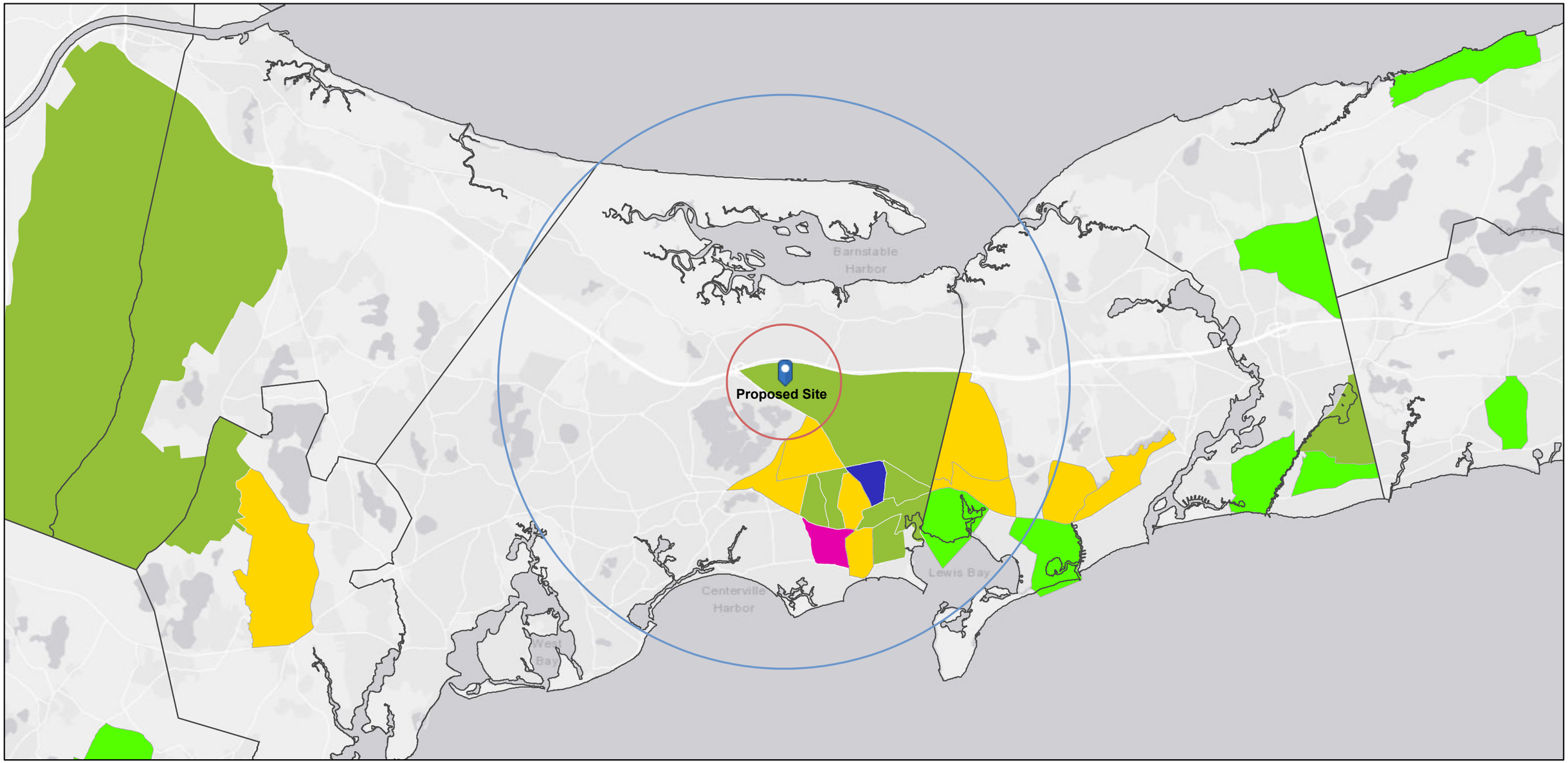
7. Identify project benefits, including "Environmental Benefits" as defined in 301 CMR 11.02, that may improve environmental conditions or public health of the EJ population.

The project will supply improved water quality and provide increased reliability of clean, safe, public drinking water to all customers serviced by the Barnstable Fire District Water Department, and all members of the general public that make use of the businesses and facilities which use or serve public drinking water.

8. Describe how the community can request a meeting to discuss the project, and how the community can request oral language interpretation services at the meeting. Specify how to request other accommodations, including meetings after business hours and at locations near public transportation.

The community can request a meeting to discuss the project by contacting Steve Olson at the contact information listed above. In this request, the community can note other accommodations needed such as oral language interpretation services, meetings after business hours, or meetings at locations near public transportation. Oral language interpretation service requests must be made one (1) week in advance of any scheduled meeting.

Barnstable Fire District Wells 3&4 WTP



1/19/2026, 10:58:45 AM

1:144,448

0 1.25 2.5 5 mi

0 2 4 8 km

Distance & Direction - Circle Graphics

- 1 Mile Radius
- 5 Mile Radius

MA 2020 Environmental Justice Block Groups

- Minority: the block group minority population is >= 40%, or the block group minority population is >= 25% and the median household income of the municipality the block group is in is < 150% of the Massachusetts median household income
- Income: the block group median household income is 65% or less than the state median household income
- Minority and Income
- Minority and English isolation
- Minority, Income and English isolation

MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS

MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS | MassGIS, MassDOT - Highway Division, MassDEP, MWRA | EEA GIS |

Formulário de avaliação de Justiça ambiental

Nome do projeto	Estação de Tratamento de Água dos Poços 3 e 4 do Distrito de Bombeiros de Barnstable
Data prevista de protocolo do MEPA	30 de Abril de 2026
Nome do proponente	Departamento de Água do Distrito de Bombeiros de Barnstable
Informações de contato (por exemplo, consultor)	Steve Olson, P.E. sco@h2olsonengineering.com 508-375-7007
Site público do projeto ou outro local físico onde os materiais do projeto podem ser obtidos (se disponíveis)	10 Riverside Drive Suite #103 Lakeville, MA 02347
Município e código postal do Projeto (se souber)	Barnstable, MA 02630
Tipo de projeto* (liste todos os que se aplicam)	Abastecimento de água – Tratamento/transporte
O local do projeto está dentro de uma planície de inundação de 100 anos mapeada do FEMA? S/N/Não sei	Não
Emissões estimadas de GEE de espaços condicionados (clique **aqui** para acessar uma ferramenta de estimativa de GEE)	5,46 tpa (toneladas por ano)

Descrição do projeto

1. Forneça uma breve descrição do projeto, incluindo o tamanho geral do local do projeto e a metragem quadrada dos prédios e estruturas propostos, se souber. O projeto proposto envolve a construção de uma nova estação de tratamento de água na Route 132, nº 1660, em Barnstable, Massachusetts. O novo edifício ficará localizado na mesma propriedade que os poços 3 e 4, dois poços pertencentes e operados pelo Departamento de Água do Distrito de Bombeiros de Barnstable para fornecer água à zona de serviço do Distrito de Bombeiros de Barnstable, localizada na cidade de Barnstable. A construção incluirá o novo edifício da estação de tratamento de água com 3.800 pés quadrados, dois filtros de areia de concreto e bacias de infiltração associadas para resíduos de tratamento, um sistema séptico em conformidade com o Título 5 para o banheiro da instalação, geradores de emergência a propano e tubulação associada no pátio. O tamanho total do local do projeto é de aproximadamente 90.000 pés quadrados.
2. Liste os limites previstos de revisão do MEPA (301 CMR 11.03) (se souber). 301 CMR 11.03(4)(b)4. – Construção de uma nova estação de tratamento de água potável com capacidade igual ou superior a 1.000.000 gpd.

3. Liste todas as autorizações estaduais, locais e federais previstas necessárias para o projeto (se souber).

Certificado do Secretário da MEPA (EEOEA)
Revisão da Comissão Histórica de Massachusetts - Concluída
Revisão do Projeto MESA (NHESP) - Concluída
Licença Título 5 (MassDEP)
Licença de construção local (Cidade de Barnstable)
Revisão do plano do local (Departamento de Construção da Cidade de Barnstable)
Licença Geral de Construção NPDES (EPA)
WS 24 – Aprovação para construir uma estação de tratamento de água com capacidade igual ou superior a 1 milhão de galões por dia (MassDEP)

4. Identifique as populações e características de Justiça ambiental (minoria, renda, falta de conhecimento de inglês) dentro de 5 milhas (8 km) do local do projeto (você pode anexar um mapa que mostre o raio de 5 milhas a partir do Visualizador de mapas de Justiça ambiental em vez de descrever por escrito).

As populações afetadas pela justiça ambiental num raio de 8 km do local do projeto incluem grupos de quarteirões identificados como minorias, de baixa renda e com isolamento linguístico em inglês. As línguas identificadas num raio de 8 km do local do projeto incluem português e crioulo português. Um mapa com essas informações está anexado a este formulário.

5. Identifique qualquer município ou setor censitário que atenda à definição de "critérios de saúde de vulneráveis de Justiça ambiental" pela Ferramenta de Justiça ambiental localizado totalmente ou parcialmente dentro do raio de 1 milha (1,6 km) do local do projeto.

De acordo com a ferramenta EJ do DPH, não há setores censitários num raio de 1,6 km do local do projeto, ou dentro da cidade de Barnstable, que atendam à definição de "critérios EJ de saúde vulnerável".

6. Identifique potenciais impactos ambientais e de saúde pública de curto e longo prazo que podem afetar as Populações de Justiça ambiental e qualquer mitigação prevista.

Não se prevê que a construção tenha qualquer impacto a curto prazo na saúde pública. Os impactos durante o período de construção, incluindo ruído, poeira e emissões, deverão afetar apenas as áreas imediatamente adjacentes ao local, que compreende uma área densamente arborizada e o campo de golfe Hyannis, e serão mitigados de acordo com os requisitos locais, estaduais e federais.

Os impactos de longo prazo na saúde pública associados ao projeto incluem um ligeiro aumento nas emissões de GEE em comparação com as instalações existentes de bombeamento e tratamento dos Poços 3 e 4, devido ao aumento no tamanho e nos requisitos de energia para o edifício e os equipamentos de tratamento. A mitigação desse aumento potencial nas emissões de GEE inclui a adesão ao Código Internacional de Conservação de Energia de 2024.

7. Identifique os benefícios do projeto, incluindo os "Benefícios ambientais", conforme definido no 301 CMR 11.02, que podem melhorar as condições ambientais ou a saúde pública da População de Justiça ambiental.

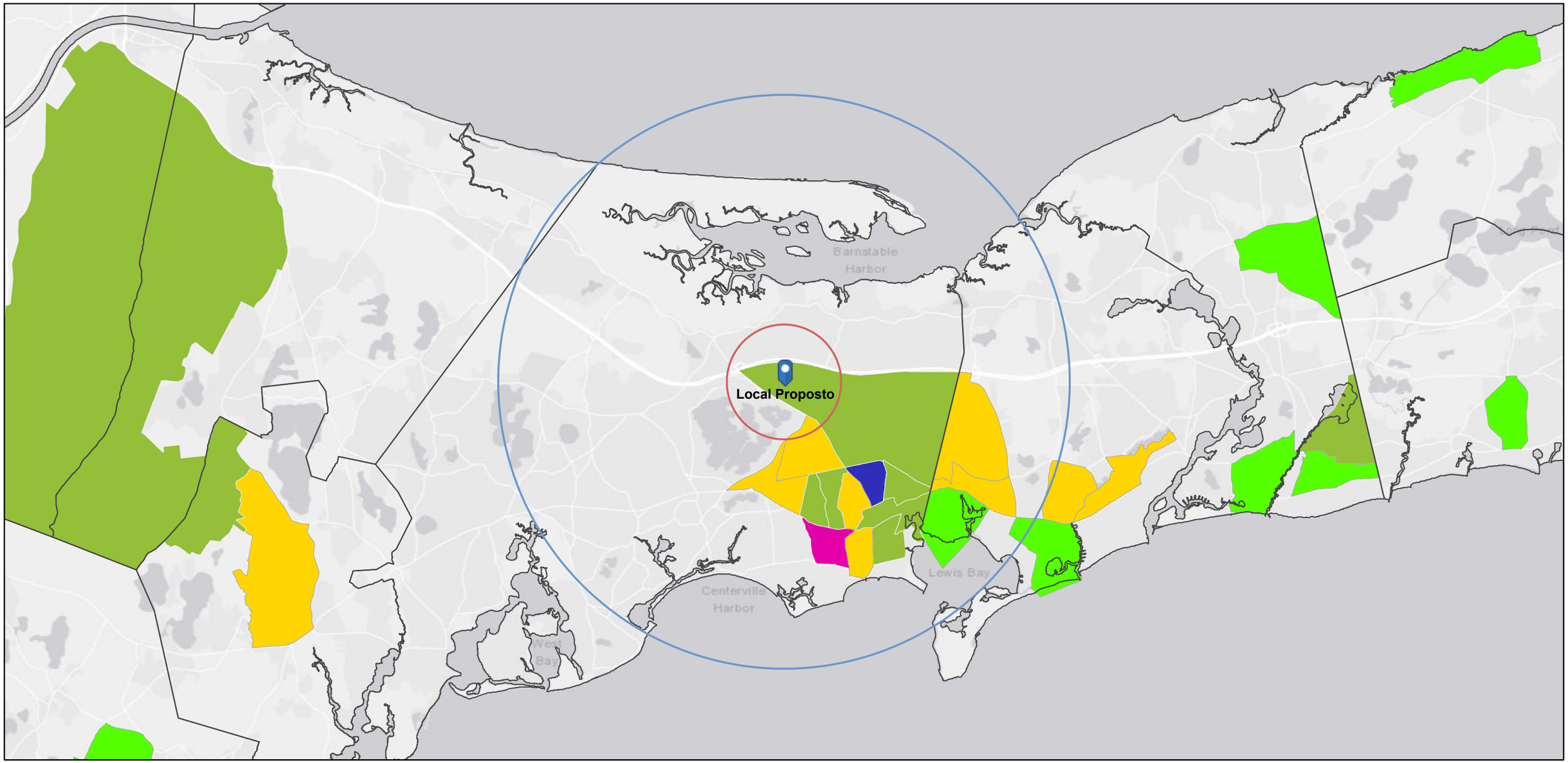
O projeto proporcionará uma melhor qualidade da água e aumentará a confiabilidade do abastecimento público de água potável limpa e segura a todos os clientes atendidos pelo Departamento de Água do Distrito de Barnstable Fire e a todos os membros do público em geral

que utilizam os negócios e instalações que utilizam ou fornecem água potável pública.

8. Descreva como a comunidade pode organizar uma reunião para discutir o projeto e como a comunidade pode solicitar serviços de interpretação para a reunião. Especifique como solicitar outras acomodações, incluindo reuniões fora do horário comercial e em locais próximos a transportes públicos.

A comunidade pode solicitar uma reunião para discutir o projeto entrando em contato com Steve Olson através das informações de contato listadas acima. Nessa solicitação, a comunidade pode indicar outras acomodações necessárias, como serviços de interpretação oral, reuniões após o horário comercial ou reuniões em locais próximos ao transporte público. As solicitações de serviços de interpretação oral devem ser feitas com uma (1) semana de antecedência de qualquer reunião agendada.

Estação de Tratamento de Água de Poços 3 e 4 do Distrito de Bombeiros de Barnstable



19/01/2026, 10:58:45

1:144,448

0 1.25 2.5 5 milhas

0 2 4 8 km

Distância e Direção - Gráficos Circulares

- Raio de 1,6 km
- Raio de 8 km

MA 2020 Grupos de Justiça Ambiental

- Minoria: a população minoritária do grupo de blocos é >= 40%, ou a população minoritária do grupo de blocos é >= 25% e a renda familiar média do município em que o grupo de blocos se encontra é < 150% da renda familiar média de Massachusetts
- Renda: a renda média familiar do grupo de quarteirões é 65% ou menos do que a renda média familiar do estado
- Minoria e Renda
- Minoria e Isolamento em Inglês
- Minoria, Renda e Isolamento em Inglês

MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS

MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS | MassGIS, MassDOT - Divisão de Rodovias, MassDEP, MWRA | EEA GIS |

Project-Specific EJ Reference List

Please populate all items in the grey boxes. Your Project-Specific EJ Reference List will auto-populate in the table below.
Add any supplemental contacts identified through additional research to the right table titled "Supplemental Community Contacts".

Project Name: Barnstable Fire District Wells 3&4 Water Treatment Plant

Project Address: 1660 Route 132, Barnstable, MA 02630

Date Generated: 1/27/2026

Filing Type: ☑ ENF/EENF ☐ Single EIR ☐ DEIR ☐ FEIR ☐ Other

MA Municipalities in Project's DGA:

Barnstable	*Blank*	*Blank*	*Blank*	*Blank*	*Blank*

Note: if there are more than six municipalities in the project DGA, unhide row 14 above. If the DGA contains more than 12 municipalities, contact MEPA-EJ@mass.gov for further instructions.

Click below to email MEPA and be sure to attach this completed project-specific EJ Reference List Excel file
↓
Email MEPA-EJ@mass.gov

Project-Specific EJ Reference List *(auto-populates)*

Contact Name	Title	Phone	Email	Affiliation	Contact Type	Proponent Notes (contact status, removal requests, updates)
Claire B.W. Muller	Movement Building Director	(508) 308-9261	claire@uumassaction.org	Unitarian Universalist Mass	Statewide CBO	
Julia Blatt	Executive Director	(617) 714-4272	juliablatt@massriversalliance.org	Mass Rivers Alliance	Statewide CBO	
Jodi Valenta	Massachusetts State Director	(617) 367-6200	Jodi.Valenta@tpl.org	The Trust for Public Land	Statewide CBO	
Kerry Bowie	Board President	Not Provided	kerry@msaadapartners.com	Browning the GreenSpace	Statewide CBO	
Sylvia Broude	Executive Director	(617) 292-4821	sylvia@communityactionworks.org	Community Action Works	Statewide CBO	
Britteny Jenkins	Vice President	Not Provided	Bjenkins@clf.org	Conservation Law Foundation	Statewide CBO	
Alex St. Pierre	Director of Communities &	Not Provided	aestpierre@clf.org	Conservation Law Foundation	Statewide CBO	
Paulina Muratore	Director of Transportation	Not Provided	pmuratore@clf.org	Conservation Law Foundation	Statewide CBO	
Breanne Frank	Associate Attorney	Not Provided	bfrank@clf.org	Conservation Law Foundation	Statewide CBO	
Amy Boyd Rabin	Vice President of Policy	(617) 221-8258	aboydrabin@environmentalleague.org	Environmental League of	Statewide CBO	
Ben Hellerstein	MA State Director	(617) 747-4368	ben@environmentmassachusetts.org	Environment Massachusetts	Statewide CBO	
Robb Johnson	Executive Director	(978) 443-2233	robb@massland.org	Mass Land Trust Coalition	Statewide CBO	
Cindy Luppi	New England Director	(617) 338-8131 x208	cluppi@cleanwater.org	Clean Water Action	Statewide CBO	
Dálida Rocha	Executive Director	Not Provided	dalida@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Lezlie Braxton Campbell	Deputy Director	Not Provided	braxton@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Lena Entin	Director of Individual Giving	Not Provided	lena@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Danny Timpona	Organizing Director	Not Provided	danny@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Miles Gresham	Campaign Director	Not Provided	miles@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Rob Moir	Executive Director	Not Provided	rob@oceanriver.org	Ocean River Institute	Statewide CBO	
Vickash Mohanka	Director, MA Chapter	Not Provided	vick.mohanka@sierraclub.org	Sierra Club MA	Statewide CBO	
Heidi Ricci	Director of Policy	Not Provided	hricci@massaudubon.org	Mass Audubon	Statewide CBO	
Bettina Washington	Tribal Historic Preservation	(508) 560-9014	thpo@wampanoagtribe-nsn.gov	Wampanoag Tribe of Gay Head	Federal Tribe	
Brian Weeden	Chair	(774) 413-0520	Brian.Weeden@mwtribe-nsn.gov	Mashpee Wampanoag Tribe	Federal Tribe	
Nakia Hendricks Jr.	Office Manager	Not Provided	106Review@mwtribe-nsn.gov	Mashpee Wampanoag Tribe	Federal Tribe	
David Weeden	THPO/Director	(774) 327.0068	David.Weeden@mwtribe-nsn.gov	Mashpee Wampanoag Tribe	Federal Tribe	
Alma Gordon	President	Not Provided	tribalcouncil@chappaquiddickwampanoag.org	Chappaquiddick Tribe of the	Indigenous Org	
Cheryll Toney Holle	Chair	(774) 317-9138	crwritings@gmail.com	Nipmuc Nation (Hassanamisco	Indigenous Org	
John Peters, Jr.	Executive Director	(617) 573-1292	john.peters@mass.gov	Massachusetts Commission on	Indigenous Org	
Melissa Ferretti	Chair	(508) 304-5023	melissa@herringpondtribe.org	Herring Pond Wampanoag Tribe	Indigenous Org	

Supplemental Community Contacts

Contact Name	Title	Affiliation	Email	Phone
Ami Bowen	Vice President of Marketing and	Harbor Community Health	abowen@hhsi.us	(617) 533-2358
Kelly Milkman	Director of Land Stewardship	Barnstable Land Trust Inc.	kelly@blt.org	(508) 771-2585 x102
Janet Milkman	Executive Director	Barnstable Land Trust Inc.	janet@blt.org	(508) 771-2585 x101
Kristina E. Dower	Executive Director	Community Action Committee of	info@cacci.cc	508-771-1727
Andrew Gottlieb	Executive Director	Association to Preserve Cape	info@apcc.org	(508) 619-3185
Kristin Andres	Director of Education &	Association to Preserve Cape	info@apcc.org	(508) 619-3185
Zenas Crocker	Executive Director	Barnstable Clean Water Coalition	info@bcleanwater.org	508-420-0780

Project-Specific EJ Reference List *(auto-populates)*

Contact Name	Title	Phone	Email	Affiliation	Contact Type	Proponent Notes (contact status, removal requests, updates)
Patricia D. Rocker	Council Chair	Not Provided	rockerpatriciad@verizon.net	Chappaquiddick Tribe of the	Indigenous Org	
Raquel Halsey	Executive Director	(617) 232-0343	rhalsey@naicob.org	North American Indian Center of	Indigenous Org	
Cora Pierce	Not Provided	Not Provided	Coradot@yahoo.com	Pocassett Wampanoag Tribe	Indigenous Org	
Elizabeth Solomon	Not Provided	Not Provided	Solomon.Elizabeth@gmail.com	Massachusetts Tribe at	Indigenous Org	
Barry Margolin	Chair, Policy & Program	Not Provided	info@capecodclimate.org	Cape Cod Climate Change	Local CBO	
Kristina Dower	Executive Director	(508) 771-1727	info@cacci.cc	Community Action Committee of	Local CBO	

ATTACHMENT I

Agency Correspondence

MASSWILDLIFE

DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

January 14, 2026

Sean Anderson
Barnstable Fire District Water Department
255 Breeds Hill Road
PO Box 546
Barnstable, Massachusetts 02630

RE: Project Location: 1650 Iyannough Road
Project Description: Construction of a new water treatment plant for the treatment of water from Well 3 and Well 4
Heritage Hub Form ID: RC-97409

Dear Applicant:

Thank you for submitting the MESA Project Review Checklist, site plans (dated December 2025 (3 sheets, C-1, C-2, C-3; H2Olson Engineering, Inc.) prepared by) and other required materials to the Natural Heritage and Endangered Species Program of the MA Division of Fisheries & Wildlife (the "Division") for review pursuant to the Massachusetts Endangered Species Act (MESA) (MGL c.131A) and its implementing regulations (321 CMR 10.00).

PROJECT DESCRIPTION

The existing site includes a paved access road, Well 3 Pump House, and Well 4 Pump House. Water from Well 3 and Well 4 is treated at the Well 4 Pump House, which consists of potassium hydroxide (KOH) and sodium hypochlorite (NAOCl) storage, feed, and handling facilities. Water is then pumped to distribution. The proposed project involves the construction of a new water treatment plant for the treatment of water from Well 3 and Well 4. The proposed facility will be equipped with three (3) 10.5-foot GreensandPlusTM media filters and associated process mechanical valves and piping, six (6) 10-foot GAC pressure vessels and associated process mechanical valves and piping, and NaOCl storage, feed, and handling facilities. This project also involves the construction of two (2) sand filters and two (2) infiltration basins for the treatment of water treatment residuals, a septic system for the facility bathroom, the installation of new yard piping to deliver water to the treatment building, new finished water piping to deliver water to the distribution system, a new generator next to the existing Well 4 Pump House, and a new water hydrant located at the end of the paved access roadway.

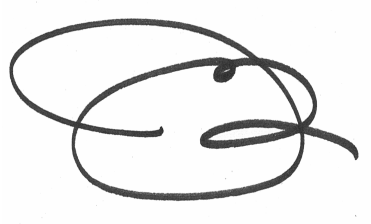
MA ENDANGERED SPECIES ACT

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries & Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if

there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Emily Holt, Endangered Species Review Assistant, at Emily.Holt@mass.gov, (508) 389-6385.

Sincerely,



Jesse Leddick
Assistant Director

cc: Stephen C Olson, H2Olson Engineering, Inc.

RECEIVED

DEC 19 2025

MASS. HIST. COMM

APPENDIX A

MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD
BOSTON, MASS. 02125
617-727-8470, FAX: 617-727-5128

PROJECT NOTIFICATION FORM

Project Name: Barnstable Fire District Wells 3&4 WTP

Location / Address: 1650 Lyannough Road/RTE 132

City / Town: Barnstable

After review of MHC files and the materials you submitted, it has been determined that this project is unlikely to affect significant historic or archaeological resources.

Caitriona Parker RC. 77760 1/12/26
Caitriona Parker Date
Preservation Planner
Massachusetts Historical Commission
xc: Robin McNamara, DEP-SRF

Project Proponent

Name: H2Olson Engineering Inc.

Address: 10 Riverside Drive, Suite 103

City/Town/Zip/Telephone: Lakeville, 02347, (508) 375-7007

Agency license or funding for the project (list all licenses, permits, approvals, grants or other entitlements being sought from state and federal agencies).

Agency Name	Type of License or funding (specify)
DEP	SRF Funding

Project Description (narrative):

See Appendix B attached.

Does the project include demolition? If so, specify nature of demolition and describe the building(s) which are proposed for demolition.

No building demolition.

Does the project include rehabilitation of any existing buildings? If so, specify nature of rehabilitation and describe the building(s) which are proposed for rehabilitation.

No building rehabilitation.

Does the project include new construction? If so, describe (attach plans and elevations if necessary).

Construction of a new water treatment building and related facilities. See Appendix C attached.

APPENDIX A (continued)

To the best of your knowledge, are any historic or archaeological properties known to exist within the project's area of potential impact? If so, specify.

None to our knowledge.

What is the total acreage of the project area?

Woodland	1.45 acres	Productive Resources:	
Wetland	0 acres	Agriculture	0 acres
Floodplain	acres	Forestry	1.45 acres
Open space	acres	Mining/Extraction	0 acres
Developed	0.10 acres	Total Project Acreage	1.55 acres

What is the acreage of the proposed new construction? 1.45 acres

What is the present land use of the project area?

Public drinking water supply with water treatment facilities.

Please attach a copy of the section of the USGS quadrangle map which clearly marks the project location.

See Appendix D attached.

Additional maps attached. See Appendix E for the Locus Map and Appendix F for the Assessor's Map. .

This Project Notification Form has been submitted to the MHC in compliance with 950 CMR 71.00.

Signature of Person submitting this form: _____ Date: 12/15/25

Name: Stephen C. Olson P.E.

Address: 10 Riverside Drive, Suite 103

City/Town/Zip: Lakeville, 02347

Telephone: (508) 375-7007

REGULATORY AUTHORITY

950 CMR 71.00: M.G.L. c. 9, §§ 26-27C as amended by St. 1988, c. 254.

Appendix E: Proposed Environmental Impact Report

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

June 9, 2026

MEPA Office
100 Cambridge Street – 9th Floor
Boston, MA 02114

RE: Proposed Environmental Impact Report (PEIR)
Barnstable Fire District Wells 3&4 Water Treatment Plant
Barnstable, Massachusetts

To whom it may concern:

On behalf of the Barnstable Fire District Water Department (District; Applicant), please find enclosed a completed Proposed Environmental Impact Report (PEIR) for the above referenced project.

The District is proposing to construct a new water treatment plant for the removal of PFAS, iron, and manganese on a parcel of land owned by the District associated with the existing pump houses for Well 3 and Well 4 at 1650 Iyannough Road/Route 132 in Barnstable (the Site). The proposed facility will be equipped with three (3) 10.5-foot diameter GreensandPlus™ media filters and associated process mechanical valves and piping, six (6) 10-foot diameter GAC media pressure vessels and associated process mechanical valves and piping, potassium hydroxide (KOH) storage, feed, and handling facilities, and sodium hypochlorite (NaOCl) storage, feed, and handling facilities.

This project also involves the construction of two (2) sand filters and two (2) infiltration basins for the management of water treatment residuals, a paved driveway to the new building, a septic system for the facility bathroom, stormwater best management practices (BMPs), new yard piping to deliver water to and from the building, new underground electrical lines to deliver power to the building, new underground fiberoptic lines to transmit Supervisory Control and Data Acquisition (SCADA) information, two (2) new generators, three (3) new propane tanks, yard fencing, and three (3) new water hydrants, one located at the end of the paved access road.

The proposed project triggers review under the Massachusetts Environmental Policy Act (MEPA) as the proposed project requires one or more State Agency Activities and exceeds the following review threshold for an Environmental Notification Form (ENF):

- 301 CMR 11.03(4)(b)4.: Construction of a new drinking water treatment plant with a Capacity of 1,000,000 or more gpd.

While the proposed project does not exceed any mandatory Environmental Impact Report (EIR) thresholds, it is located within an Environmental Justice (EJ) Designated Geographic Area (DGA), as the proposed project is located within one mile of mapped EJ Communities. Given that the proposed project is located within the EJ DGA, an EIR is required in accordance with MEPA's Environmental Justice Protocols (effective January 1, 2022).

The Applicant respectfully requests that the Secretary apply the Rollover process in accordance with the provisions set forth in 301 CMR 11.06(13). As such, this PEIR has been prepared in accordance with 301 CMR 11.05(9) and is being submitted concurrently with an Expanded ENF (EENF). The attached PEIR and separate EENF address the EJ Protocol requirements, and includes a baseline assessment, description of outreach, initial impact analysis, alternative analysis, and a discussion of mitigation measures for the pertinent MEPA review thresholds.

Enclosed with this submittal are the table of contents, a project narrative, alternatives analysis, figures and plans, and other required materials. This PEIR and separate EENF are being submitted for publication in the June 24, 2026 edition of the Environmental Monitor.

Please feel free to contact me if you have any questions or require additional information. I can be reached at sco@h2olsonengineering.com or (508) 375–7007.

Very Truly Yours,
H2Olson Engineering, Inc.

Stephen C. Olson, P.E.
President

CC: Sean Anderson, Barnstable Fire District Water Department, Barnstable, MA
Genevieve Cordeiro, E.I.T., H2Olson Engineering, Inc.

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EIR DISTRIBUTION LIST

EENF & PEIR Distribution List

Addressee	Email	Submission Format
Massachusetts Environmental Policy Act (MEPA) Office MEPA Office 100 Cambridge Street, Suite 900 Boston, MA 02114	MEPA@mass.gov	Electronic Copy
Department of Environmental Protection, Boston Office Commissioner's Office One Winter Street Boston, MA 02108	helena.boccadoro@mass.gov	Electronic Copy
DEP/Southeastern Regional Office Attn: MEPA Coordinator 20 Riverside Drive Lakeville, MA 02347	george.zoto@mass.gov jonathan.hobill@mass.gov	Electronic Copy
Massachusetts Department of Transportation – Boston Public/Private Development Unit 10 Park Plaza, Suite #4150 Boston, MA 02116	MassDOTPPDU@dot.state.ma.us	Electronic Copy
Massachusetts Department of Transportation – District Office District #5 Attn: MEPA Coordinator 1000 County Street Taunton, MA 02780	Cindy.McConarty@dot.state.ma.us	Electronic Copy
MA Historical Commission Attn: The MA Archives Building 220 Morrissey Boulevard Boston, MA 02125		Hard Copy
Cape Cod Commission (CCC)	ksenatori@capecodcommission.org regulatory@capecodcommission.org	Electronic Copy
Town Council Town of Barnstable 367 Main Street Hyannis, MA 02601	cynthia.lovell@barnstable.gov	Electronic Copy
Planning Board Town of Barnstable 367 Main Street Hyannis MA 02601	james.kupfer@barnstable.gov karen.pina@barnstable.gov	Electronic Copy
Conservation Commission Town of Barnstable 230 South Street Hyannis MA 02601	edwin.hoopes@barnstable.gov	Electronic Copy

Addressee	Email	Submission Format
Public Health Division Town of Barnstable 200 Main Street Hyannis MA 02601	thomas.mckean@barnstable.gov	Electronic Copy
MEPA Office Attn: EEA EJ Director 100 Cambridge Street, Suite 900 Boston, MA 02144	MEPA-EJ@mass.gov	Electronic Copy
Department of Public Health Director of Environmental Health 250 Washington Street Boston, MA 02115	dphtoxicology@massmail.state.ma.us	Electronic Copy

PUBLIC NOTICE OF ENVIRONMENTAL REVIEW

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs

MEPA Office

100 Cambridge St., Suite 900
Boston, MA 02114
Telephone 617-626-1020

PUBLIC NOTICE OF ENVIRONMENTAL REVIEW

PROJECT: Barnstable Fore District Wells 3&4 Water Treatment Plant

LOCATION: 1650 Iyannough Road/Route 132 Barnstable, Massachusetts

PROPONENT: Barnstable Fire District Water Department

The undersigned is submitting an Expanded Environmental Notification Form ("EENF") to the Secretary of Energy & Environmental Affairs on or before June 9, 2026.

This will initiate review of the above project pursuant to the Massachusetts Environmental Policy Act ("MEPA," M.G.L. c. 30, ss. 61-62L). Copies of the EENF may be obtained from:

- Steve Olson at sco@h2olsonengineering.com or at (781) 588–6800

Electronic copies of the EENF are also being sent to the Conservation Commission and Planning Board of Barnstable, Massachusetts**.**

The Secretary of Energy & Environmental Affairs will publish notice of the ENF in the Environmental Monitor, receive public comments on the project, and then decide if an Environmental Impact Report is required. A site visit and/or remote consultation session on the project may also be scheduled. All persons wishing to comment on the project, or to be notified of a site visit and/or remote consultation session, should email MEPA@mass.gov or the MEPA analyst listed in the Environmental Monitor. Requests for language translation or other accommodations should be directed to the same email address. Mail correspondence should be directed to the Secretary of Energy & Environmental Affairs, 100 Cambridge St., Suite 900, Boston, Massachusetts 02114, Attention: MEPA Office, referencing the above project.

By Barnstable Fire District Water Department

Estado de Massachusetts
Executive Office of Energy and Environmental Affairs

MEPA Office

100 Cambridge St., Sala 900
Boston, MA 02114
Telefone 617-626-1020

AVISO PÚBLICO DE REVISÃO AMBIENTAL

PROJETO: Estação de Tratamento de Água dos Poços 3 e 4 do Distrito de Bombeiros de Barnstable

LOCAL: 1650 Iyannough Road / Rodovia 132 Barnstable, Massachusetts

PROPONENTE: Departamento de Água do Distrito de Bombeiros de Barnstable

O(A) signatário(a) está enviando, pelo presente documento, um Formulário de notificação ambiental ("ENF") a(o) Secretário(a) de Energy & Environmental Affairs (Questões Ambientais e de Energia) no dia
9 de junho de 2026.

Isso iniciará a revisão do projeto mencionado acima de acordo com a Lei de Política Ambiental de Massachusetts ("MEPA", L.G.M. c. 30, ss. 61-62L). Cópias do ENF podem ser obtidas com:
-Steve Olson pelo e-mail sco@h2olsonengineering.com ou pelo telefone (781) 588–6800

Cópias eletrônicas do ENF também estão sendo enviadas à Comissão de Conservação e ao Conselho de _____ *(Município)***.**

O(A) Secretário(a) de Energy & Environmental Affairs publicará o aviso do ENF no Monitor ambiental, receberá os comentários públicos sobre o projeto e, depois, decidirá se um Relatório de impacto ambiental é necessário. Uma visita ao local e/ou sessão de consulta remota sobre o projeto também poderá ser agendada. Todas as pessoas que desejem comentar sobre o projeto, ou serem avisadas de uma visita ao local e/ou sessão de consulta remota, devem enviar um e-mail para: MEPA@mass.gov ou para o(a) analista do MEPA listado(a) no Monitor ambiental. Solicitações de interpretação ou outras acomodações devem ser direcionadas para o mesmo endereço de e-mail. A correspondência postal deve ser direcionada para: Secretary of Energy & Environmental Affairs, 100 Cambridge St., Suite 900, Boston, Massachusetts 02114, Atenção: MEPA Office, referenciando o projeto acima.

Por Departamento de Água do Distrito de Bombeiros de Barnstable

PROPOSED ENVIRONMENTAL IMPACT REPORT

PROPOSED ENVIRONMENTAL IMPACT REPORT

FOR

WELLS 3&4 WATER TREATMENT BUILDING

JUNE 2026

Prepared For:

BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

1841 PHINNEY'S LANE

BARNSTABLE, MA 02630

Prepared By:

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

Section 1: Introduction

Project Name: Barnstable Fire District Wells 3&4 Water Treatment Plant

Project location: 1650 Iyannough Road/Route 132 Barnstable, Massachusetts

Project Proponent: Barnstable Fire District Water Department

This Proposed Environmental Impact Report (PEIR) is being submitted by H2Olson Engineering, Inc. (H2Olson) on behalf of the Barnstable Fire District Water Department (District; Applicant) for the Barnstable Fire District Wells 3&4 Water Treatment Plant Project (Project). The Project is located on a portion of District-owned land currently in use for public water supply. The existing land consists of a paved access road, Well 3 Pump House, and Well 4 Pump House. The proposed Project includes the construction of a new water treatment plant for the treatment of water from both existing wells. The proposed site location is provided in the Design Drawings in Appendix A.

The existing property is predominantly woodlands. Land use in the area surrounding the Project includes undeveloped forest to the north, Hathaway's Pond Recreation Area to the east, and the Hyannis Golf Club to the south and west.

1.1 Project Purpose

The District has identified a need for water capacity and water quality improvements at the existing Well 3 and Well 4 site. The water at the existing site is not in compliance with current United States Environmental Protection Agency (USEPA) maximum contaminant levels (MCLs) for PFAS. Because of this, the District has reduced production for Wells 3 and 4 to lower the concentration of PFAS in the distribution system. The permitted withdrawal at Well 3 and Well 4 is 0.77 million gallons per day (MGD) and 0.67 MGD, respectively. However, average daily flow from Well 3 and 4 has been substantially lower, as reported in the District's 2024 Annual Statistical Report (ASR) at only 173,051 and 111,243 gallons per day (GPD), respectively. As projections for the District show an increase in water demand, resulting from economic growth and a projected increase in housing, the District has a need to meet its permitted withdrawal rates. The District has an obligation to its customers to meet water demand needs while maintaining water quality standards. As such, this project is being proposed to improve the dependability, reliability, and usable production capacity of the District's water supply sources.

1.2 Project Overview

The Project consists of a water treatment building, two (2) sand filters and two (2) infiltration basins for the management of water treatment residuals, a septic system for the facility bathroom, stormwater best management practices (BMPs), new yard piping, new generators and propane tanks, and three (3) new water hydrants, one located at the end of the paved access road. The project received the Emerging

Contaminants (EC) in Small or Disadvantaged Communities Grant (SDC) funded by USEPA, which has a monetary sum of 1 million dollars. The remainder of the project will be funded by the District. The Project is expected to begin construction in spring of 2027 and be completed in fall 2028.

The existing conditions and location of proposed work are depicted in the Design Drawings and Site Figures located in Appendix A and Appendix B, respectively.

1.3 MEPA Process

The Project is subject to environmental review pursuant to Section 11.01(2)(a) of the MEPA regulations, as one or more review thresholds are met or exceeded. The project exceeds the following review threshold for an Environmental Notification Form (ENF):

- 301 CMR 11.03(4)(b)4.: Construction of a New drinking water treatment plant with a capacity of 1,000,000 or more gallons per day (gpd).

The Project requires an Environmental Impact Report (EIR) under the standards set forth in 301 CMR 11.06(7)(b), as the Project site is located within a Designated Geographic Area (DGA) around an Environmental Justice (EJ) population.

No additional mandatory EIR thresholds are met or exceeded by the proposed Project.

1.3.1 Request for a Rollover EIR

The Proponent is filing this PEIR in accordance with 301 CMR 11.06(13) to provide more extensive and detailed information as part of a request to allow a Rollover EIR process.

The requirements for a Rollover EIR as set forth in 301 CMR 11.06(13) are listed below and followed by a discussion of the Proponent's compliance with each.

For any Project that is required to file an EIR in accordance with 301 CMR 11.06(7)(b), and has submitted a dual Expanded ENF and Proposed EIR in accordance with 301 CMR 11.05(9), the Secretary may allow a rollover EIR, provided that the Secretary finds that the dual Expanded ENF and Proposed EIR:

(a) Presents a complete and definitive description and analysis of the Project and its alternatives, and an assessment of its potential environmental and public health impacts and mitigation measures sufficient to allow a Participating Agency to fulfill its obligations in accordance with M.G.L. c. 10, §§ 61 and 62K and 301 CMR 11.12(5);

A complete and definitive description and analysis of the Project and its alternatives are provided in Section 4 and Section 5 of this PEIR. Potential environmental and public health impacts and draft Section 61 Findings are detailed in Section 3 and Section 6, respectively.

(b) Demonstrates that the Project will not materially exacerbate any existing unfair or inequitable Environmental Burden and related public health consequences impacting an Environmental Justice (EJ) Population, and will not result in a disproportionate adverse effect or increased climate change effects on an EJ Population;

A detailed environmental burden assessment and impact analysis relative to the proposed work is provided in Section 3 of this PEIR. This Project is not anticipated to result in unfair or inequitable impacts to the EJ populations or exacerbate current environmental burdens relative to existing or ongoing environmental damage or climate change risks. Rather, by removing iron, manganese, and PFAS, this Project will result in an improvement to the community as a whole, including the EJ community.

(c) Describes measures taken to provide meaningful opportunities for public involvement by EJ Populations prior to filing the EENF, including any changes made to the Project to address concerns raised by or on behalf of EJ Populations;

Community outreach measures undertaken by the Proponent are detailed in Section 3 of this PEIR.

(d) Shows that comments received on the dual ENF and Proposed EIR do not raise substantial issues not previously considered by the Proponent;

The Proponent looks forward to receiving and addressing comments on the Project application.

(e) Shows that no substantive issues remain to be resolved.

The PEIR is being filed concurrently with the EENF. The Proponent requests that the Secretary grant the request for Rollover EIR pursuant to 301 CMR 11.06(13).

In addition to the required elements specified under 301 CMR 11.07(6), the PEIR contains the following required elements in accordance with 301 CMR 11.07(6)(n):

1. Statements about the results of an assessment of any existing unfair or inequitable Environmental Burden and related public health consequences impacting the EJ Population from any prior or current private, industrial, commercial, state, or municipal operation or Project that has caused or continues to cause Damage to the Environment;
2. If the assessment conducted under 301 CMR 11.07(6)(n)1. indicates that an Environmental Justice Population is subject to an existing unfair or inequitable Environmental Burden or related health consequence:
    i. description of the environmental and public health impact from the Project that would likely result in a disproportionate adverse effect on such population; and
    ii. any potential impact or consequence from the Project that would increase or reduce the effects of climate change on the Environmental Justice Population. In conducting the assessment in 301 CMR 11.07(6)(n)2., the Proponent shall consider the extent to which the environmental and public health impact of the Project may exacerbate any existing unfair or inequitable Environmental Burden and related public health consequence identified under 301 CMR 11.07(6)(n)1. The Proponent shall also consider the comparative impact of the Project on Environmental Justice Populations versus non-Environmental Justice Populations and any benefits conferred by the Project to reduce the potential for unfair or inequitable effects on the Environmental Justice Population;
3. description of alternatives and measures to avoid, or, if unavoidable, to minimize and mitigate potential environmental and public health impacts so as to address any identified disproportionate adverse effects, or an increase in the effects of climate change, on Environmental Justice Populations;

4. Proposed Section 61 Findings that include any and all actions to be taken to address any identified disproportionate adverse effects, or an increase in the effects of climate change, on Environmental Justice Populations, so as to reduce the potential for unfair or inequitable effects on such Environmental Justice Populations; and
5. Response to Comments to the extent related to an assessment of disproportionate adverse effects, or an increase in the effects of climate change, on Environmental Justice Populations.

1.3.2 Environmental Justice Populations

For new Projects filed after January 1, 2022, all EIRs must conform to the requirements set forth in the *MEPA Public Involvement Protocol for Environmental Justice (EJ) Populations* (the Public Involvement Protocol) and the *MEPA Interim Protocol for Analysis of Project Impacts on EJ Populations* (the Analysis of Project Impacts), both effective January 1, 2022. These protocols supplement proposed amendments to MEPA regulations at 301 CMR 11.00, promulgated on December 24, 2021.

The Project site is located within one mile of mapped EJ Communities. These EJ populations are located to the north, east, south, and west of the project site. All EJ Communities within the DGA are located within the Town of Barnstable, although only a portion of them are directly supplied with drinking water by the District.

While the Project Site is located within 5 miles of additional mapped EJ Communities, the Project does not exceed any review thresholds relative to Air, nor is the Project anticipated to result in 150 or more new average daily trips (adt) of diesel vehicle traffic over a duration of one (1) year or more. Therefore, the DGA of the Project is presumed to be one (1) mile. Please refer to Section 3 for details regarding EJ Considerations.

1.3.3 Potential Future Projects

The District anticipates undertaking one project on the property within the next two to five years. This project consists of connecting a Supplemental Well 3 to the system. This project supports the District's goal to restore lost water supply production capacity, while also providing redundancy in the system, thus increasing its resiliency and dependability.

This future project is not related to nor impacted by the construction of the proposed Project described herein. This supplemental well project is an independent undertaking. It is the Applicant's understanding that the Barnstable Fire District Wells 3 and 4 Water Treatment Plant Project's impact would not change the MEPA thresholds triggered for this proposed project. It is recognized that the connection of Supplemental Well 3 will require approval from the Massachusetts Department of Environmental Protection (MassDEP). Supplemental Well 3 does not require the filing of a BRP WM-02, and therefore Agency Action is not required. The project does not trigger MEPA thresholds as described in 301 CMR 11.03.

1.4 Anticipated Permits

All anticipated local, state, and federal permits that the project will require are listed as follows:

- MEPA Secretary's Certificate (EEOEA)
- NPDES Construction General Permit (USEPA)
- MassDEP WS 24: Approval to Construct a Water Treatment Facility of 1 million Gallons per Day or Greater
- Massachusetts Historical Commission Review – Completed
- MESA Project Review (NHESP) – Completed
- Title 5 Septic System Permit (MassDEP, Town of Barnstable)
- Local Building, Electrical, Gas, and Sheet Metal Permit (Town of Barnstable)
- Local Hazardous Materials Registration (Town of Barnstable Health Division)
- Site Plan Review (Town of Barnstable Building Department)
- Stormwater Management Permit (Town of Barnstable Department of Public Works)

Please see Section 7 for a complete summary of all required permits.

Section 2: Existing Environment

This section provides a site description and resource area characterization for the Project site. The Project location is shown on the Site Locus Map and the USGS Quadrangle Map provided in Appendix B. The Project site and surrounding area are also shown on the MassGIS Environmental Constraints Map and the FEMA FIRMette in Appendix B. The Project site in relation to town zoning is shown on the Town of Barnstable Zoning Map in Appendix B.

2.1 Project Site

The Project Site is located on a portion of District-owned land currently in use for public water supply located at 1650 Iyannough Road/Route 132 Barnstable, Massachusetts. This land consists of a paved access road, Well 3 Pump House, and Well 4 Pump House. The property is located in the Residential RG and RF-1 zoning districts, as well as the Wellhead Protection Overlay District, as seen in the Town of Barnstable Zoning Map located in Appendix B. Existing utilities include water mains to transport water from Well 3 and Well 4 into distribution, overhead electrical lines to transmit power to the two pump houses, and underground fiberoptic lines to transmit SCADA information between Pump Houses, as seen in the Design Drawings shown in Appendix A. the Design Drawings have been prepared with reference to the Massachusetts State Plane Coordinate System (NAD83 horizontal datum, NAVD88 vertical datum).

Currently, water from Well 3 is pumped to the Well 4 Pump House, where water from both wells is treated with potassium hydroxide for pH adjustment and sodium hypochlorite for disinfection before being pumped to distribution. The current system has a combined capacity of 1,500 GPM.

The Project Site includes a portion of the existing paved access road, a wooded area to the south of the existing paved access road, and a small wooded area to the south of the Well 4 Pump House. The total Limit of Work (LOW) for the Project site contains an area of approximately 91,350 square feet (sf). Refer to the Design Drawings in Appendix A or the Site Locus Map located in Appendix B for the location and extent of the project LOW.

The existing property is predominantly woodlands. Land use in the area surrounding the Project includes undeveloped forest to the north, Hathaway’s Pond Recreation Area to the east, and the Hyannis Golf Club to the south and west. The existing paved access road runs east to west, connecting the Site to Iyannough Road/Route 132. Topography at the project site varies, as the site contains numerous depressions, or kettles.

2.2 Massachusetts Natural Heritage and Endangered Species Program (NHESP)

The latest edition of NHESP's interactive map viewer at the time of this filing (15th Edition Natural Heritage Atlas, August 1, 2021) and MassGIS online mapping data were reviewed during the preparation of this PEIR. According to these sources, the proposed work is not located within or near the limits of mapped *Priority Habitats of Rare Species* or *Estimated Habitats of Rare Wildlife*.

Additionally, the Proponent filed a Massachusetts Endangered Species Act (MESA) Project Review with NHESP on December 16, 2025. NHESP responded to this application on January 14, 2026, and determined that the project will not result in a prohibited take of state-listed rare species. Refer to Appendix C for this determination from NHESP.

2.3 Areas of Critical Environmental Concern (ACEC)

The Project Site is not located within the limits of an Area of Critical Environmental Concern (ACEC) based on a review of the Massachusetts Department of Conservation and Recreation (DCR) ACECs Statewide Map and ACEC data available on MassGIS online. Refer to the MassGIS Environmental Constraints Map located in Appendix B for the locations of ACEC in relation to the Project Site.

2.4 Massachusetts Historical Commission (MHC)

The Project Site is not located in an area where impacts to historical or archaeological resources are anticipated to occur. The Proponent filed a Project Notification Form (PNF) with MHC on December 16, 2025. MHC responded to this application on January 12, 2026, and determined that the project is unlikely to affect significant historic or archaeological resources. Refer to Appendix C for this determination from MHC.

2.5 FEMA Flood Zone

The Project Site is not located within the limits of the FEMA 100-year floodplain, as seen in the FEMA FIRMette Flood Zone Map located in Appendix B.

2.6 Climate Resiliency

This section addresses the Project purpose and impacts as they pertain to climate change adaptation and resiliency, in accordance with the MEPA Interim Protocol on Climate Change Adaptation and Resiliency (the "MEPA Interim Protocol"), effective October 1, 2021.

As noted in the Resilient Massachusetts Action Team (RMAT) Climate Resilience Design Standards (CRDS) Tool Project Report (RMAT Report) provided in Appendix D, the Project site has a "High Risk" of exposure related to extreme precipitation (stormwater flooding) and to extreme heat and a "Low Risk" to extreme precipitation (riverine flooding) and to sea level rise/storm surge.

To mitigate for extreme precipitation, the RMAT Report recommended the use of a projected 2070 50-year 24-hour storm with a precipitation depth of 8.7 inches. The proposed design used this projected precipitation depth as part of the HydroCAD™ hydrologic analysis to determine pre- and post-development runoff rates. The post-development runoff volumes are less than the pre-development runoff volumes for the whole site. Design Points 2, 3, and 4 all show greater post-development peak discharge rates, even though the post-development runoff volumes for Design Points 2 and 4 are lower. As such, the proposed site was designed to accommodate future upgrades to the site to adapt to climate change as the CRDS Tool suggests. Refer to Section 4 or the Stormwater Report located in Appendix E for a full discussion on stormwater runoff.

To mitigate for extreme heat, the RMAT Report recommended to incorporate increased vegetation on site. The proposed design incorporates the use of shrubs on site, both to attenuate peak runoff rates and to provide opportunities to decrease the temperature and relative humidity on site. The project was also designed to minimize tree clearing to the greatest extent possible. This was achieved by utilizing the existing site's access road and providing two infiltration trenches to help attenuate peak runoff rates without clearing additional space for full BMP treatment trains. The remainder of the site's clearing is necessary for the operation of the water treatment facility. Refer to the Design Drawings in Appendix A and the Stormwater Report in Appendix E for the extent of the clearing, shrub planting, and infiltration trenches.

Although the proposed project results in an increase in both precipitation and heat risk, the components of this project are necessary to ensure clean, safe drinking water for the Barnstable Fire District. Increasing reliability of the District's public water supply is a critical factor in increasing climate resiliency for the District looking into the future.

Section 3: Environmental Justice Considerations

3.1 Characteristics of EJ Populations

In accordance with Section I(A) of the Public Involvement Protocol, a figure depicting the location of the Project relative to EJ populations as depicted on the Executive Office of Energy and Environmental Affairs (EEA) EJ Maps Viewer provided in Appendix F. This figure depicts the EJ populations within one mile (i.e. the DGA) and five miles of the Project. These distances were calculated based upon the LOW in all directions from the Project site.

The following EJ populations are located within one mile (i.e. the DGA) of the Project Site:

- Block Group 1, Census Tract 126.01 - Minority
- Block Group 2, Census Tract 126.01 - Minority
- Block Group 1, Census Tract 153 - Minority and Income

The following EJ populations are located within five miles of the Project Site:

- Block Group 2 Census Tract 121.01 - Minority
- Block Group 4 Census Tract 121.01 - Minority
- Block Group 1 Census Tract 121.02 - Income
- Block Group 3 Census Tract 121.02 - Income
- Block Group 4 Census Tract 121.02 - Minority
- Block Group 2 Census Tract 125.02 - Minority and Income
- Block Group 3 Census Tract 125.02 - Minority and English Isolation
- Block Group 4 Census Tract 125.02 - Minority
- Block Group 1 Census Tract 126.01 - Minority
- Block Group 2 Census Tract 126.01 - Minority
- Block Group 1 Census Tract 126.02 - Minority and Income
- Block Group 2 Census Tract 126.02 - Minority, Income, and English isolation
- Block Group 3 Census Tract 126.02 - Minority
- Block Group 4 Census Tract 126.02 - Minority and Income
- Block Group 1 Census Tract 153 - Minority and Income
- Block Group 2 Census Tract 153 - Minority and Income
- Block Group 3 Census Tract 153 - Minority and Income

According to the “Languages Spoken in Massachusetts” tab on the EJ Maps Viewer, there are two communities identified in which greater than five percent of the community speak a language other than English, or who do not identify speaking English “very well.”. Located, in part, within a 1 mile radius of the proposed WTP site is Census Tract 153, where 7.1% of the population are identified as speaking Portuguese/Portuguese Creole. Located, in whole, within a 5 mile radius of the proposed WTP site is Census Tract 126.02, where 8.3% of the population are identified as speaking Portuguese/Portuguese Creole.

The Town of Barnstable did not meet any vulnerable health EJ criteria depicted by the Massachusetts Department of Public Health (DPH) EJ Tool. The Project, however, may potentially result in an unfair or inequitable environmental burden as the project site has a “High” risk rating in the RMAT tool for extreme

precipitation, though this impact will be localized to the Project Site. Besides this, the project is not likely to have disproportionate, adverse effects on EJ populations as it will not exacerbate pre-existing conditions related to air, water, or soil pollution. Construction activities will conform to the MassDOT diesel retrofit program specifications to the extent practicable. BMPs for erosion and sedimentation will be implemented throughout construction.

3.2 Community Outreach

Per 301 CMR 11.05(4), Advance Notification of the Project was sent via electronic mail on March 11, 2026 by H2Olson to all organizations and tribes listed on the EJ Reference List, provided by the MEPA Office on January 17, 2026. The Advance Notification consisted of English and Portuguese versions of the EJ Screening Form, as provided by the MEPA Office in the Public Involvement Protocol. These documents were additionally mailed to property owners and residents within EJ populations located within one mile of the Project Site. Copies of the EJ Reference List and EJ Screening are provided in Appendix F.

The Proponent is committed to responding promptly to all inquiries and receiving feedback on the Project. Contact information was provided on the EJ Screening Form for questions, comments, and requests for meetings to discuss the Project. No requests for public meetings have been received as of this filing. The Proponent will continue to engage the community throughout the MEPA review process. The EJ Reference List will be used to circulate notices of the MEPA Site Visit, summaries of supplemental information submitted tot eh MEPA office, and any other relevant notices or materials generated during the course of MEPA review. Any information distributed will be written in English and translated into Portuguese.

3.3 Existing Unfair or Inequitable Environmental Burden Assessment

The Proponent has assessed existing unfair or inequitable environmental burden in accordance with 301 CMR 11.07(6)(n)1. and Part II of the MEPA Interim Protocol for Analysis of Project Impacts on Environmental Justice Populations and concluded that the EJ population may potentially be impacted by an unfair or inequitable environmental burden. Statements about the existing unfair or inequitable environmental burden and related public health consequences are presented below.

3.3.1 Vulnerable Health Criteria

The Massachusetts Department of Public Health (DPH) Environmental Justice Tool was consulted to evaluate if any “vulnerable health EJ criteria” are exhibited within the DGA of the Project. These criteria represent sentinel health outcomes that provide an efficient means for understanding a community’s general health vulnerability to environmental exposures, and include indicators for heart attack, childhood blood lead, low birth weight, and childhood asthma. According to the DPH EJ Tool, there are no census tracts within 1 mile of the project site, or within the Town of Barnstable, that meet this definition of “vulnerable health EJ criteria”.

The following additional layers in the DPH EJ Tool were consulted to review other potential sources of pollution within the boundaries of the EJ population DGA.

- MassDEP Major Air and Waste Facilities (Air Operating Permits, Hazard Waste Treatment, Storage, Disposal, Hazardous Waste Recycler, Large Quantity Generators, Large Quantity Toxic User)
- MassDEP Tier Classified 21E Sites
- Tier II Facilities
- MassDEP Sites with Activity and Use Limitations (AULs)
- MassDEP Public Water Suppliers
- Wastewater Treatment Plants
- Underground Storage Tanks
- MassDEP Groundwater Discharge Permits
- EPA Facilities (Toxics Release Inventory Sites 2017, Superfund Site Boundaries)
- Municipal Buildings and Healthcare Facilities
- Road Infrastructure (Major Highways, Road Inventory)
- MBTA Bus and Rapid Transit (MBTA bus shelters, stops, rapid transit stops, commuter rail stations, ferry stops, parking lots, bus routes, commuter rail lines, ferry routes)
- Other Transportation Infrastructure (Airports, Freight Rail Yards, Water Taxis, Railroad Tracks, Ferry Routes)
- Regional Transit Agencies (RTA Stops, RTA Routes, RTA Service Area)
- Energy Generation and Supply (Nuclear Power Plants, Power Plants, Transmission Lines)

Several potential pollution sources within the EJ population boundaries within the DGA were identified in this review. A summary of these potential pollution sources is provided in Table 3-1.

Table 3-1: DPH Summary of Potential Pollution Sources

Pollution Source	Source Name	EJ Population
Large Quantity Generator	Sencorpwhite Inc.	Block Group 1, Census Tract 153
Large Quantity Generator	Everett H Corson Inc.	Block Group 1, Census Tract 153
Large Quantity Generator	IRA Toyota of Hyannis	Block Group 1, Census Tract 153
Large Quantity Generator	Jiffy Lube 412	Block Group 1, Census Tract 126.01
Tier II Facilities	Well #3	Block Group 1, Census Tract 153
Tier II Facilities	Treatment Facility 4	Block Group 1, Census Tract 153
Tier II Facilities	Five Star Transportation	Block Group 1, Census Tract 153
Tier II Facilities	Cape Cod Aggregates – Hyannis	Block Group 1, Census Tract 153
Tier II Facilities	Aggregate Industries Northeast Region, Inc.	Block Group 1, Census Tract 153
Tier II Facilities	BJ's Wholesale Club (0321)	Block Group 1, Census Tract 153
Tier II Facilities	The Home Deport Store #2612	Block Group 1, Census Tract 153
Tier II Facilities	Hyannis Toyota	Block Group 1, Census Tract 153
Tier II Facilities	National Grid – Merchants Way 109	Block Group 1, Census Tract 153
Tier II Facilities	Jiffy Lube #412	Block Group 1, Census Tract 126.01

Tier II Facilities	Barnstable Police Department	Block Group 1, Census Tract 126.01
Underground Storage Tanks	Island Sun Transport	Block Group 1, Census Tract 153
Underground Storage Tanks	ExxonMobil Oil Corp.	Block Group 1, Census Tract 153
Underground Storage Tanks	Cape Cod Aggregates Corp.	Block Group 1, Census Tract 153
Underground Storage Tanks	Cumberland Farms 2187	Block Group 1, Census Tract 153
Municipal Buildings - School	Faith Christian School	Block Group 1, Census Tract 153
Municipal Buildings - School	Living Independently Forever	Block Group 1, Census Tract 126.01
Major Highway	US6	Block Group 1, Census Tract 153
Road Inventory	N3423	Block Group 1, Census Tract 153
Road Inventory	SR132	Block Group 1, Census Tract 153 Block Group 1, Census Tract 126.01
Road Inventory	N3233	Block Group 1, Census Tract 153 Block Group 1, Census Tract 126.01 Block Group 2, Census Tract 126.01
Road Inventory	N30701	Block Group 1, Census Tract 153 Block Group 1, Census Tract 126.01
Road Inventory	N3234	Block Group 1, Census Tract 126.01
RTA Stop	Cape Cod Five	Block Group 1, Census Tract 153
RTA Stop	Cape Cod Five (HQ)	Block Group 1, Census Tract 153
RTA Stop	Super Stop & Shop (Liberty Square), Hyannis	Block Group 1, Census Tract 153
RTA Stop	Festival Mall, Hyannis	Block Group 1, Census Tract 153
RTA Stop	Southwind Plaza, Hyannis	Block Group 1, Census Tract 153
RTA Stop	Housing Assistance Corporation	Block Group 1, Census Tract 153
RTA Stop	Wilkens Outpatient Medical Complex, Hyannis	Block Group 1, Census Tract 153
RTA Stop	Cape Codder Resort, Hyannis	Block Group 1, Census Tract 126.01
Energy Transmission Line	Object ID 654	Block Group 1, Census Tract 153
Energy Transmission Line	Object ID 653	Block Group 1, Census Tract 153
Energy Transmission Line	Object ID 656	Block Group 1, Census Tract 153

3.3.2 RMAT Report

The RMAT Tool Report (Appendix D) indicated “High” risk ratings for Extreme Precipitation (Stormwater Flooding), which could be an indicator of elevated climate risks for EJ populations in the vicinity of the Project Site. Pursuant to the MEPA protocol, it is noted that the risk rating for the Extreme Heat parameter should not be used as a definitive indicator of elevated climate risks.

3.3.3 EJ Screen

As of February 5, 2025, USEPA removed EJScreen from its official website. The following assessment was based off an unofficial copy of EJScreen hosted by the Public Environmental Data Partners. It is important to note that this model is a reconstruction of EJScreen Version 2.3 and may not include all updated EPA information. Therefore, results from this analysis were not considered as strongly as the verified data described in Sections 3.3.1 and 3.3.2 above. Table 3-2 below provides a summary of the indicators analyzed and potential sources of pollution found within the boundaries of the EJ population within the DGA. Unless specified, the results shown apply to all three EJ Census Groups specified in Section 3.1 as being within the DGA.

Table 3-2: EJScreen Summary of Potential Pollution Sources

Indicator	Exposure v. Risk	Key Medium	Result
Toxic Releases to Air	Risk/Hazard	Air	Less than 50th Percentile
Diesel Particulate Matter	Potential Exposure	Air	Less than 50th Percentile
Particulate Matter 2.5	Potential Exposure	Air	Less than 50th Percentile
Ozone	Potential Exposure	Air	80-90th Percentile (Both EJ and Non-EJ Communities)
Lead Paint	Potential Exposure	Dust/Lead Paint	Less than 50th Percentile
Traffic Proximity	Proximity/Quantity	Air	Less than 50th Percentile
Risk Management Plan (RMP) and Hazardous Waste Proximity	Proximity/Quantity	Waste/Water/Air	Less than 50th Percentile
Superfund Proximity	Proximity/Quantity	Waste/Water/Air	Less than 50th Percentile
Underground Storage Tanks	Proximity/Quantity	Waste/Water/Air	50-80th Percentile
Wastewater Discharge	Proximity/Quantity	Water	Less than 50th Percentile

3.3.4 Concerns from CBOs

No additional concerns regarding the EJ population and any existing unfair or inequitable environmental burden has been received as of this filing.

The data provided above from the DPH EJ Tool, RMAT Report, and EJ Screen demonstrate that the EJ population within the DGA may potentially bear an existing unfair or inequitable environmental burden and related public health consequences. The proposed Project is not anticipated to contribute any further pollution or environmental burdens on the EJ population, however, because there are EJ communities immediately surrounding the Project location, and the Project has a “High” risk rating for extreme precipitation, the EJ community is highly likely to be impacted by an unfair or inequitable environmental burden, pursuant to the MEPA protocol. Refer to Section 3.4 below for further analysis of this projected burden.

3.4 Analysis of Project Impacts

The Proponent has conducted an impact analysis in accordance with 301 CMR 11.07(6)(n)2. and Part III of the MEPA Interim Protocol for Analysis of Project Impacts on Environmental Justice Populations and concluded that the Project will not create a disproportionate adverse effect or materially exacerbate any existing unfair or inequitable environmental or public health burden impacting the EJ population. Potential Project impacts and benefits are discussed below.

3.4.1 Nature and Severity of Project Impact

During construction, the Project is anticipated to result in an increase in traffic volume, which will subsequently increase the noise, dust, and emissions surrounding the site. These impacts will be mitigated as seen in the Construction Period Pollution Prevention Plan shown in the Stormwater Report located in Appendix E, and in accordance with local, state, and federal requirements.

Long term public health impacts associated with the Project include a slight increase in GHG emissions compared to the existing conditions due to the increase in size and power requirements for the building and treatment equipment. Mitigation for this increase in GHG emissions includes adherence to the 2024 International Energy Conservation Code; further discussion on GHG mitigation measures is described below in Section 3.4.5. There is no expected increase in post-construction vehicle traffic.

3.4.2 Project Benefits

The Project will supply improved water quality and provide increased reliability of clean and safe public drinking water to all customers serviced by the District, and all members of the general public that make use of the businesses and facilities which use or serve public drinking water serviced by the District. This description falls within the definition of “Environmental Benefit” as described in 301 CMR 11.02, as the Project results in increased access to drinking water, which falls within water resources.

Please refer to the Water District EJ Population Map located in Appendix B for the extent of the District’s water distribution in regards to the EJ population within the DGA. As seen in this map, the District supplies water to both EJ and Non-EJ communities. Out of the three EJ census tracts located within the DGA, only a portion of one, Block Group 1, Census Tract 153, is directly supplied by the District. However, those EJ communities that are not directly supplied by the District at home may be supplied by it at businesses they frequent. As the Project site is located within 1 mile of EJ communities, as are many industries and businesses, it is safe to assume that the EJ communities are likely to consume District supplied drinking water. It is for this reason that the Project will result in a more equitable distribution of energy and environmental benefits in accordance with “Environmental Justice Principals” as defined in 301 CMR 11.02.

3.4.3 Comparable Impacts on EJ and Non-EJ Populations

The DGA of the Project site contains both EJ and Non-EJ Populations, as seen in the EEA EJ Maps Viewer provided in Appendix F and the Water Distribution Map provided in Appendix B. In these figures, it can be seen that the Project site is located within an EJ community (Block Group 1, Census Tract 153). However, it is worth noting that Non-EJ Communities reside directly across the street from the site, on the other side of Route 132. For this reason, it is assumed that many project impacts will affect both EJ and Non-EJ communities in a similar manner.

One such impact is construction-related increase in traffic volume. At this time in the project design, the increase in traffic volume is currently unknown. However, it is known that the Project Site is located on Route 132, which is approximately 4,000 feet from US 6 Exit 68. Construction vehicles will most likely take this route to arrive at the site, the emissions of which will affect both EJ and Non-EJ communities alike. As seen above in Section 3.3.3, both EJ and Non-EJ communities are subject to an elevated exposure to ozone above the 80th percentile of the statewide average. This existing environmental burden applies to both EJ and Non-EJ communities and thus does not result in a disproportionate adverse effect on EJ communities.

Another impact is the increase in GHG emissions from activities at the new building. This impact will affect both EJ and Non-EJ communities alike, as both communities are located within a one-mile radius from the site. Even so, the estimated increase in GHG emissions is so small that both communities will not suffer from a substantial impact. Refer to Section 3.4.5 below for more information.

A third impact is the increased likelihood of extreme precipitation, as predicted by the RMAT Tool. This prediction is not anticipated to affect either EJ or Non-EJ Communities through the use of a hydrologic analysis of the site. Refer to Section 3.4.4 below for more information.

A final impact is the improved drinking water quality and reliability of the District, which will affect both EJ and Non-EJ communities alike. Both EJ and Non-EJ Communities will either be supplied directly by the District, or will have access to the drinking water through businesses and industries in the area.

3.4.4 Climate Adaptation

The output report generated from the RMAT Tool indicated a “High” risk of extreme precipitation. Although this risk results in the increased likelihood of EJ communities being impacted by an unfair or inequitable environmental burden, pursuant to the MEPA protocol, this result is not anticipated to be applicable to the EJ populations within the DGA.

As seen in Section 4.2, the Project involves the construction of stormwater BMPs for the treatment, infiltration, and attenuation of stormwater runoff. These BMPs were designed according to precipitation data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the 2-, 10-, 25- and 100-year 24-hour storms, along with the RMAT projected 2070 50-year 24-hour storm. Since the results showed an increased runoff post-construction for these storms, further analysis was performed. For the 100-year storm, an offsite flooding analysis was completed, which determined that the site is not subject to an increase in offsite flooding. For the RMAT projected 50-year storm, the current design allows for future upgrades to the site to adapt to climate change as the RMAT model suggests. As such, the Project is

not expected to affect the EJ community in terms of climate change. Refer to Section 4.2 and the Stormwater Report in Appendix E for more detailed information.

3.4.5 Greenhouse Gas Emissions Policy

The proposed Project does not meet any review thresholds as described in 301 CMR 11.03(8). Section IV.B. of the *Interim Protocol for the Analysis of Project Impacts on Environmental Justice Populations* indicates that a GHG emissions analysis should be conducted if a project is expected to generate 2,000 or more tons per year (tpy) of GHG (CO_2) emissions from conditioned spaces that are likely to be used or occupied by EJ populations. The proposed Project will result in new stationary sources of CO_2 emissions; however, this building is not intended for occupancy nor use by EJ populations.

The Project involves the construction of a conditioned building with two air cooled condensers, a heat pump, and a generator. Within this building include pumps and electrical equipment needed for the daily operation of the water treatment plant. The building and its appliances will run off propane gas, with generator capable of providing three days of emergency heat and electricity. Through the use of the GHG Estimation Tool, the proposed project is estimated to generate only 5.9 tpy, as seen in Appendix G. The MEPA Greenhouse Gas (GHG) Emissions Policy (effective date May 5, 2010) does not currently require quantification of emissions associated with construction-period impacts.

Although no analysis is required, safeguards for GHG emissions are implemented into the project design. Contract Specifications will require the contractor to comply with the provisions of MGL Chapter 90, section 16A and the DEP Anti-Idling Regulations (310 CMR 7.11(b)), which prohibit unnecessary engine idling and require engines to be shut down if the vehicle is stopped for more than five minutes.

The contractor shall also abide by the MassDOT diesel retrofit specification, which states that any diesel-powered non-road construction equipment with engine horsepower ratings of 50 and above to be used for 30 or more days over the course of construction will either be EPA Tier 4-compliant or will be retrofitted with EPA-verified (or equivalent) emission control devices such as oxidation catalysts or other comparable technologies (to the extent that they are commercially available) installed on the exhaust system side of the diesel combustion engine.

Section 4: Proposed Activities

This Section provides a description of the proposed scope of work, construction access, BMPs and post-construction site stabilization measures.

4.1 Water Treatment Plant Construction

The existing facilities located at 1650 Iyannough Road/Route 132 include a paved access road and two well pump houses. Water from Well 3 is pumped to the Well 4 pump house, where water from both wells is treated with potassium hydroxide (KOH) for pH adjustment and sodium hypochlorite (NaOCl) for disinfection before entering the water distribution system. The Well 3 Pump House consists of a raw water pump with a capacity of 800 gallons per minute (GPM) at 256 total dynamic head (TDH), a right-angle drive, and associated electrical equipment. The Well 4 Pump House consists of a raw water pump with a capacity of 600 GPM at 253 TDH, a right-angle drive, associated electrical equipment, and associated water treatment equipment. This equipment includes a day tank for KOH, a day tank for NaOCl, and chemical feed pumps. The water quality of the existing facilities is impaired, as there is no treatment for source water iron, manganese, or PFAS, which has then been leading the District to limit water production at the site.

The District is proposing a new water treatment plant at the site to treat for iron, manganese, and PFAS, which will enable them to provide water up to their approved pumping capacity. The new water treatment plant will consist of a 4,040-square foot single-story building with an interior mezzanine. The plant will contain three (3) 10.5-foot diameter GreensandPlus™ media filters and associated process mechanical valves and piping for the removal of source water iron and manganese, and six (6) 10-foot diameter GAC media pressure vessels and associated process mechanical valves and piping for the removal of source water PFAS. Both KOH and NaOCl storage, feed, and handling facilities will be relocated to the new building. As such, the building will contain a 4,350-gallon bulk tank and 330-gallon day tank for KOH, and a 545-gallon bulk tank and two 55-gallon day tanks for NaOCl.

There will be three high lift finished water pumps each with a capacity of 1,200 GPM at 175 TDH, and one backwash pump with a capacity of 1,040 GPM at 53 TDH. Additionally, there will be a facility bathroom, control room/lab to conduct chemical analysis, and 67,000-gallon washwater supply tank/clear well underneath the first-floor slab. The washwater will be used for backwashing both the GreensandPlus™ media filters and GAC media pressure vessels. The backwash waste will then drain to one of the two sand filters for sediment removal, and one of the two infiltration basins for groundwater recharge. This residuals management system, with one sand filter and one infiltration basin offline, is designed to hold 55,000 gallons of backwash waste. Refer to the Design Drawings located in Appendix A for locations.

4.2 Stormwater Management

The proposed project involves the construction of approximately 8,000 square feet of new impervious surface area: 4,040 square feet of new treatment plant and 3,960 square feet of new pavement comprising of a driveway and parking area. See below for a summary of the stormwater impacts and measures proposed to comply with the standards found in MassDEP's Stormwater Management Handbook (Standards). For a full description of the above, refer to the Stormwater Report located in Appendix E.

Standard 1: No New Untreated Discharges

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

There will be no direct discharge of untreated stormwater to nearby wetlands or waters of the Commonwealth.

Standard 2: Peak Rate Attenuation

Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

The existing and proposed hydrologic conditions were modeled using HydroCAD™ version 10.20-9a to demonstrate that post-development stormwater runoff rates will be less than or equal to the pre-development runoff rates. The analysis utilized precipitation data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the 2-, 10-, 25- and 100-year 24-hour storms, along with the RMAT projected 2070 50-year 24-hour storm.

The sub-catchments on the project site were divided into six design points for direct comparison between pre- and post-development conditions. The results from this analysis show that the post-development peak discharge rates do not exceed pre-development discharge rates for the 2- and 10-year 24-hour storms at all design points, as is required by the Standards. However, during the 25-, 100- and RMAT projected 50-year 24-hour storms, the post-development peak discharges do exceed pre-development discharge rates at up to three design points. Since the results showed an increased runoff post-construction for these storms, further analysis was made. An offsite flooding analysis was completed for the 100-year 24-hour storm, which indicates that the site is not subject to an increase in offsite flooding. The current design also allows for future upgrades to the site to adapt to climate change as the RMAT model suggests through the results of the projected 50-year 24-hour storm.

Standard 3: Recharge

Loss of annual recharge to groundwater shall be eliminated or minimized. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from predevelopment conditions based on soil type.

Natural Recourses Conservation Service (NRCS) mapping indicates the presence of loamy fine sand with a Hydraulic Soil Group (HSG) A. Site visits, test pits, and soil borings conducted at the site also indicate

the soils are mainly composed of fine to medium sand. For the proposed increase in impervious area, the required recharge volume is 962 cubic feet.

The project proposes to mitigate loss of annual groundwater recharge via an infiltration basin and six dry wells. The total provided recharge volume is 1,214 cubic feet. All proposed infiltration BMPs have been designed to drain within 72 hours and maintain a separation of two feet or greater from the seasonal high groundwater table.

Limited portions of the Site's impervious area will not receive treatment nor drain to the proposed infiltration BMPs due to the need to meet existing grades and the goal to minimize the project disturbance area. As such, the total recharge volume was adjusted to reflect this, as per the procedure set forth in the Standards. No new impervious area falls into this category; all imperious areas that do not drain to the proposed infiltration BMPs were previously existing at the site. Although the proposed design does not account for all impervious area on site, the percentage of impervious area treated is at 71%, above the required 65% as per the Standards.

Standard 4: Water Quality

Stormwater management systems shall be designed to remove 80% of the average annual postconstruction load of Total Suspended Solids (TSS).

The project proposes treatment of stormwater from impervious areas via three treatment trains as follows:

1. Deep sump hooded catch basins, oil/grit separator, sediment forebay, infiltration basin

2. Filtering rain garden, sediment forebay, infiltration basin

3. Dry wells

Treatment Train 1 contains runoff from the new pavement and roof runoff from two down spouts. Treatment Train 2 contains runoff from the remainder of the new paved driveway and portions of the existing paved access road. Both Treatment Train 1 and 2 will provide at least 80% TSS removal in total and 44% TSS removal in pre-treatment. Treatment Train 3 contains runoff from the remaining 6 down spouts. Since the proposed roof will not be made of metal, as described in the Standards, this runoff is considered clean, and does not require pre-treatment.

The project is required to treat the 1-inch water quality volume due to the presence of soils with rapid infiltration rates and the location of the project within a Zone I and Zone II Wellhead Protection Area, both considered Critical Areas. The resulting required 1-inch water quality volume is 1,136 cubic feet. Proposed treatment BMPs have been designed to provide a total water quality volume of 2,282 cubic feet.

The proposed Project is located within the Barnstable Harbor embayment within the Wequaquet Lake Watershed, which has a final Total Maximum Daily Load (TMDL) issued for fecal coliform. The most likely runoff to contribute to this TMDL is from the pavement. As such, the infiltration BMP for this impervious area, the infiltration basin, was chosen as it has a 90% removal efficiency for pathogens.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

Land use with high potential pollutant loads must have source control and pollution prevention measures implemented in accordance with the Massachusetts Stormwater Handbook.

The project site is not a land use with higher potential pollutant loads, as defined by the Standards.

Standard 6: Critical Areas

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of specific source control, pollution prevention measures.

The proposed project discharges to both the Zone I and Zone II Wellhead Protection Areas, and all proposed stormwater BMPs are located within the Zone I. Although Standard 6 generally prohibits stormwater discharges and the construction of stormwater BMPs within a Zone I, the regulations provide an exception when proposed work is essential to the operation of a public water supply. As the proposed project involves the construction of a new water treatment plant for a public water supply, this project is exempt from this standard.

Infiltration basins, sediment forebays, oil/grit separators, rain gardens, deep sump catch basins, and dry wells are considered suitable BMPs for Zone Is. Treatment trains have been designed to provide 44% pretreatment prior to discharge to an infiltration BMP and will treat the 1-inch water quality volume.

Standard 7: Redevelopment

A redevelopment project is required to meet certain Stormwater Management Standards only to the maximum extent practicable.

Although a portion of the site was previously developed, this Project is considered new development as the proposed project includes a net increase in impervious area. As such, the project is required to fully meet all the Massachusetts Stormwater Management Standards.

Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control

A plan to control construction related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities shall be developed and implemented.

The Project will disturb more than one acre of land and will therefore be required to obtain coverage under the NPDES Construction General Permit. A Stormwater Pollution Prevention Plan (SWPPP) will be provided before the start of construction; however, erosion and sediment controls are identified in the Design Plans and a Construction Period Pollution Prevention and Erosion and Sediment Control Plan is provided as part of the Stormwater Report located in Appendix E.

Standard 9: Long Term Operation and Maintenance Plan

A Long-Term Operation and Maintenance Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

A Long-Term Operation and Maintenance Plan has been included within the Stormwater Report in Appendix E. Operations and maintenance of stormwater management systems will be the responsibility of the District.

Standard 10: Prohibition of Illicit Discharges

All illicit discharges to the stormwater management system are prohibited.

There are no existing illicit discharges to the project site. New illicit discharges to the project site are prohibited. An illicit discharge compliance statement is included in the Stormwater Report located in Appendix E.

4.3 Anticipated Construction Sequence

The proposed Project is not anticipated to be executed in a phased manor. The following represents a general construction sequence to be followed by the awarding contractor.

1. Obtain plan approval and other applicable permits.
2. Flag the work limits and applicable resource areas. Mark the tree area for protection.
3. Hold a pre-construction conference at least one week prior to starting construction.
4. Install stabilized construction entrance, perimeter erosion controls, and inlet protection.
5. Establish the location of stockpile and staging areas.
6. Install sediment basin and if needed.
7. Conduct site clearing.
8. Rough grade site and stockpile topsoil.
9. Install drainage pipes and other utilities.
10. Install site features including building, treatment facilities, pavement, etc.
11. Install infiltration basin, sediment forebay, oil/grit separator, deep sump hooded catch basins, dry wells, and infiltration trenches.
12. Complete final grading.
13. Restore drainage BMPs impacted by construction-period sediment.
14. Install site fencing.
15. Complete final stabilization and site restoration.

16. Remove temporary erosion control measures pending approval by the responsible party.

4.4 Construction Period Protective Measures

The proposed Project includes many construction period protective measures to prevent against pollution and erosion of the site and surrounding areas. To protect the vegetation and areas around the site, the Project includes stabilized construction entrances, tree protection, street sweeping, and erosion control barriers around the downgradient of the limit of work. To protect the Project area itself, the site will include temporary seeding, catch basin inlet protection, construction period grassed swales, and construction period sedimentation basins.

For a full discussion, refer to the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan included as part of the Stormwater Report located in Appendix E.

4.5 Post-Construction Pollution Prevention

The proposed Project includes various measures to ensure source control and pollution prevention after construction concludes. These measures include restrictions on the storage of materials and waste onsite, spill prevention and response protocols, routine inspection and maintenance procedures of stormwater BMPs, and the prohibition of the use of fertilizers, herbicides, and pesticides on site.

For a full discussion, refer to the Long-Term Operation and Maintenance Plan included as part of the Stormwater Report located in Appendix E.

Section 5: Alternatives Analysis

The District's objective for this project is to provide the Town of Barnstable with safe, clean drinking water. Several alternatives were evaluated to achieve these project goals, with the preferred option identified as the most effective. Detailed discussions of these alternatives are provided in the following sections, presented in no particular order.

5.1 No-Build Alternative

As required by the MEPA regulations, the No-Build Alternative was assessed as a potential project alternative. Under this alternative, the Town of Barnstable would retain its existing system of water treatment: water from Well 3 and Well 4 would be pumped to the Well 4 Pump House, where the water is treated for pH adjustment and disinfection before being pumped to distribution. This alternative does not address the District's need for a restored water capacity, nor does it address the District's exceedance of the EPA MCL for PFAS. The No-Build Alternative would not serve the needs of the District; therefore, this alternative was not selected.

5.2 Decommissioning of Well 3 and Well 4

Another alternative assessed was to decommission Well 3 and Well 4 altogether. This alternative addresses the District's exceedance of the USEPA MCL for PFAS, as the water supplied by the District's remaining three wells are either not in exceedance of this MCL, or have treatment operations to remove PFAS before being released into distribution. This alternative does not, however, address the District's need for a restored water supply capacity. Decommissioning Well 3 and Well 4 would put a large strain on the District's remaining three wells, and the District would not be able to meet its current water demand, especially in the summer months when the Town of Barnstable experiences a population increase. With both Well 3 and Well 4 decommissioned, the District would not be able to meet it's max day capacity with its largest source offline, as required by 310 CMR 22. As such, this alternative was not selected.

5.3 Water Treatment Plant Addition

A third alternative assessed was to construct an addition to the Well 4 Pump House, where water is currently being treated for pH adjustment. This pump house addition would include both GAC media pressure vessels and greensand media filters to treat the raw water, as recommended in the Pilot Scale Treatability Study Report. This alternative addresses both the District's exceedance of the EPA MCL for PFAS and its need for a restored water capacity.

The Well 4 Pump house is located in a small depression. As such, it would be difficult to place all required elements of the project (structures for the management of water treatment residuals, stormwater BMPs, etc) in this area without drastically changing the topography of the existing site. Additionally, this option places the building more towards the center of the Zone I Wellhead Protection Area, which in turn,

requires the construction of a longer septic line to place the septic system outside of the Zone I. The longer this line is, the higher the risk of a leak within the Zone I. This location is also within the DGA of the site, thus resulting in no benefit in terms of potential disproportionate adverse effect to the EJ communities. This alternative is feasible under current zoning, but for the reasons stated above it was not selected.

5.4 New Water Treatment Plant Construction

The final alternative assessed was to construct a new building for the treatment of water from Wells 3 and 4, and site it in the wooded area south of the existing paved access road. This alternative addresses both the District's violation of the USEPA MCL for PFAS and its need for a restored water capacity. The area proposed in this alternative requires much less site grading than Alternative #3, thus requiring fewer site-stabilization methods and being less susceptible to erosion. Additionally, this area provides more room for all required elements of the project and places the building closer to the edge of the Zone I when compared to Alternative #3. For the reasons described above, this alternative was selected as the preferred alternative.

Section 6: Draft Section 61 Findings

In accordance with M.G.L. c. 30, Section 61 and 301 CMR 11.12(5), any State Agency that takes Action on a project for which the Secretary required an EIR shall determine whether the project is likely, directly or indirectly, to cause Damage to the Environment and shall make a finding describing the Damage to the Environment and confirming that all feasible measures have been taken to avoid or minimize the Damage to the Environment. Draft Section 61 Findings for the state permits required for the Barnstable Fire District Wells 3&4 Water Treatment Plant are provided below.

The Proposed Section 61 Findings below and the subsequent sections contain commitments the Proponent has made as a basis for respective agency Section 61 Findings.

6.1 Draft Section 61 Findings – Water Capacity

The District will seek a BRP WS 24 Permit Approval from MassDEP for the Barnstable Fire District Wells 3&4 Water Treatment Plant Project pursuant to M.G.L. 310 CMR 22.00. The Project will result in the construction of a water treatment plant with the capacity for 1.44 MGD. The Project is designed to avoid, minimize, and mitigate impacts to the site's watershed, including the following:

- There is no increase in District water supply nor groundwater withdrawal. The permitted withdrawal at the Project Site is 1.44 MGD.
- There is no increase in permitted capacity of the supply wells. The permitted flow through the plant at the Project Site is 1.44 MGD, with the ability to treat a capacity of up to 1,200 GPM for less than 24 hours.

Findings

Based upon its review of the MEPA documents, the permit applications submitted to date, and the regulations, the Department finds that the terms and conditions to be incorporated into the permit required for this Project will constitute all feasible measures to avoid damage to the environment, including consideration of the potential effects of climate change, and will minimize and mitigate such damage to the maximum extent practicable for those impacts subject to the authority. Implementation of the mitigation measures will occur in accordance with the terms and conditions set forth in the permit.

_____

Department of Environmental Protection

_____

By

_____

[Date]

6.2 Draft Section 61 Findings – Stormwater

The district will seek a Stormwater Management Permit approval for the Barnstable Fire District Wells 3&4 Water Treatment Plant Project from the Town of Barnstable Department of Public Works pursuant to the MassDEP Massachusetts Stormwater Management Standards as well as with Chapter 185 and 903 of the Barnstable Bylaws.

The Project will result in the disruption of approximately 2.10 acres of previously undeveloped land and the addition of approximately 8,000 square feet of impervious area.

The Project includes mitigation measures designed to avoid, minimize, and mitigate impacts from stormwater runoff, including the following:

- Stormwater controls are designed to meet the requirements of all ten standards found in the Massachusetts Stormwater Quality Handbook.
- Consideration for future site changes due to climate change have been reviewed using the RMAT output recommendations.
- Sediment and erosion controls will be installed and maintained during construction and appropriate construction period BMPs will be utilized.
- Site limits, access routes, and construction entrances will be defined with construction fencing.
- Nonwoven geotextile beneath crushed stone will be used at temporary construction entrances.
- A long-term operation and maintenance plan will be maintained to ensure all devices on-site operate as intended.

Findings

Based upon its review of the MEPA documents, the permit applications submitted to date, and the regulations, the Department finds that the terms and conditions to be incorporated into the permit required for this Project will constitute all feasible measures to avoid damage to the environment, including consideration of the potential effects of climate change, and will minimize and mitigate such damage to the maximum extent practicable for those impacts subject to the authority. Implementation of the mitigation measures will occur in accordance with the terms and conditions set forth in the permit.

_____

Department of Environmental Protection

_____

By

_____

[Date]

Section 7: Regulatory Compliance

This Project has been designed to avoid environmental impacts when possible, minimize unavoidable impacts when practicable, and provide mitigation that is commensurate with the proposed alterations. Descriptions of compliance with the regulatory requirements of pertinent local, state, and federal regulatory programs are provided in the following sections.

7.1 Federal Permits

7.1.1 NPDES Construction General Permit

The National Pollutant Discharge Elimination System (NPDES) requires that construction projects disturbing greater than 1 acre of land obtain coverage under the construction general permit (CGP). As part of obtaining coverage under the CGP, a Notice of Intent (NOI) with a stormwater pollution prevention plan (SWPPP) must be submitted to USEPA prior to the start of land-disturbing activities. The SWPPP must be implemented and updated throughout the duration of construction.

The awarded contractor for this project will prepare and submit the necessary information needed for coverage under the CGP. The SWPPP will be provided to the required agencies prior to the start of construction. However, erosion and sediment controls are identified in the Design Plans and a Construction Period Pollution Prevention and Erosion and Sediment Control Plan is provided as part of the Stormwater Report located in Appendix E.

7.2 State Permits

7.2.2 MassDEP - BRP WS 24 Approval to Construct a Facility to Treat One Million Gallons per Day or Greater

All projects involving the construction of a water treatment plant with the capacity to treat one million gallons per day or greater must submit a BRP WS 24 permit to MassDEP for approval in accordance with 310 CMR 22.00.

The BRP WS 24 permit will be submitted to MassDEP for technical review. The Proponent anticipates receiving approval following the completion of MEPA review and prior to the start of construction.

7.2.3 MHC Review

Any projects that require funding, licenses, or permits from any state agency must be reviewed by Massachusetts Historical Commission (MHC) in compliance with M.G.L. c. 9, §26-27C. This law provides for MHC review of state projects, State Archaeologist's Permits, the protection of archaeological sites on public land from unauthorized digging, and the protection of unmarked burials. The regulations that guide MHC review of state funded, licensed or permitted projects are published in Chapter 9, Section 26-27C (950 CMR 70.00 – 71.00).

The Proponent filed a project notification form (PNF) with MHC on December 16, 2025. MHC responded to this application on January 12, 2026, and determined that the project is unlikely to affect significant historic or archaeological resources. Refer to Appendix C for this determination from MHC.

7.2.4 NHESP MESA Project Review

Any projects that are located within state-listed species habitat must be reviewed by the Massachusetts Natural Heritage and Endangered Species Program (NHESP) for compliance with the Massachusetts Endangered Species Act (MESA) and its implementing regulations (321 CMR 10.00). Although the Project is not located within or near the limits of mapped *Priority Habitats of Rare Species* or *Estimated Habitats of Rare Wildlife* in the latest edition of NHESP's interactive map viewer (15th Edition Natural Heritage Atlas, August 1, 2021) or MassGIS online mapping data, the Proponent filed with NHESP to confirm to ensure the Project minimizes avoidable project impacts.

The Proponent filed a MESA Project Review with NHESP on December 16, 2025. NHESP responded to this application on January 14, 2026, and determined that the project will not result in a prohibited Take of state-listed rare species. Refer to Appendix C for this determination from NHESP.

7.3 Local Permits

7.3.1 Stormwater Management Permit

Stormwater runoff from all industrial, commercial, institutional, office, residential and transportation projects shall be managed according to the MassDEP Stormwater Management Handbook. Additionally, no construction activity that results in a disturbance of land equal to or greater than one (1) acre of land within the Town of Barnstable may commence without first obtaining a Stormwater Management Permit issued by the Department of Public Works. The Department of Public Works will review the permit for compliance with the standards found in the MassDEP Stormwater Management Handbook, as well as with Chapter 185 and 903 of the town bylaws.

A summary of the Project's stormwater impacts and measures proposed to comply with the standards found in the MassDEP Stormwater Management Handbook in located in Section 4.1, while the full stormwater report is included in Appendix E of this PEIR. The Stormwater Management Permit will be submitted to the Town of Barnstable Department of Public Works prior to the start of construction.

7.3.2 Site Plan Review Permit

Any project that includes the new construction of any building or structure must prepare and submit a Site Plan Review permit to the Town of Barnstable Building Commissioner for review in accordance with Chapter 240 of the town bylaws. Representatives from the Health, Building, Conservation, Planning and Development, and Engineering departments are included in the review to ensure development standards are met in all business, commercial, industrial, and multifamily projects. As such, this permit includes the submission of zoning and site-use information, stormwater runoff drainage calculations, as well as existing and proposed conditions of the site.

The Site Plan Review permit will be submitted to the Town of Barnstable Building Commissioner prior to the start of construction.

7.3.3 Commercial Building Permit

Any project that includes the new construction of any building or renovation of any existing building must prepare and submit a Building permit to the Town of Barnstable Building Department.

The awarded contractor for this project will prepare and submit the necessary information needed for the Commercial Building permit. This permit application will be submitted for review by the Building Department succeeding the acceptance of the Site Plan Review permit and prior to the start of construction.

7.3.4 Hazardous Materials Registration

In accordance with the Town of Barnstable general ordinance Chapter 108 Hazardous Materials, businesses which handle or store hazardous materials must register and submit an inventory of hazardous materials and obtain a hazardous materials permit from the Town of Barnstable Health Division.

The inventory and permit for hazardous materials will be submitted to the Town of Barnstable Health Division prior to the start of construction.

7.3.5 Title 5 Septic System Permit

Any project that includes the construction and maintenance of septic systems and the transport of septic-system waste must be reviewed by the local Board of Health in compliance with 310 CMR 15.000 “Title 5”. This permit application must show that the proposed septic system is designed adequately and incorporates all required structures based on the location of the system.

Before the start of construction, a Disposal System Construction permit will be submitted to the Barnstable Board of Health for approval. Permit application for the construction of the septic system will be submitted by the awarding contractor prior to the start of construction.

7.3.6 Electrical Permit

Any project that includes the installation of any electrical wiring, appliances, or services must prepare and submit an Electrical permit to the Town of Barnstable Building Department.

The awarded contractor for this project will prepare and submit the necessary information needed for the Electrical permit. This permit application will be submitted for review by the Building Department succeeding the acceptance of the Site Plan Review permit and prior to the start of construction.

7.3.7 Gas Permit

Any project that includes the installation, removal, or repair of a building’s pluming must prepare and submit a Gas permit to the Town of Barnstable Building Department.

The awarded contractor for this project will prepare and submit the necessary information needed for the Gas permit. This permit application will be submitted for review by the Building Department succeeding the acceptance of the Site Plan Review permit and prior to the start of construction.

7.3.8 Sheet Metal Permit

Any project that includes the installation, assembly, or repair of duct work, architectural sheet metal, and metal roofing must prepare and submit a Sheet Metal Permit to the Town of Barnstable Building Department.

The awarded contractor for this project will prepare and submit the necessary information needed for the Sheet Metal permit. This permit application will be submitted for review by the Building Department succeeding the acceptance of the Site Plan Review permit and prior to the start of construction.

APPENDIX A

Design Drawings

BARNSTABLE WATER DEPARTMENT
WELLS 3 & 4 WTP

Hyannis Golf Course, Barnstable, Massachusetts

Prepared For:

BARNSTABLE FIRE DISTRICT, WATER DEPARTMENT

P.O. Box 546
Barnstable, Massachusetts
Sean Anderson, Superintendent

Index of Drawings

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3	G-2	GREENSAND SYSTEM PROCESS FLOW DIAGRAM
4	G-3	GAC SYSTEM PROCESS FLOW DIAGRAM
		CIVIL SHEETS
5	C-1	EXISTING CONDITIONS
6	C-2	SITE LAYOUT
7	C-3	SITE PREPARATION PLAN
8	C-4	UTILITY PLAN
9	C-5	STORMWATER MANAGEMENT PLAN
10	C-6	GRADING AND PAVEMENT PLAN
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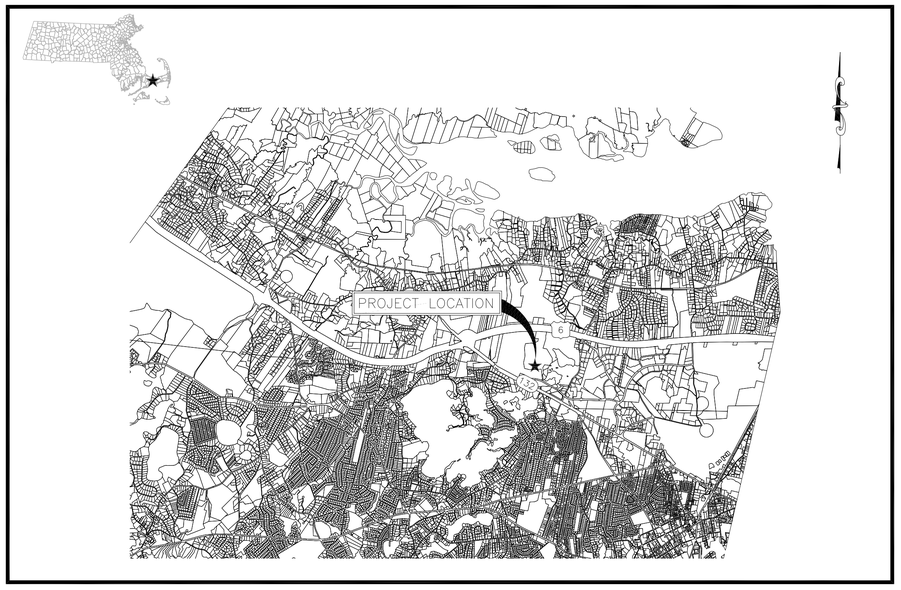

Locus Plan
SCALE: 1"=5000'

Index of Drawings

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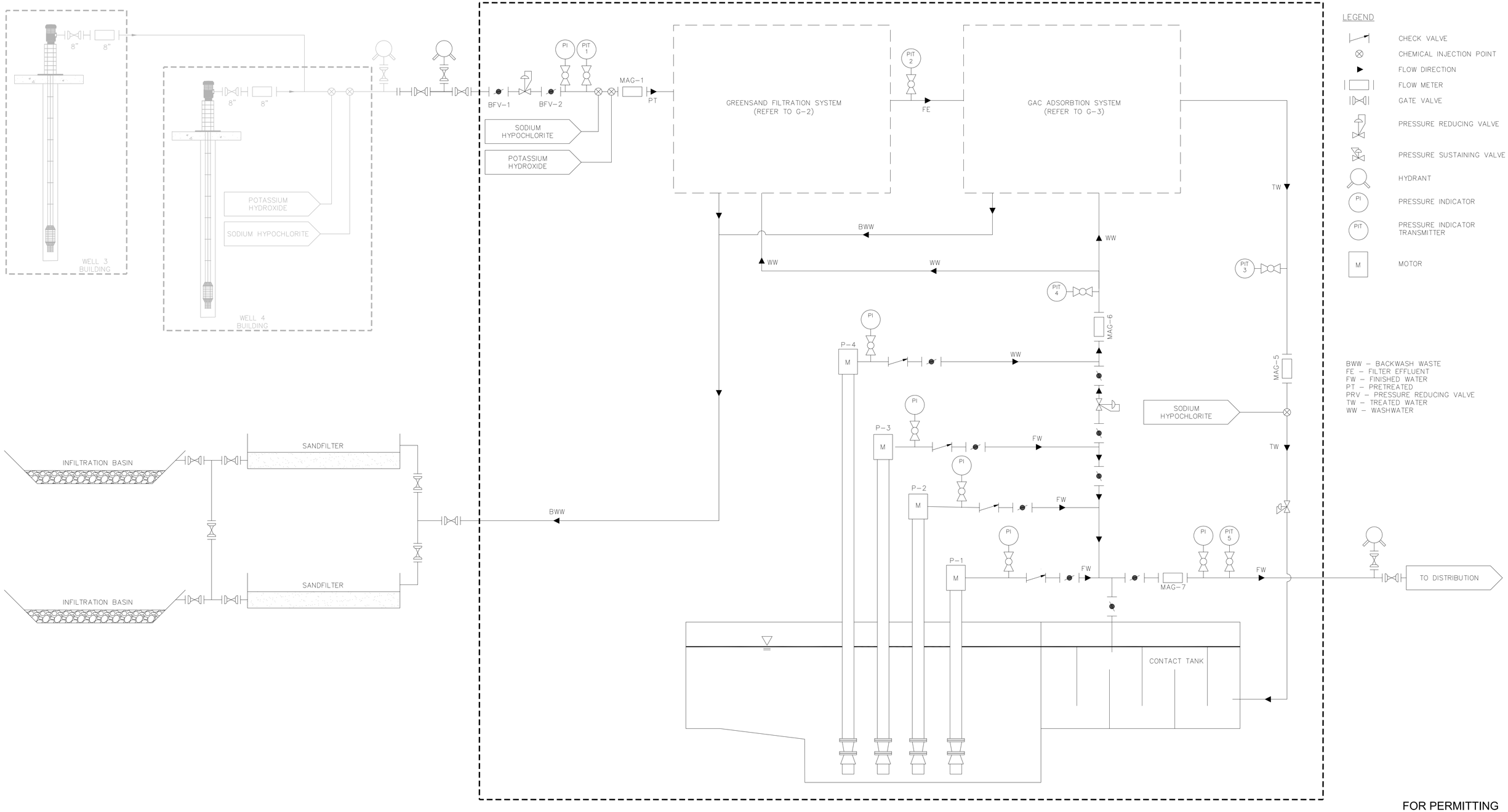
Contract No. 127.25.01
FOR PERMITTING
JUNE 2026

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 6498
REGISTERED PROFESSIONAL ENGINEER
6498

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS



LEGEND

- CHECK VALVE
- CHEMICAL INJECTION POINT
- FLOW DIRECTION
- FLOW METER
- GATE VALVE
- PRESSURE REDUCING VALVE
- PRESSURE SUSTAINING VALVE
- HYDRANT
- PI — PRESSURE INDICATOR
- PIT — PRESSURE INDICATOR TRANSMITTER
- M — MOTOR

BWW – BACKWASH WASTE
FE – FILTER EFFLUENT
FW – FINISHED WATER
PT – PRETREATED
PRV – PRESSURE REDUCING VALVE
TW – TREATED WATER
WW – WASHWATER

FOR PERMITTING

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(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 49076
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	N.T.S.
DESIGNED BY:	RAT
CHECKED BY:	DNW
DRAWN BY:	RAT
APPROVED BY:	SCO

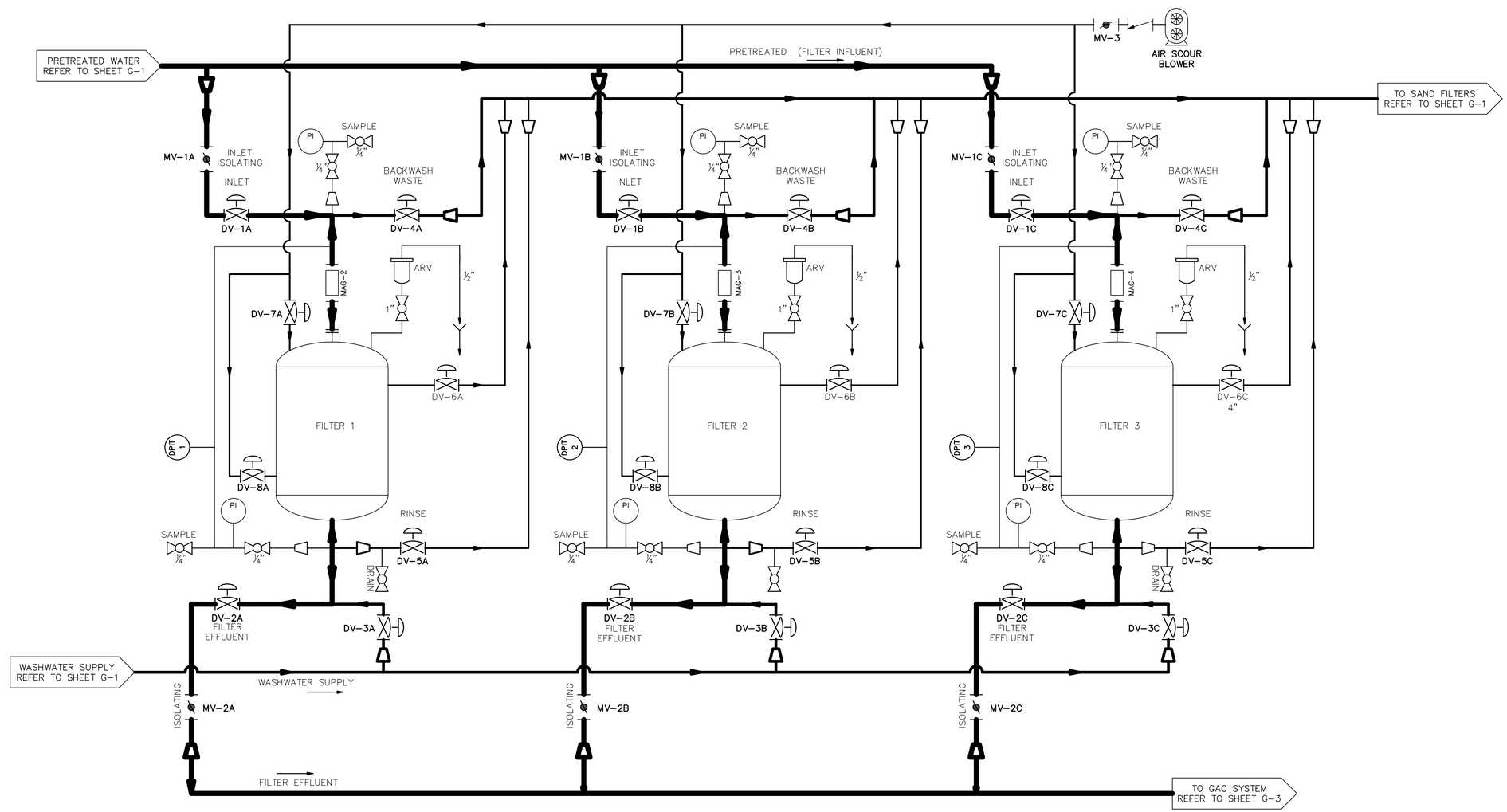
BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
WELL 3 AND 4 PROCESS FLOW DIAGRAM

DRAWING NO.: G-1

SHEET NO. 2 OF 57

C:\Users\Ryan\H2Olson Engineering, Inc\H2O - Documents\03 Projects\127 - Barnstable Fire Distrtch\127.25.02 - Well 3&4 WTP Design\01 Design\A_Drawings\G-Sheets\G- Flow Diagram.dwg



LEGEND

- BALL VALVE
- BUTTERFLY VALVE
- HYDROPNEUMATICALLY ACTUATED VALVE
- REDUCER
- COUPLING
- AIR RELIEF VALVE
- MAGNETIC FLOW METER
- FLOW DIRECTION
- PI — PRESSURE INDICATOR
- DPIT — DIFFERENTIAL PRESSURE INDICATOR/TRANSMITTER
- PRIMARY FLOW
- SECONDARY FLOW
- TERTIARY FLOW
- ANAILLARY FLOW

ARV – AIR RELIEF VALVE
CV – CONTROL VALVE
DI – DUCTILE IRON
FCV – FLOW CONTROL VALVE
MV – MANUAL VALVE
SmV – SAMPLE VALVE

- DRAIN

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APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
GREENSAND SYSTEM PROCESS FLOW DIAGRAM

DRAWING NO.:
G-2

SHEET NO. 3 OF 57

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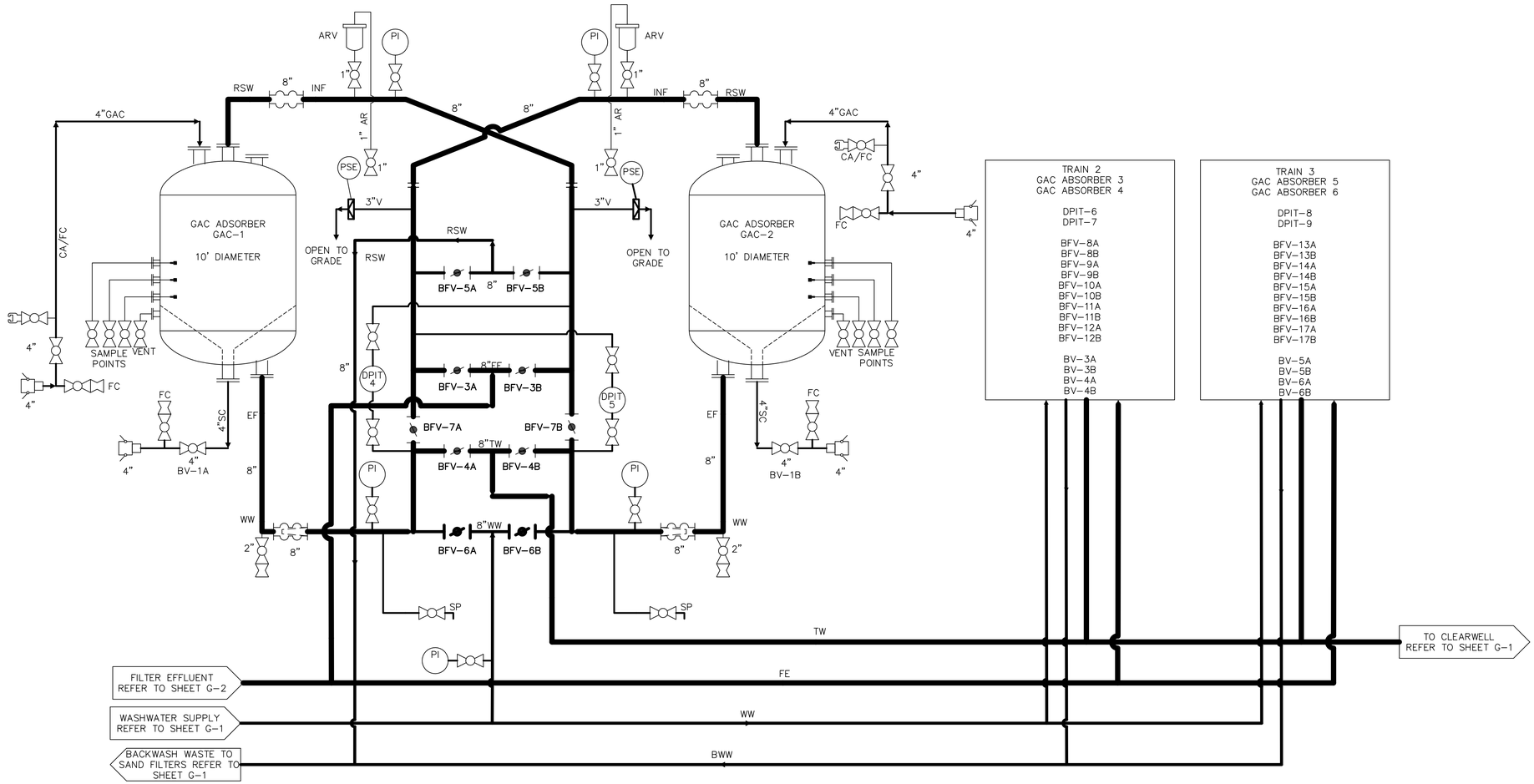

LEGEND

- BALL VALVE
- BUTTERFLY VALVE
- PI — PRESSURE INDICATOR
- DPIT — DIFFERENTIAL PRESSURE INDICATOR TRANSMITTER
- QUICK DISCONNECT MALE ADAPTOR
- AIR RELIEF VALVE
- QUICK DISCONNECT FEMALE COUPLET
- FLOW DIRECTION
- HOSE COUPLING
- EXPANSION JOINT
- PRIMARY FLOW
- SECONDARY FLOW
- TERTIARY FLOW
- ANAILLARY FLOW

AR – AIR RELIEF
ARV – AIR RELIEF VALVE
BWW – BACKWASH WASTE
FC – FLUSH CONNECTION
FE – FILTER EFFLUENT
INF – INFLUENT
RSW – RINSEWATER
SC – SPENT CARBON
SP – SAMPLE PORT
TW – TREATED WATER
WW – WASHWATER

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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
GAC SYSTEM PROCESS FLOW DIAGRAM

DRAWING NO.:
G-3

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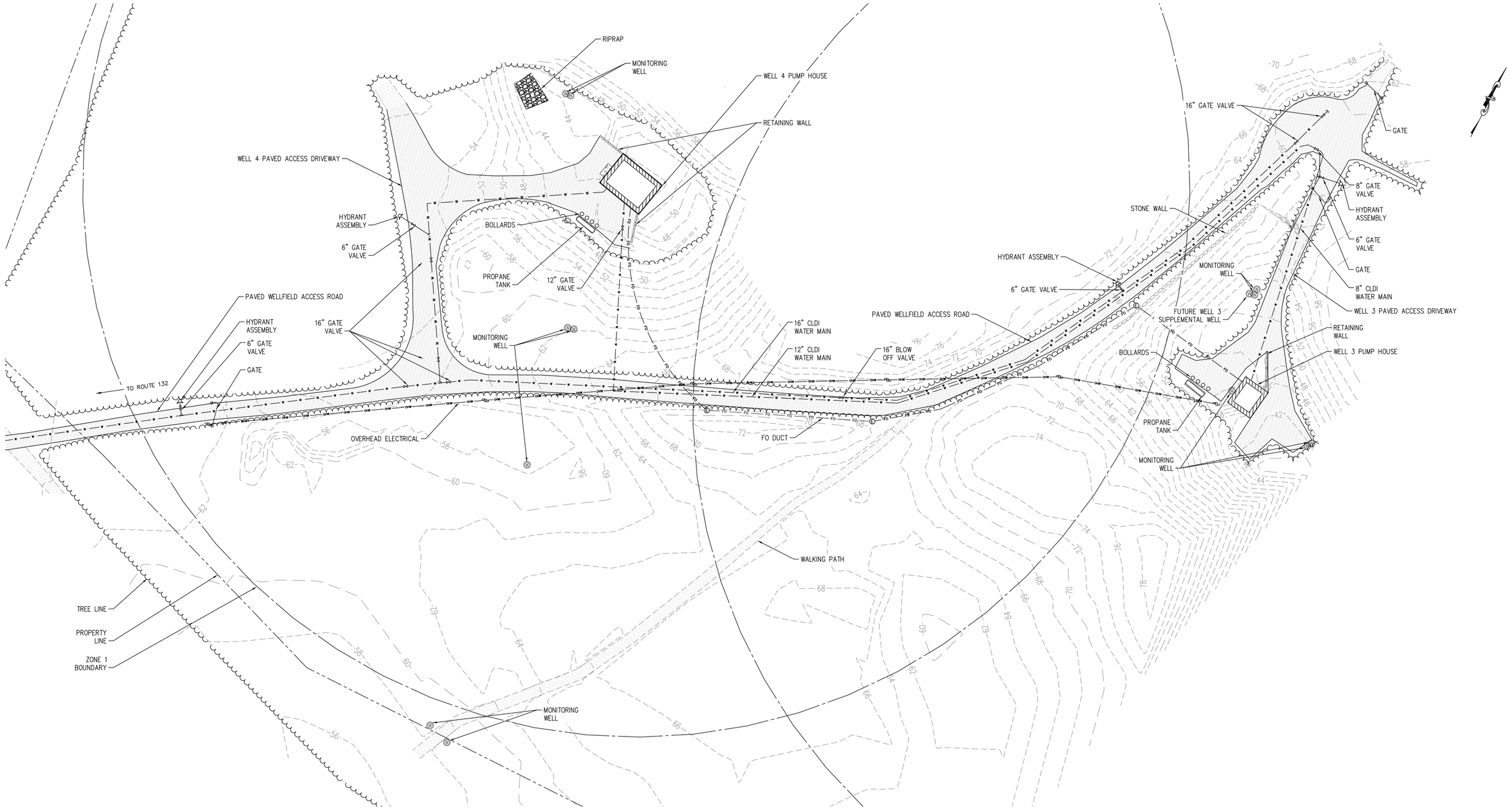

PLAN VIEW

SCALE: 1" = 35'

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STEPHEN C. OLSON
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
EXISTING CONDITIONS

DRAWING NO.:
C-1

SHEET NO. 5 OF 57

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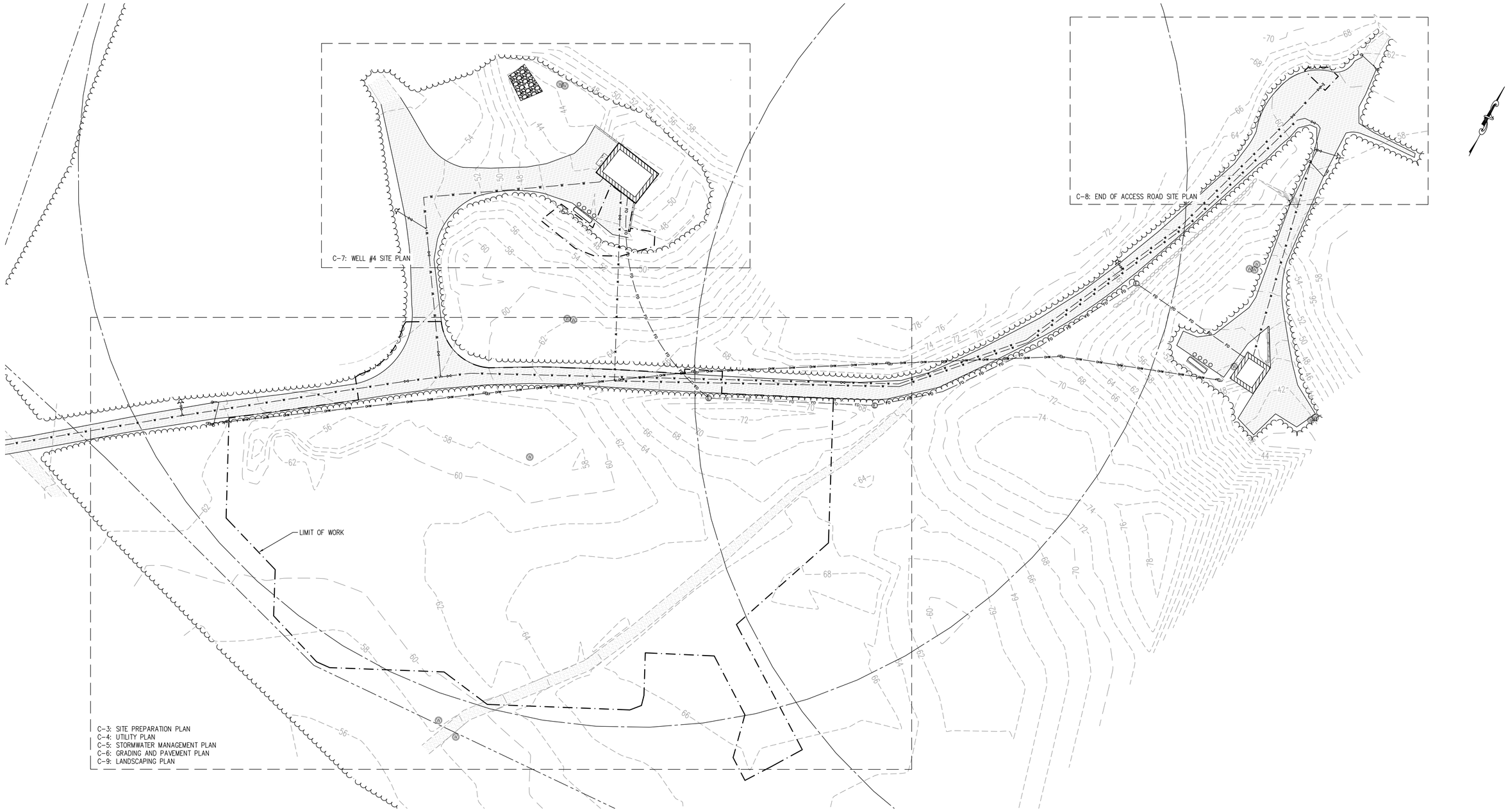

PLAN VIEW

SCALE: 1" = 35'

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STEPHEN C. OLSON
No. 49035
REGISTERED PROFESSIONAL ENGINEER
6/4/26

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BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: SITE LAYOUT

DRAWING NO.: C-2

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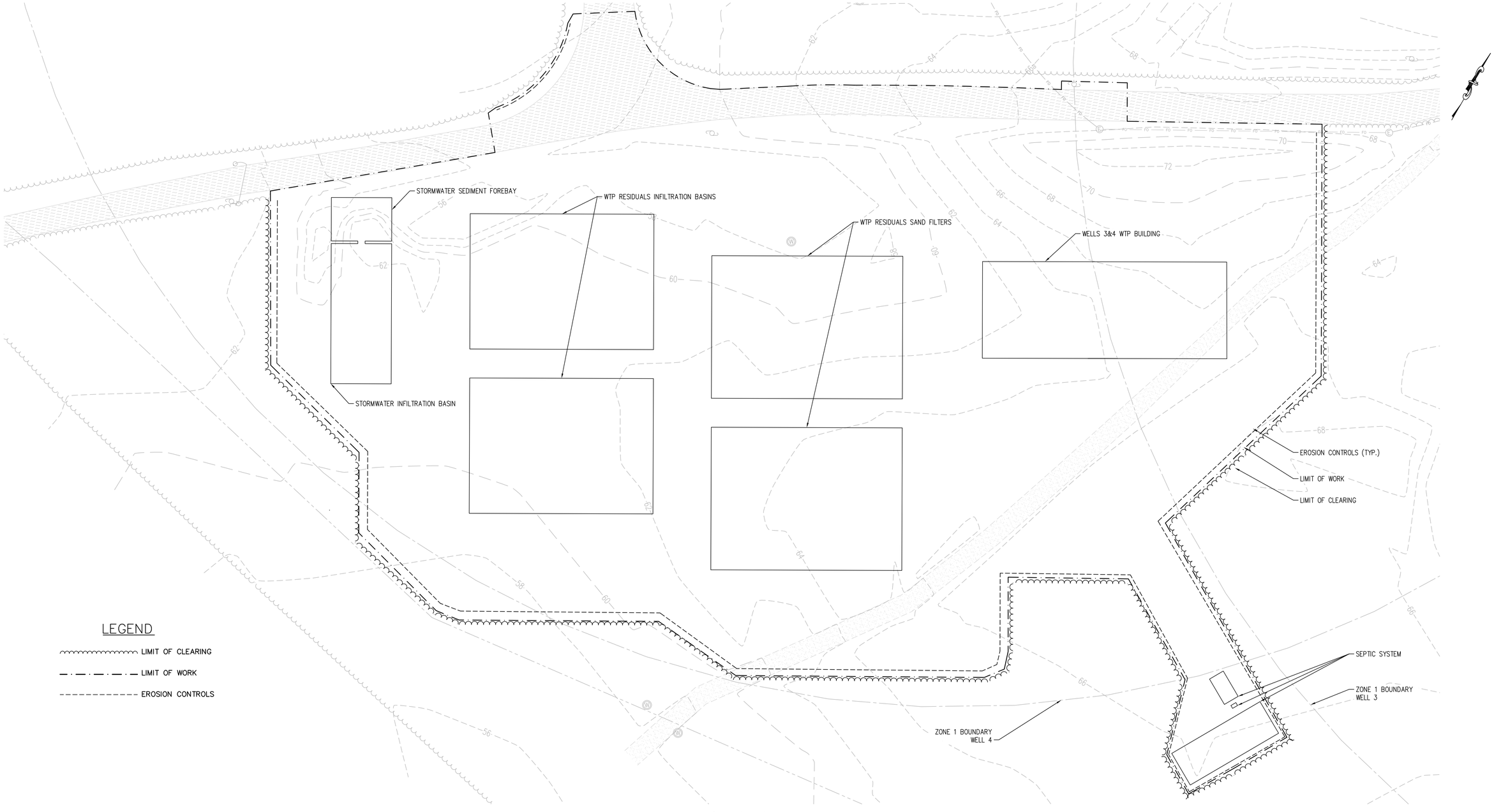

PLAN VIEW

SCALE: 1" = 20'

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NO. 49,736
REGISTERED PROFESSIONAL ENGINEER
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DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SITE PREPARATION PLAN

DRAWING NO.:
C-3

SHEET NO. 7 OF 57

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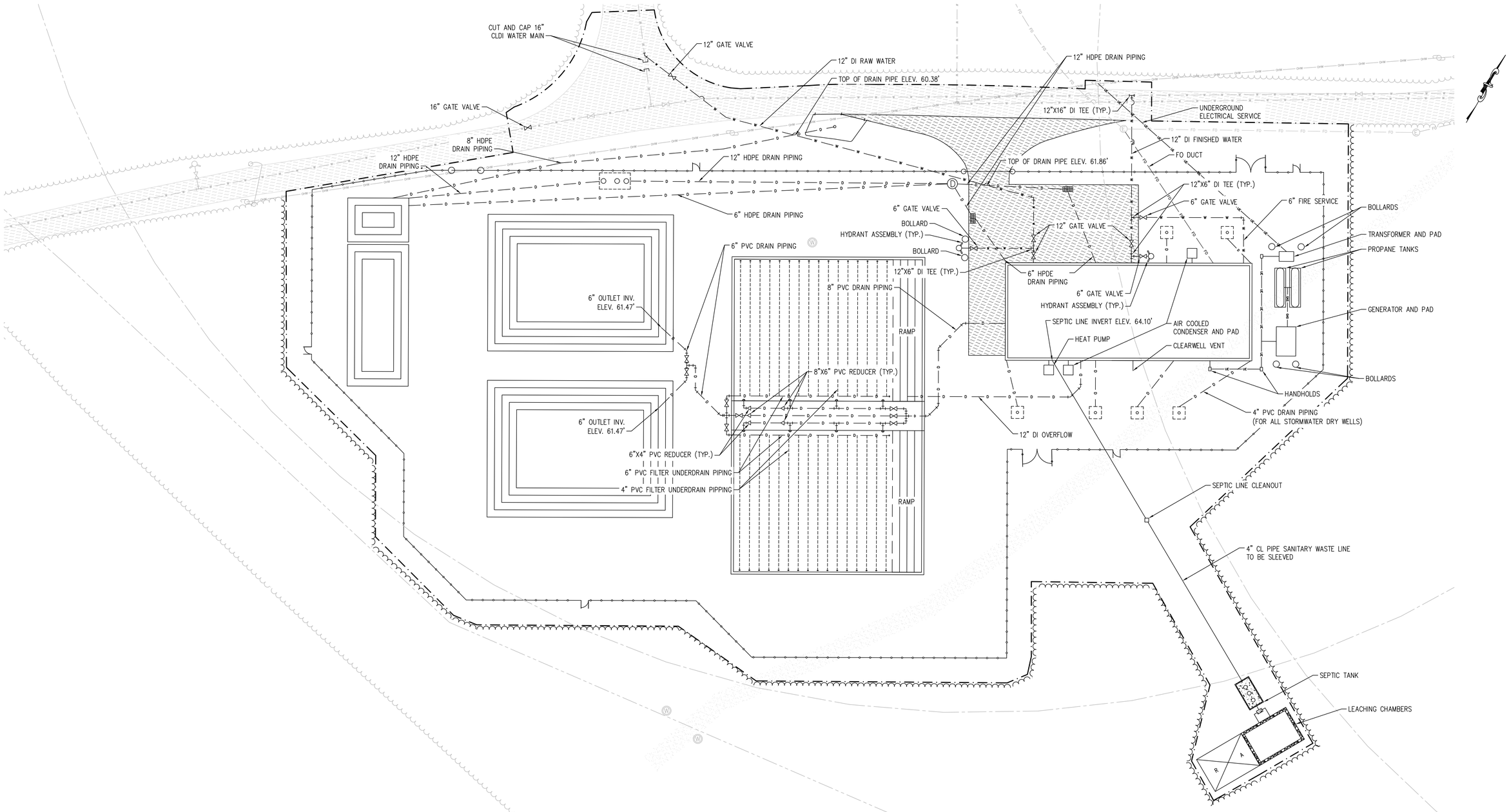

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BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: UTILITY PLAN

DRAWING NO.: C-4

SHEET NO. 8 OF 57

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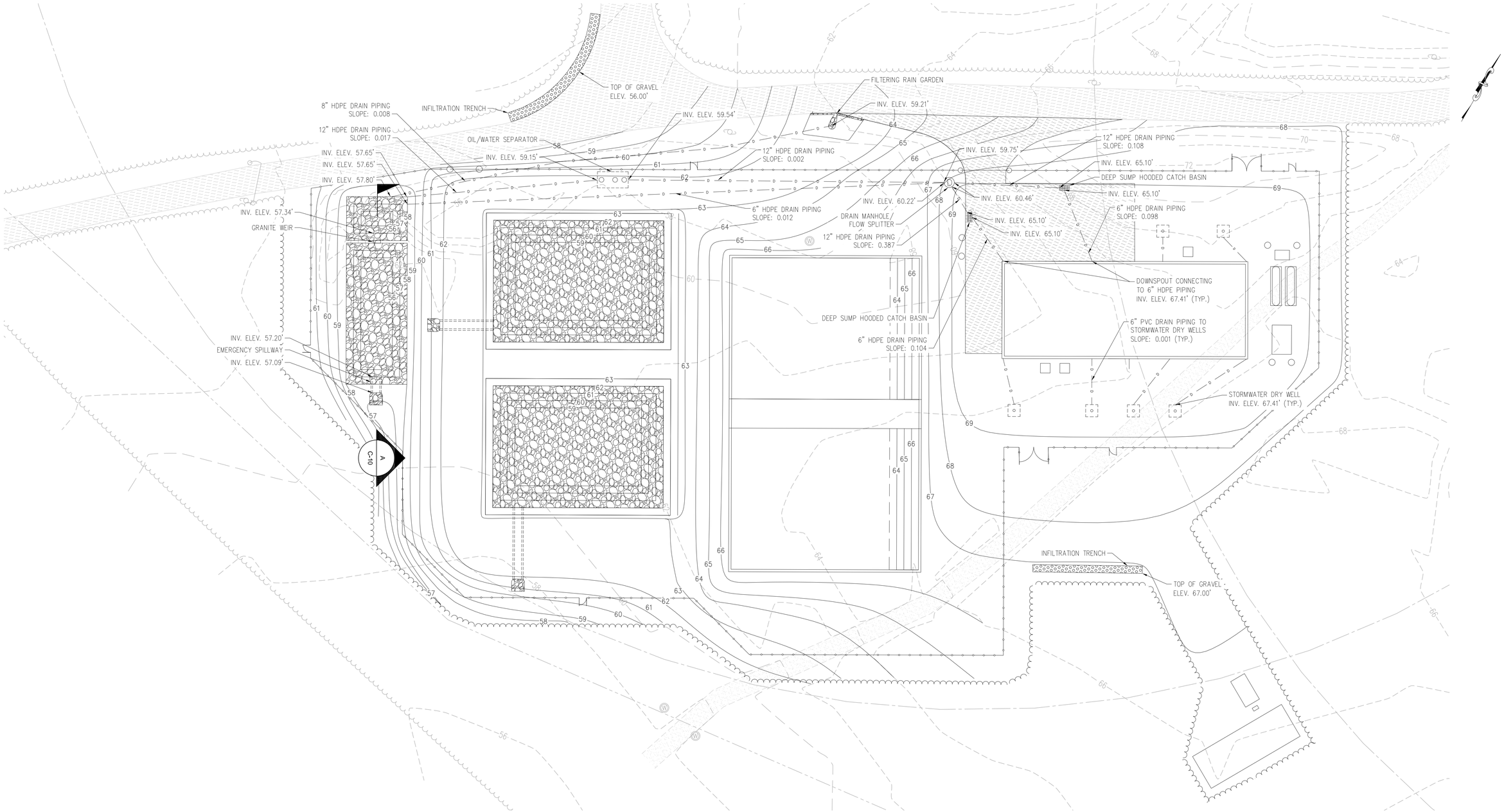

PLAN VIEW

SCALE: 1" = 20'

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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
STORMWATER MANAGEMENT PLAN

DRAWING NO.:
C-5

SHEET NO. 9 OF 57

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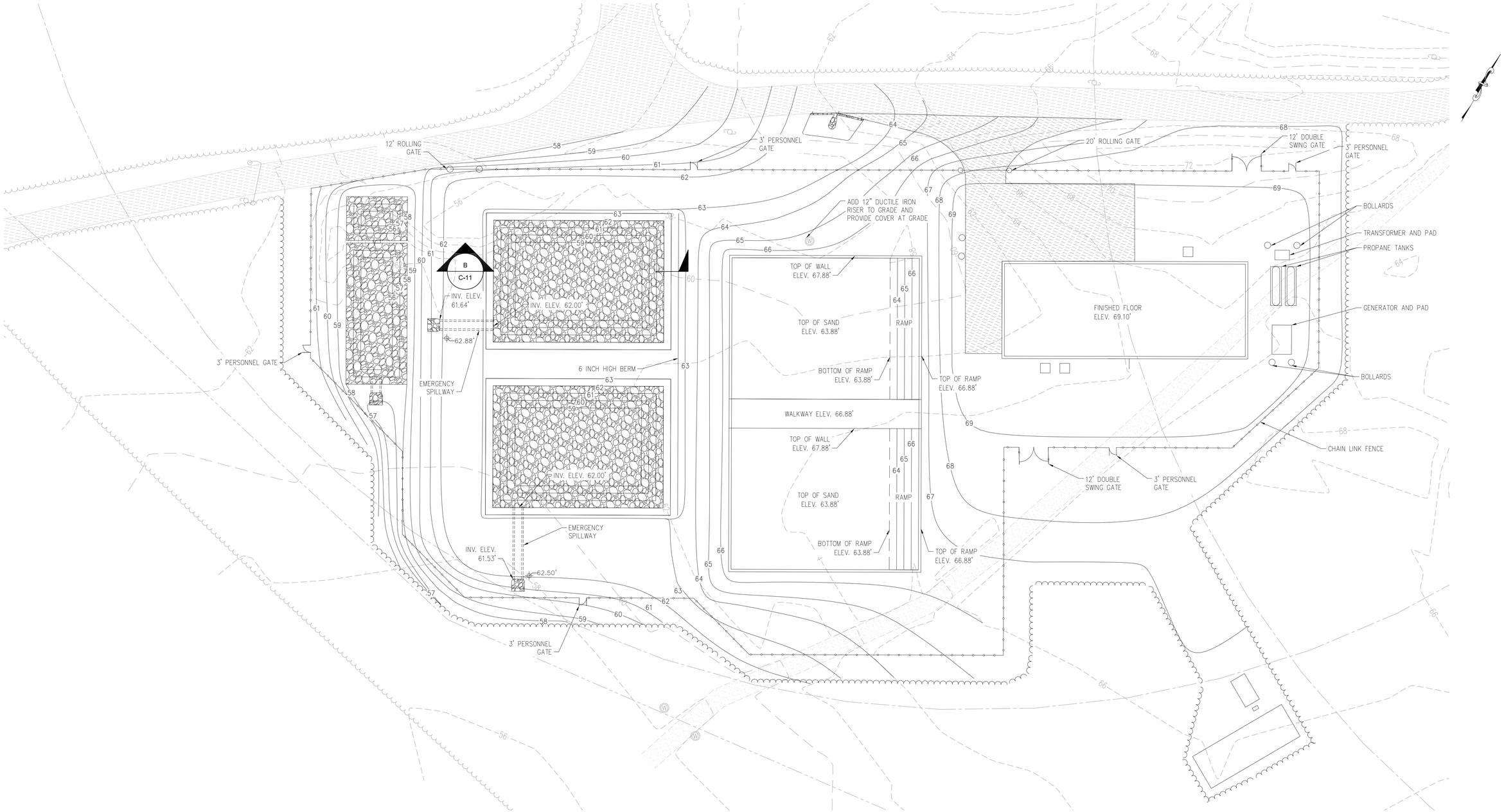

PLAN VIEW

SCALE: 1" = 20'

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PROJECT NO.:	127.25.01
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APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
GRADING AND PAVEMENT PLAN

DRAWING NO.:
C-6

SHEET NO. 10 OF 57

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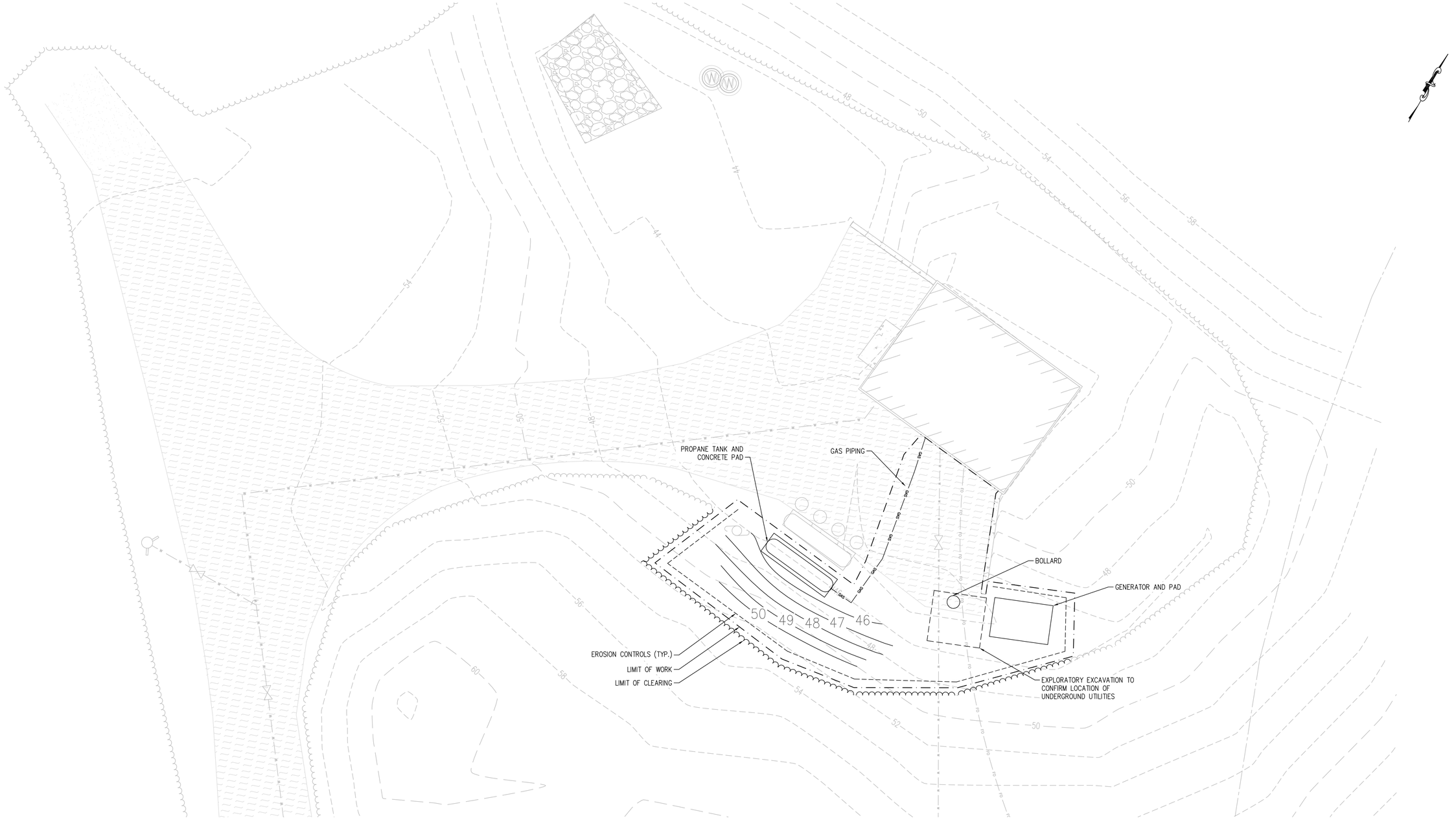

PLAN VIEW

SCALE: 1" = 10'

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0" 1"
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REVISIONS		
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PROJECT NO.:	127.25.01
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SCALE:	1" = 10'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
WELL #4
SITE PLAN

DRAWING NO.:
C-7

SHEET NO. 11 OF 57

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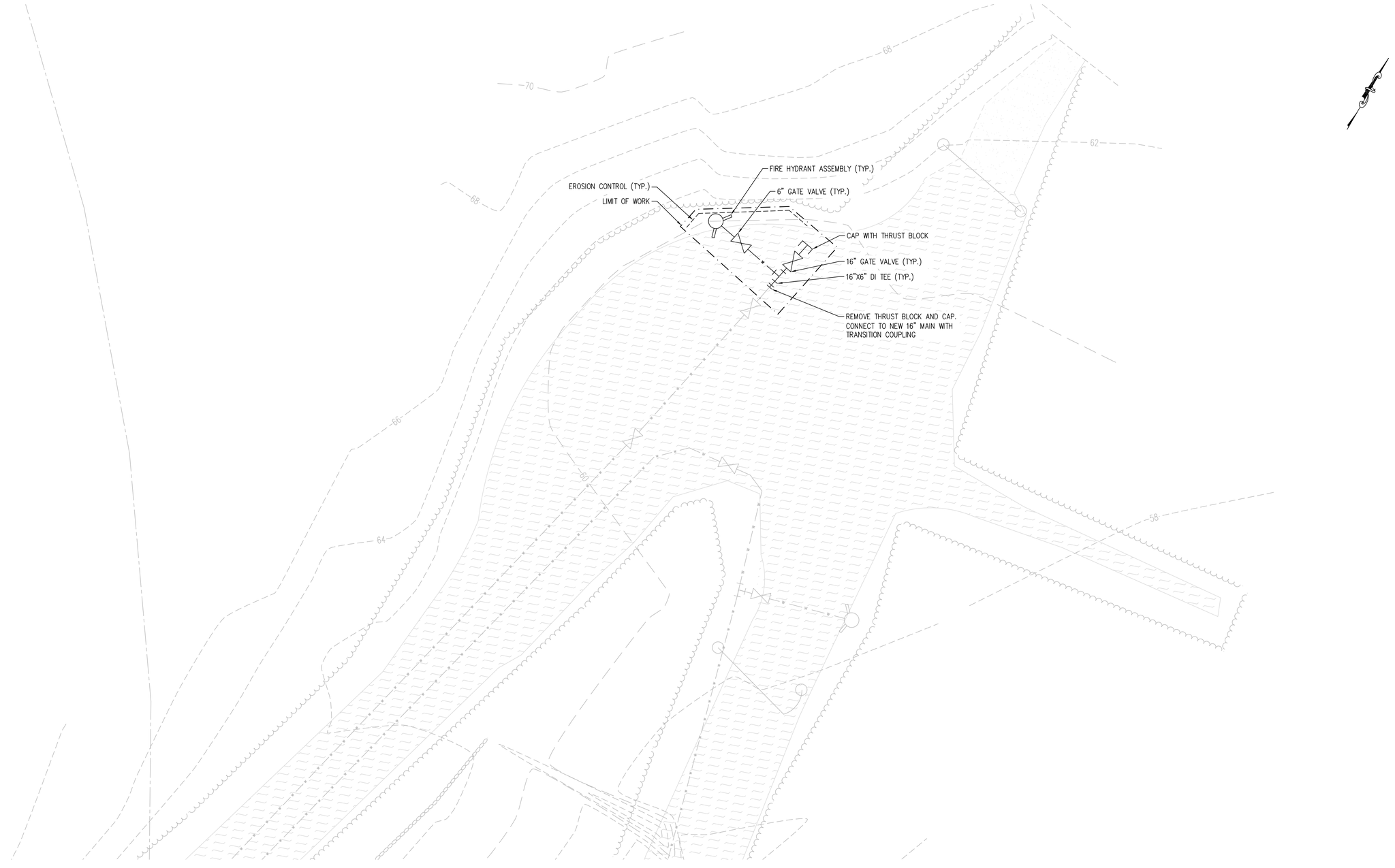

PLAN VIEW

SCALE: 1" = 8'

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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 49386
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 8'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
END OF ACCESS ROAD SITE PLAN

DRAWING NO.:
C-8

SHEET NO. 12 OF 57

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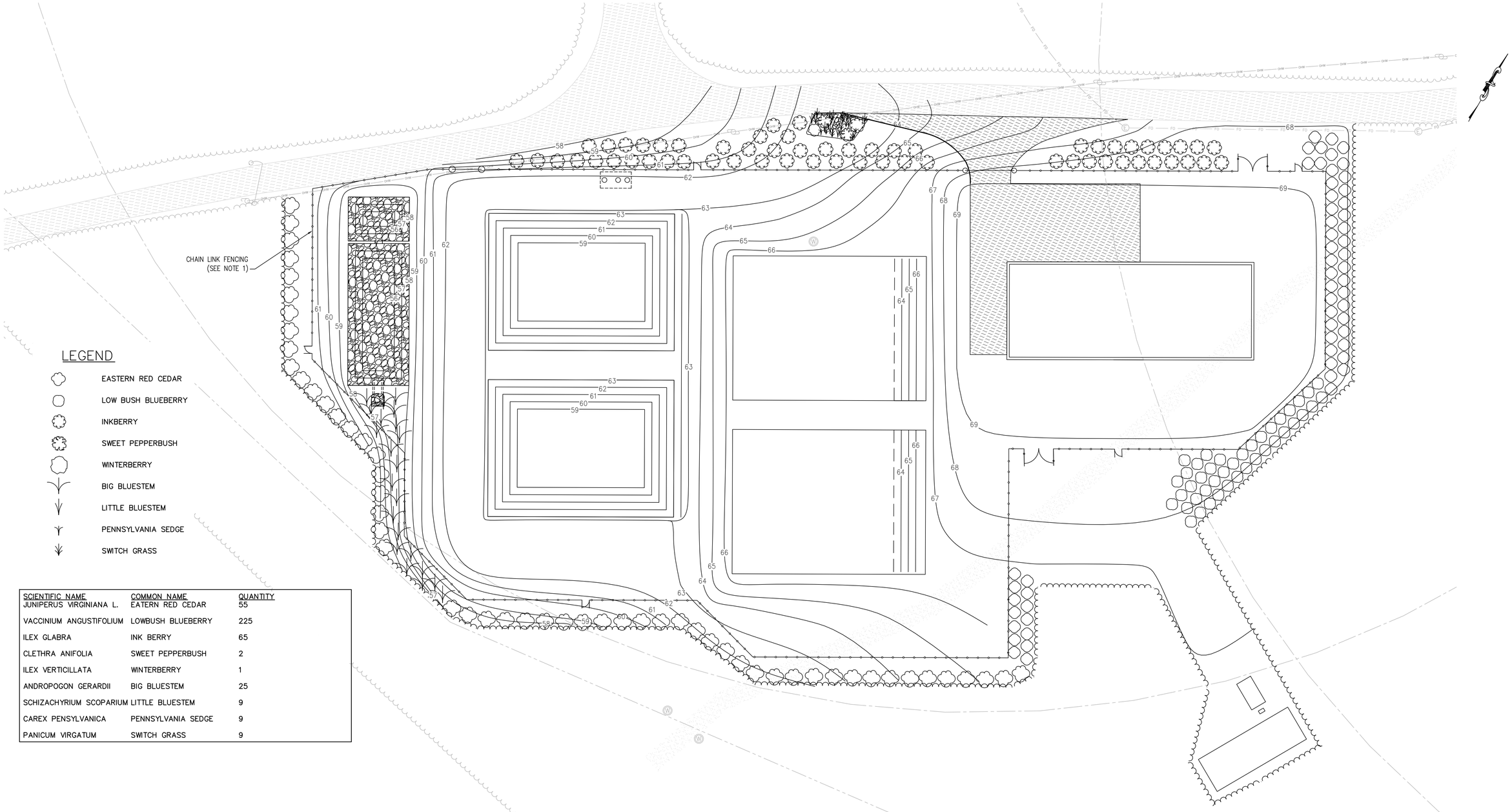

SCIENTIFIC NAME	COMMON NAME	QUANTITY
JUNIPERUS VIRGINIANA L.	EATERN RED CEDAR	55
VACCINIUM ANGUSTIFOLIUM	LOWBUSH BLUEBERRY	225
ILEX GLABRA	INK BERRY	65
CLETHRA ANIFOLIA	SWEET PEPPERBUSH	2
ILEX VERTICILLATA	WINTERBERRY	1
ANDROPOGON GERARDII	BIG BLUESTEM	25
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	9
CAREX PENSYLVANICA	PENNSYLVANIA SEDGE	9
PANICUM VIRGATUM	SWITCH GRASS	9

NOTES:

1. CHAIN LINK FENCING SHALL BE SEVEN FEET TALL.

PLAN VIEW

SCALE: 1" = 20'

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DRINKING WATER PROFESSIONALS
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0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 20'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
LANDSCAPING PLAN

DRAWING NO.:
C-9

SHEET NO. 13 OF 57

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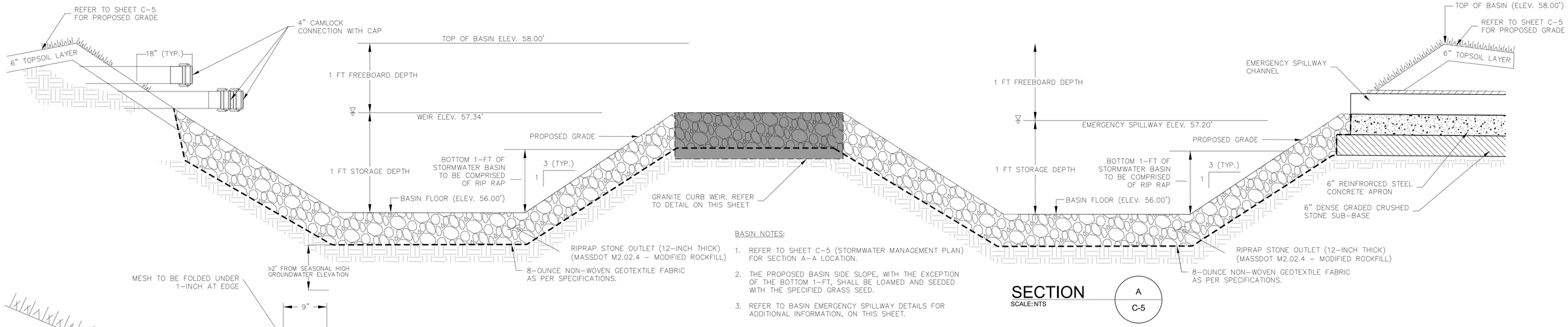
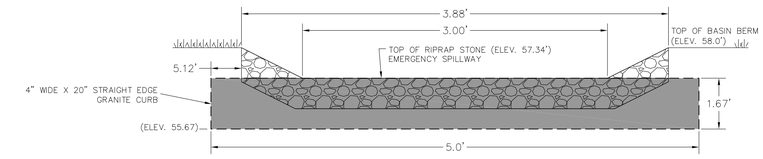


BASIN NOTES:

1. REFER TO SHEET C-5 (STORMWATER MANAGEMENT PLAN) FOR SECTION A-A LOCATION.
2. THE PROPOSED BASIN SIDE SLOPE, WITH THE EXCEPTION OF THE BOTTOM 1-FT, SHALL BE LOAMED AND SEEDED WITH THE SPECIFIED GRASS SEED.
3. REFER TO BASIN EMERGENCY SPILLWAY DETAILS FOR ADDITIONAL INFORMATION, ON THIS SHEET.

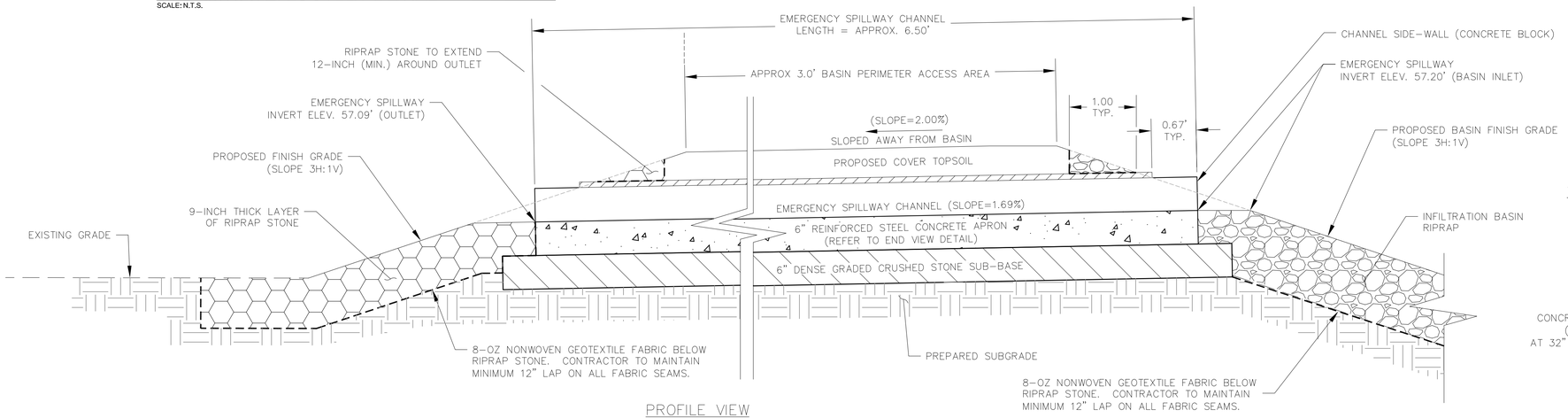
SECTION A
SCALE: NTS

C-5

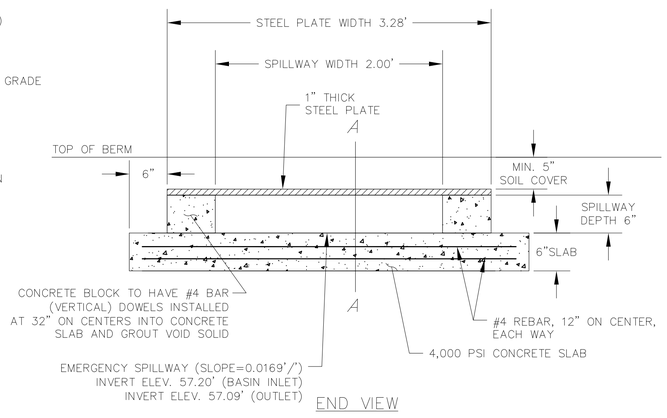


GRANITE CURB WEIR DETIAL
SCALE: N.T.S.

STORMWATER OUTLET DETIAL
SCALE: N.T.S.



PROFILE VIEW



END VIEW

EMERGENCY SPILLWAY DETAIL
SCALE: N.T.S.

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS STEPHEN C. OLSON 49836 REGISTERED PROFESSIONAL ENGINEER

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: STORMWATER BASIN SECTIONS

DRAWING NO.: C-10

SHEET NO. 14 OF 57

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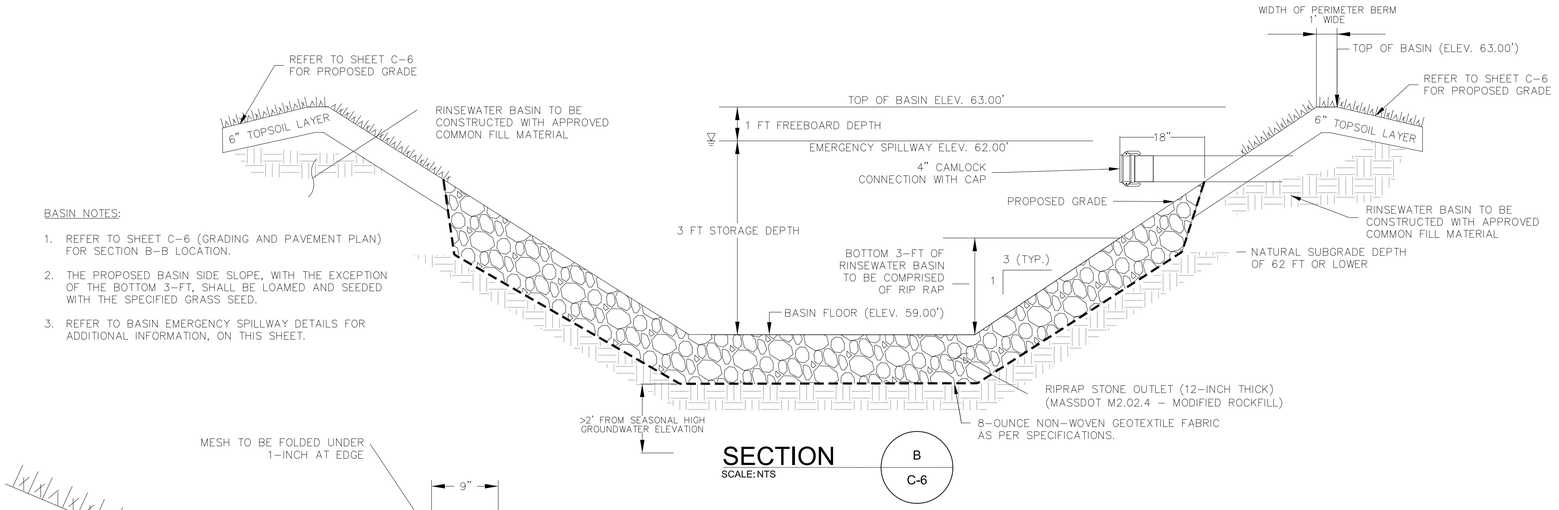


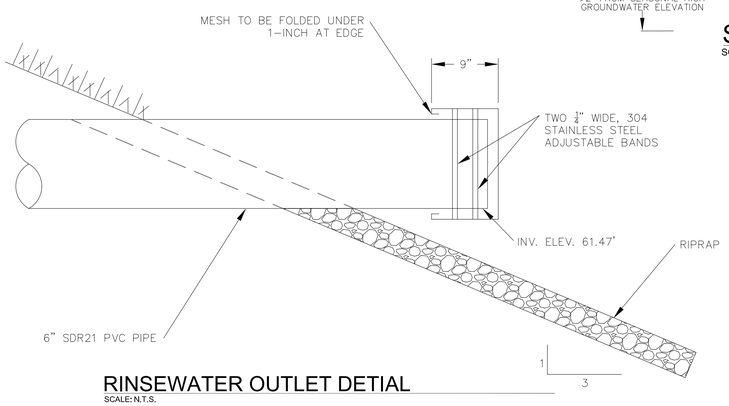
BASIN NOTES:

1. REFER TO SHEET C-6 (GRADING AND PAVEMENT PLAN) FOR SECTION B-B LOCATION.
2. THE PROPOSED BASIN SIDE SLOPE, WITH THE EXCEPTION OF THE BOTTOM 3-FT, SHALL BE LOAMED AND SEEDED WITH THE SPECIFIED GRASS SEED.
3. REFER TO BASIN EMERGENCY SPILLWAY DETAILS FOR ADDITIONAL INFORMATION, ON THIS SHEET.

SECTION

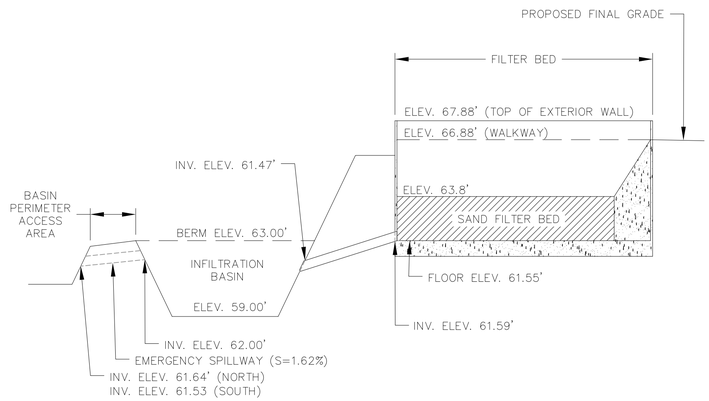
SCALE: NTS

B / C-6



RINSEWATER OUTLET DETIAL

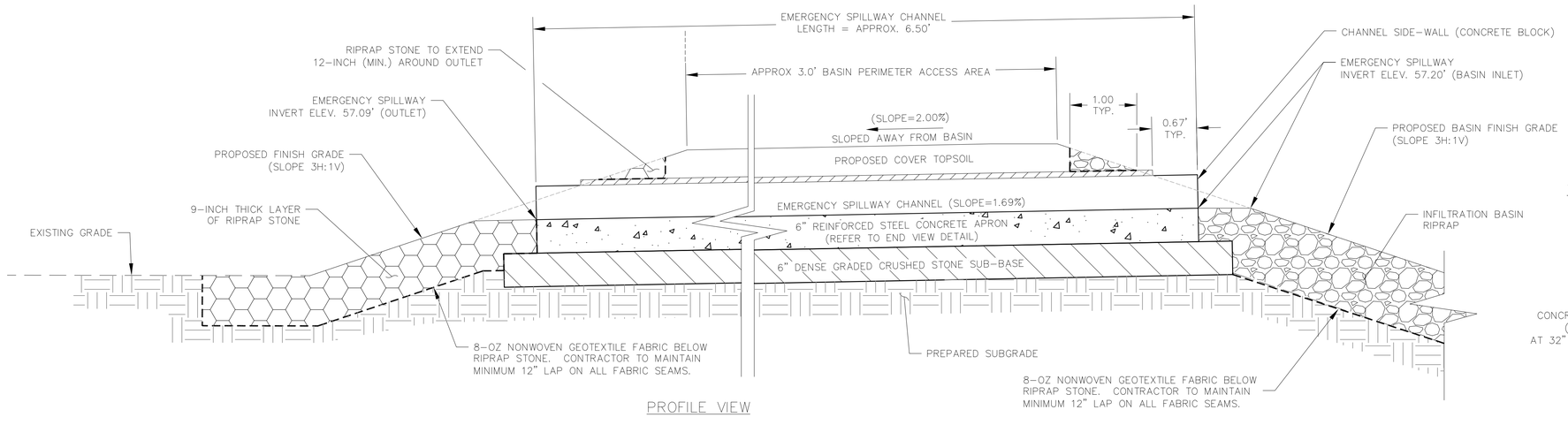
SCALE: N.T.S.



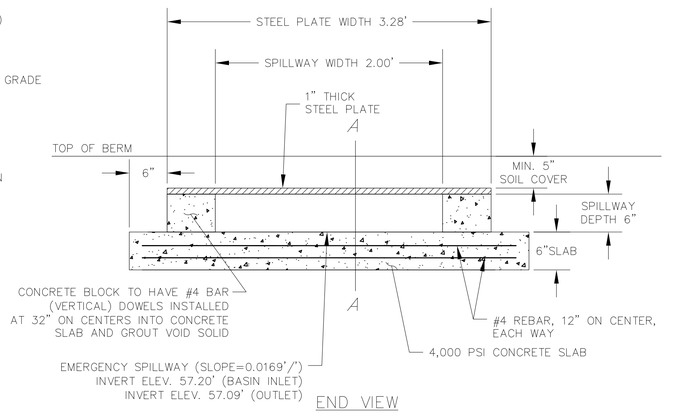
NOTE:
1. PROPOSED SYSTEM IS COMPRISED OF 2 SAND FILTER BEDS AND TWO INFILTRATION BASINS. SECTION SHOWN IS REPRESENTATIVE OF TYPICAL SYSTEM ELEVATIONS.

FILTER BED & INFILTRATION BASIN SYSTEM SECTION

SCALE: N.T.S.



PROFILE VIEW



END VIEW

EMERGENCY SPILLWAY DETAIL

SCALE: N.T.S.

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REVISIONS

NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 37880
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
RINSEWATER INFILTRATION BASIN SECTIONS

DRAWING NO.:
C-11

SHEET NO. 15 OF 57

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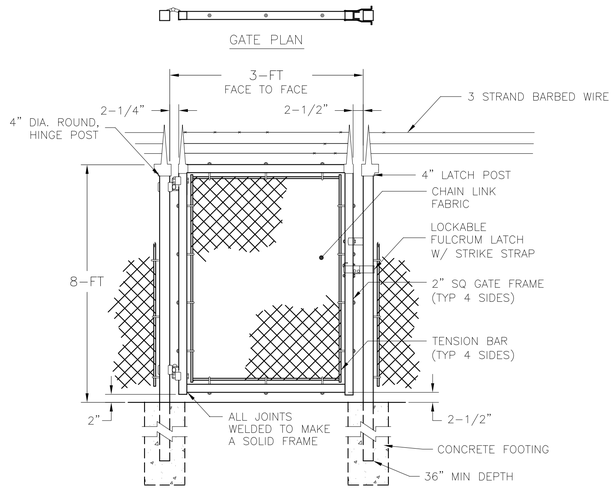
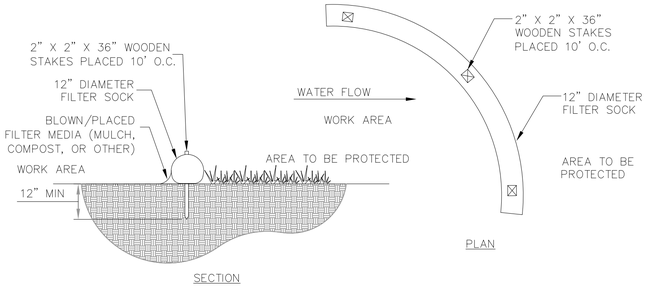


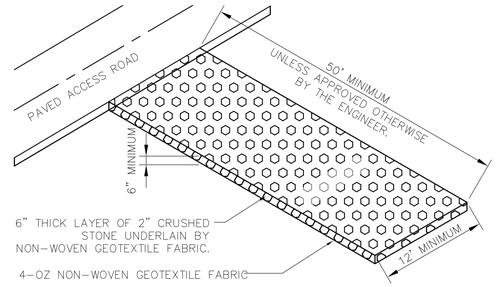
PERSONEL GATE DETAIL

SCALE: N.T.S.



SEDIMENTATION CONTROL BARRIER

SCALE: NOT TO SCALE

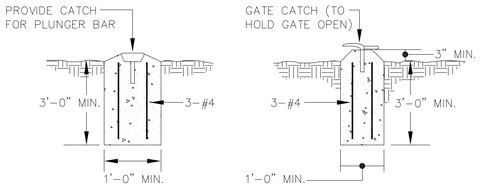


ENTRANCE PAD NOTES:

1. NON–WOVEN GEOTEXTILE FABRIC SHALL BE PLACED OVER THE ENTIRE AREA OF THE CONSTRUCTION ENTRANCE PRIOR TO PLACING STONE.
2. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING SEDIMENT ONTO PUBLIC RIGHT–OF WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, WASHED, OR TRACKED ONTO PUBLIC RIGHT–OF–WAY MUST BE REMOVED PROMPTLY.
3. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR SHALL REMOVE THE CONSTRUCTION ENTRANCE PAD AND RESTORE THE SURFACE TO ORIGINAL CONDITION.

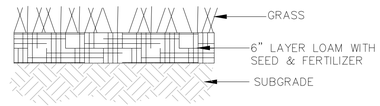
CONSTRUCTION ENTANCE PAD

SCALE: NOT TO SCALE



TYPICAL GATE KEEPER & CATCH DETAIL

SCALE: N.T.S.

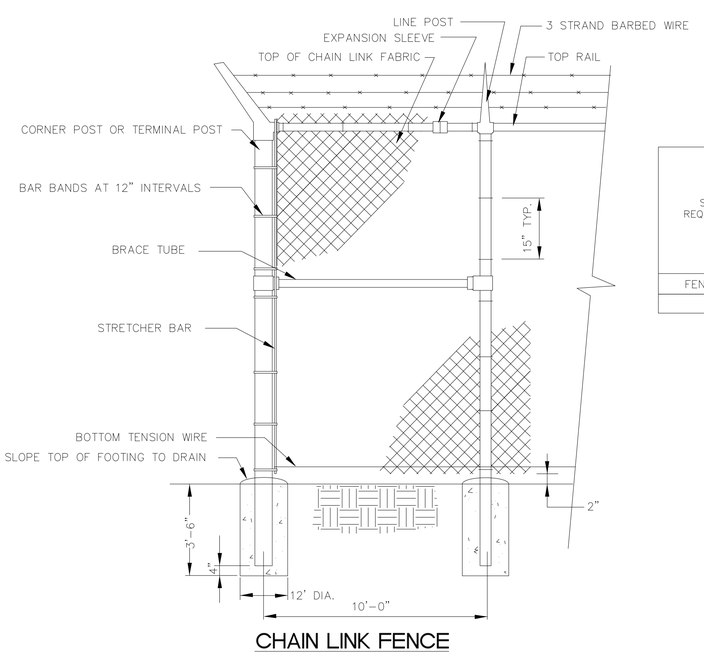


NOTES

1. ALL GRASSED SURFACE SLOPES STEEPER THAN 7H:1V SLOPE SHALL INCLUDE THE INSTALLATION OF EROSION CONTROL BLANKET AFTER THE LOAM, SEED AND FERTILIZER HAVE BEEN PLACE.
2. MATERIAL SPECIFICATIONS FOR THE EROSION CONTROL BLANKET SHALL MEET CURLEX II EROSION CONTROL BLANKET AS MANUFACTURED BY AMERICAN EXCELSIOR COMPANY, OR EQUAL.

GRASSED VEGETATED SURFACE

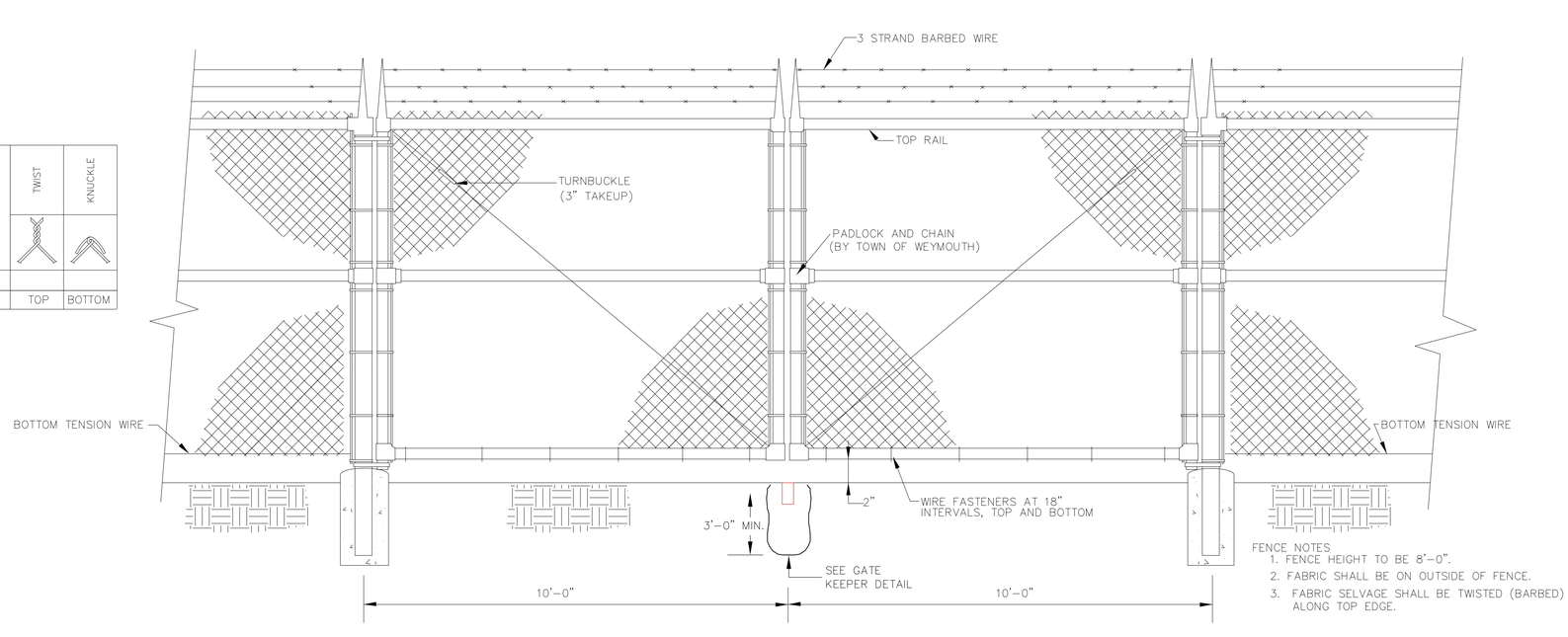
SCALE: NOT TO SCALE



SELVAGE REQUIREMENTS	TWIST	KNUCKLE
FENCE HEIGHT		
8'–0"	TOP	BOTTOM

CHAIN LINK FENCE

N.T.S.



FENCE NOTES

1. FENCE HEIGHT TO BE 8'–0".
2. FABRIC SHALL BE ON OUTSIDE OF FENCE.
3. FABRIC SELVAGE SHALL BE TWISTED (BARBED) ALONG TOP EDGE.

CHAIN LINK FENCE AND ACCESS GATE

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SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS I

DRAWING NO.:
C-12

SHEET NO. 16 OF 57

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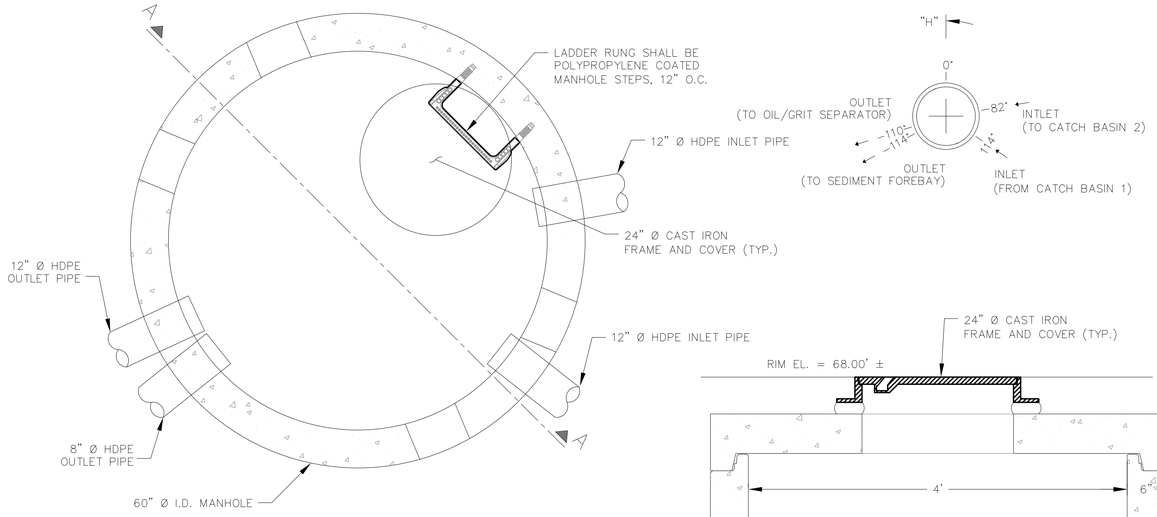
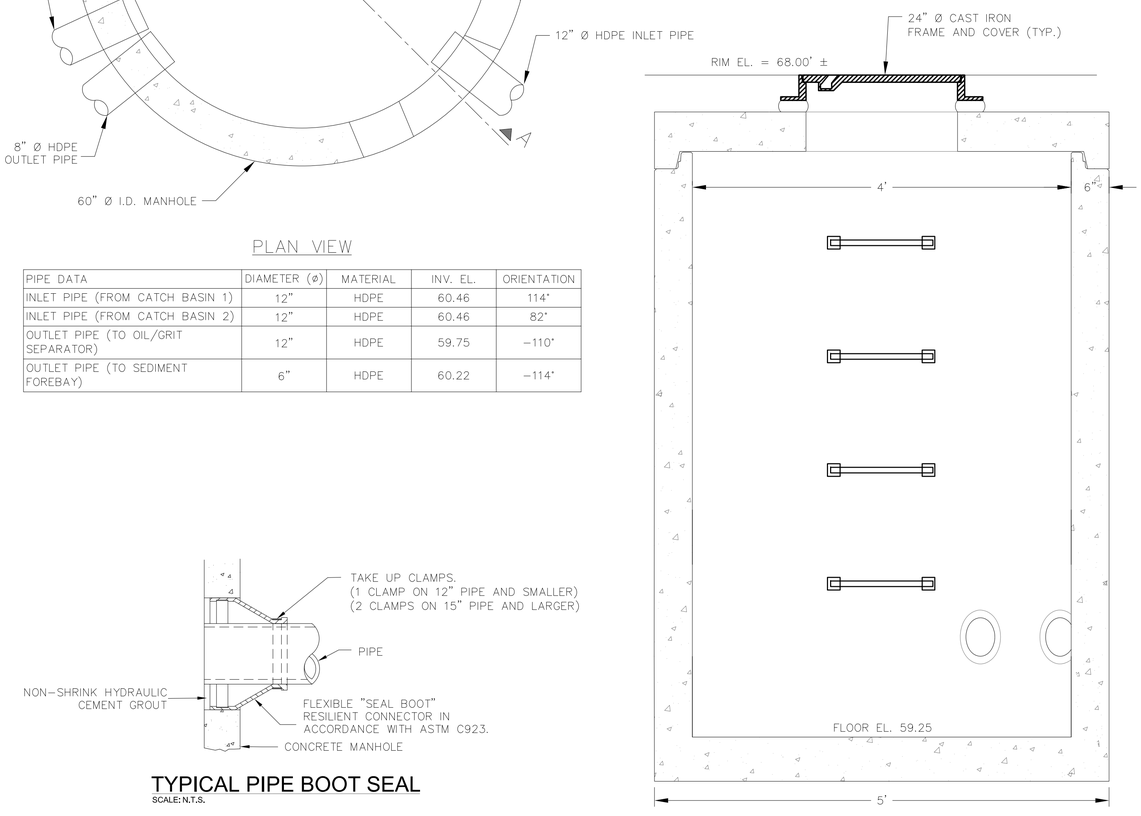


PLAN VIEW

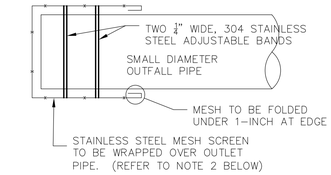
PIPE DATA	DIAMETER (ø)	MATERIAL	INV. EL.	ORIENTATION
INLET PIPE (FROM CATCH BASIN 1)	12"	HDPE	60.46	114°
INLET PIPE (FROM CATCH BASIN 2)	12"	HDPE	60.46	82°
OUTLET PIPE (TO OIL/GRIT SEPARATOR)	12"	HDPE	59.75	-110°
OUTLET PIPE (TO SEDIMENT FOREBAY)	6"	HDPE	60.22	-114°



SECTION A-A

OUTLET CONTROL STRUCTURE DETAIL
SCALE: N.T.S.

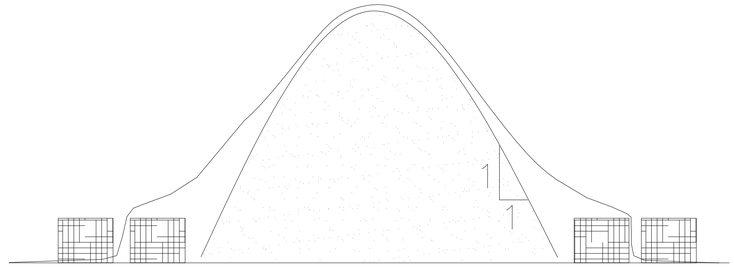
TYPICAL PIPE BOOT SEAL
SCALE: N.T.S.



OUTLET SCREEN NOTE:

1. OUTLET SCREEN TO BE INSTALL ON SMALL DIAMETER OUTFALL PIPING, AS CALLED OUT ON THE PLANS.
2. MESH SCREEN SHALL BE SQUARE, STAINLESS STEEL, TYPE 304, WELDED 2 X 2 MESH (SQUARE), 0.4370" X 0.4370" OPENING, 0.063" THICK (16 GAUGE) WIRE DIAMETER, 76% OPEN AREA.

OUTLET SCREEN DETAIL
SCALE: N.T.S.



STOCKPILE DETAIL
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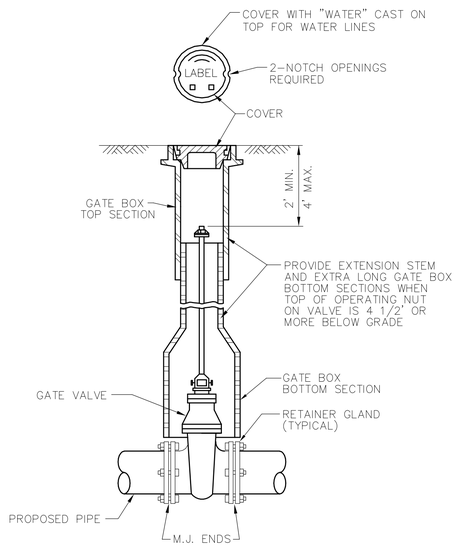
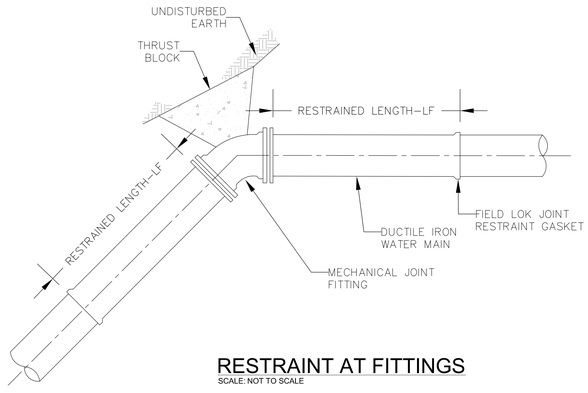
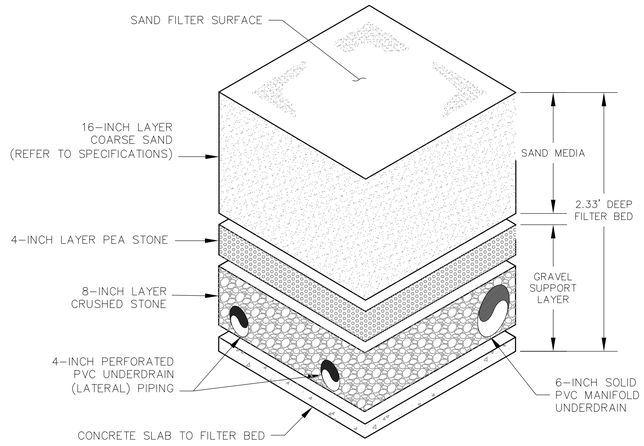


GATE VALVE AND VALVE BOX DETAIL
SCALE: N.T.S.



RESTRAINT AT FITTINGS
SCALE: NOT TO SCALE



SAND MEDIA NOTES:

1. PERFORATED LATERAL UNDERDRAIN PIPING SHALL BE SPACED AT 4-FT (ON CENTER). PERFORATIONS SHALL BE 1/4-INCH DIA., 6 HOLES PER FOOT LOCATED ON THE BOTTOM. REFER TO PERFORATION DETAIL ON SHEET C-11.

SAND FILTER - MEDIA BED
SCALE: N.T.S.

PIPE SIZE	PLUG SF	PLUG LF	TEE SF	TEE LF	90° BEND SF	90° BEND LF	45° BEND SF	45° BEND LF	22 1/2° BEND SF	22 1/2° BEND LF	11 1/4° BEND SF	11 1/4° BEND LF
6"	2.8	37	2.8	32	4.0	18	2.1	7	1.1	4	1.0	2
8"	4.8	48	4.8	43	6.8	23	3.7	10	1.9	5	1.0	2
10"	7.3	58	7.3	53	10.3	28	5.6	12	2.8	6	1.4	3
12"	10.3	69	10.3	63	14.5	33	7.9	14	4.0	6	2.0	3
16"	17.8	89	17.8	83	25.2	42	13.6	17	7.0	8	3.5	4
20"	27.5	108	27.5	102	38.9	51	21.0	21	10.7	10	5.4	5
24"	39.2	127	39.2	121	55.4	59	30.0	25	15.3	12	7.7	6

RESTRAINT NOTES:

1. MINIMUM SURFACE AREA OF CONCRETE THRUST BLOCK AGAINST UNDISTURBED EARTH – SF (SQUARE FEET)
2. MINIMUM RESTRAINED LENGTH OF PIPE ON EITHER SIDE OF FITTING – LF (LINEAR FEET)
3. THE "SF" VALUES IN THE ABOVE TABLE ARE BASED ON 3,000 P.S.F. SOIL BEARING CAPACITY, 150 P.S.I. TEST PRESSURE AND A 1.5 FACTOR OF SAFETY.
4. THE "LF" VALUES IN THE ABOVE TABLE ARE BASED ON A TYPE 3 LAYING CONDITION, A SAND SILT SOIL DESIGNATION, A 5 FOOT RUN LENGTH, 150 P.S.I. TEST PRESSURE AND A 1.5 FACTOR OF SAFETY.

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SCALE ADJUSTMENT GUIDE
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BAR IS ONE INCH ON ORIGINAL DRAWING

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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: CIVIL DETAILS II

DRAWING NO.: C-13

SHEET NO. 17 OF 57

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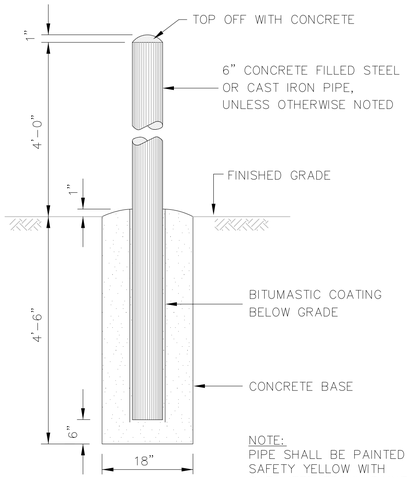
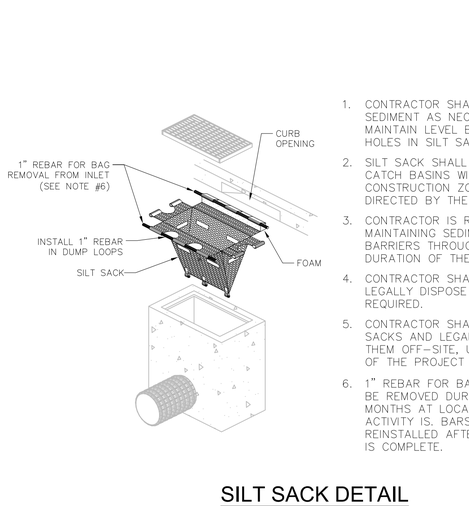


NOTE:
PIPE SHALL BE PAINTED SAFETY YELLOW WITH CATALIZED EPOXY PAINT

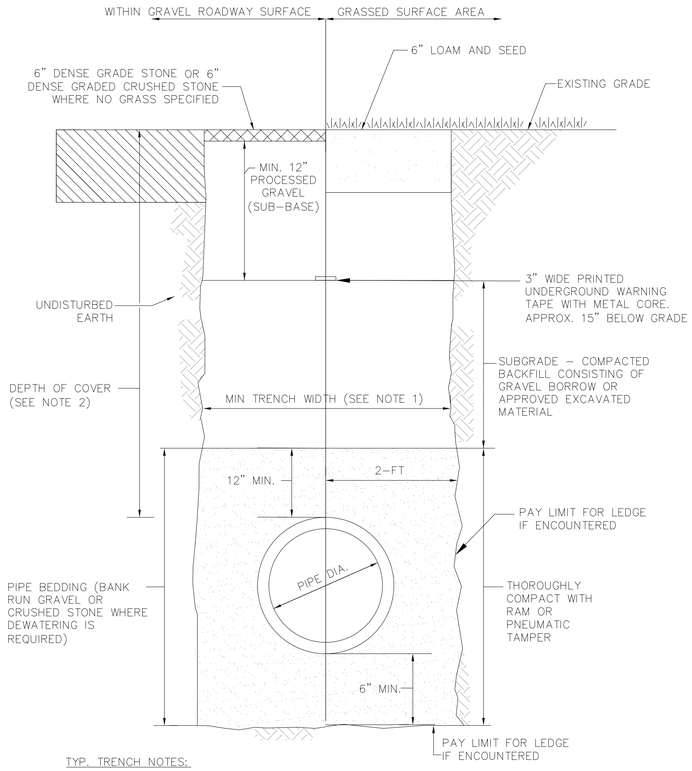
BOLLARD DETAIL

N.T.S.



1. CONTRACTOR SHALL REMOVE SEDIMENT AS NECESSARY TO MAINTAIN LEVEL BELOW OVERFLOW HOLES IN SILT SACK.
2. SILT SACK SHALL BE USED ON ALL CATCH BASINS WITHIN CONSTRUCTION ZONE OR AS DIRECTED BY THE AUTHORITY.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SEDIMENTATION BARRIERS THROUGHOUT THE DURATION OF THE PROJECT.
4. CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF SEDIMENT AS REQUIRED.
5. CONTRACTOR SHALL REMOVE SILT SACKS AND LEGALLY DISPOSE OF THEM OFF-SITE, UPON COMPLETION OF THE PROJECT AND AS REQUIRED.
6. 1" REBAR FOR BAG REMOVAL SHALL BE REMOVED DURING WINTER MONTHS AT LOCATIONS WHERE PLOW ACTIVITY IS. BARS SHALL BE REINSTALLED AFTER SNOW SEASON IS COMPLETE.

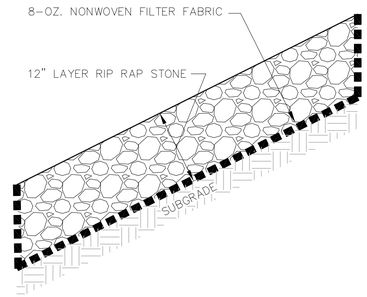
SILT SACK DETAIL



TYP. TRENCH NOTES:
1. MIN. COVER 5' COVER FOR WATER MAIN
2. MIN. 3' COVER FOR STORM DRAIN

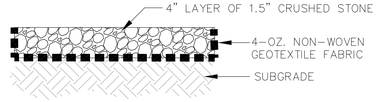
TYPICAL TRENCH DETAIL

SCALE: N.T.S.



RIPRAP SLOPE PROTECTION DETAIL

SCALE: N.T.S.



NOTE:
1. CRUSHED STONE SHALL MEET MASSDOT M2.01.7 SPECIFICATION AND GRADATION REQUIREMENTS.
2. CONTRACTOR SHALL PREPARE SUBGRADE TO RECEIVE THE CRUSHED STONE AND SHALL PERFORM AT A MINIMUM PROOF ROLLS THE SUBGRADE FOUR TIMES WITH A PLATE COMPACTOR OR AS DIRECTED BY THE ENGINEER BEFORE PLACING CRUSHED STONE.
3. UPON PLACEMENT OF MATERIAL AND REACHING FINAL GRADE, CONTRACTOR SHALL TAMP CRUSHED STONE WITH PLATE COMPACTOR TO ENSURE MATERIAL IS WELL CONSOLIDATED.

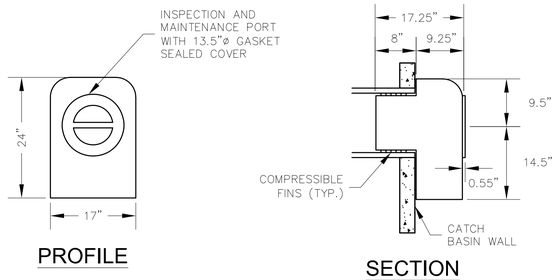
CRUSHED STONE PAD DETAIL

SCALE: N.T.S.

GENERAL NOTES:
1. TEST WELL SHALL BE ANCHORED WITH REBAR.
2. SEE SHEET C-5 FOR STORMWATER DRY WELL LOCATIONS.
3. STONE FILL SHALL BE 1.5"-3.0" IN DIAMETER.

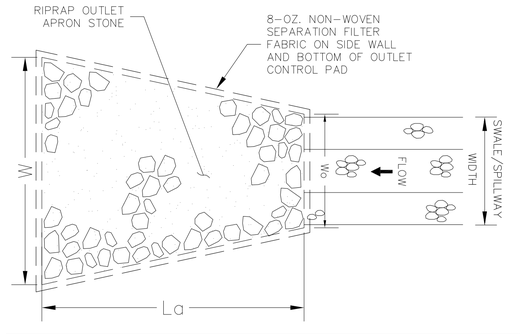
STORMWATER DRY WELL

SCALE: N.T.S.



HDPE CATCHBASIN HOOD

SCALE: N.T.S.



DISCHARGE POINT	La	Wo	W	RIPRAP STONE	LAYER THICKNESS
BASIN EMERGENCY SPILLWAY	6.5'	5.0'	6.5'	D50=4"	9"

RIPRAP OUTLET CONTROL PAD DETAIL

SCALE: N.T.S.

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS III

DRAWING NO.:
C-14
SHEET NO. 18 OF 57

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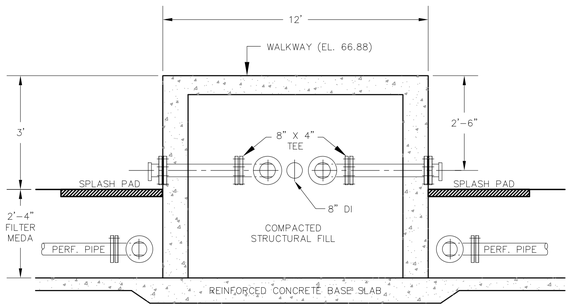
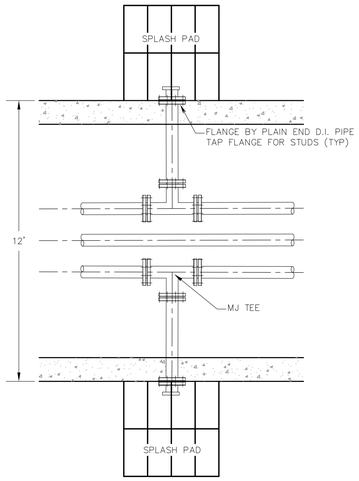
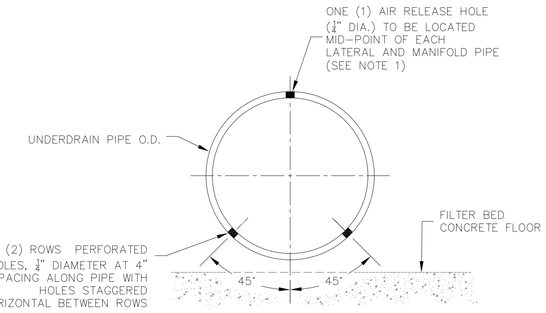


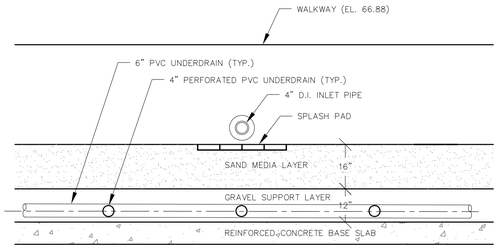
SECTION B - B
SCALE: NTS



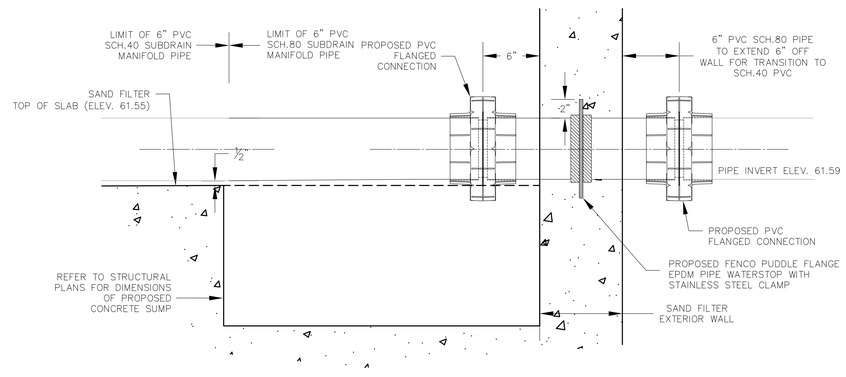
PLAN VIEW - FILTER BED DISCHARGE PIPE
SCALE: NTS



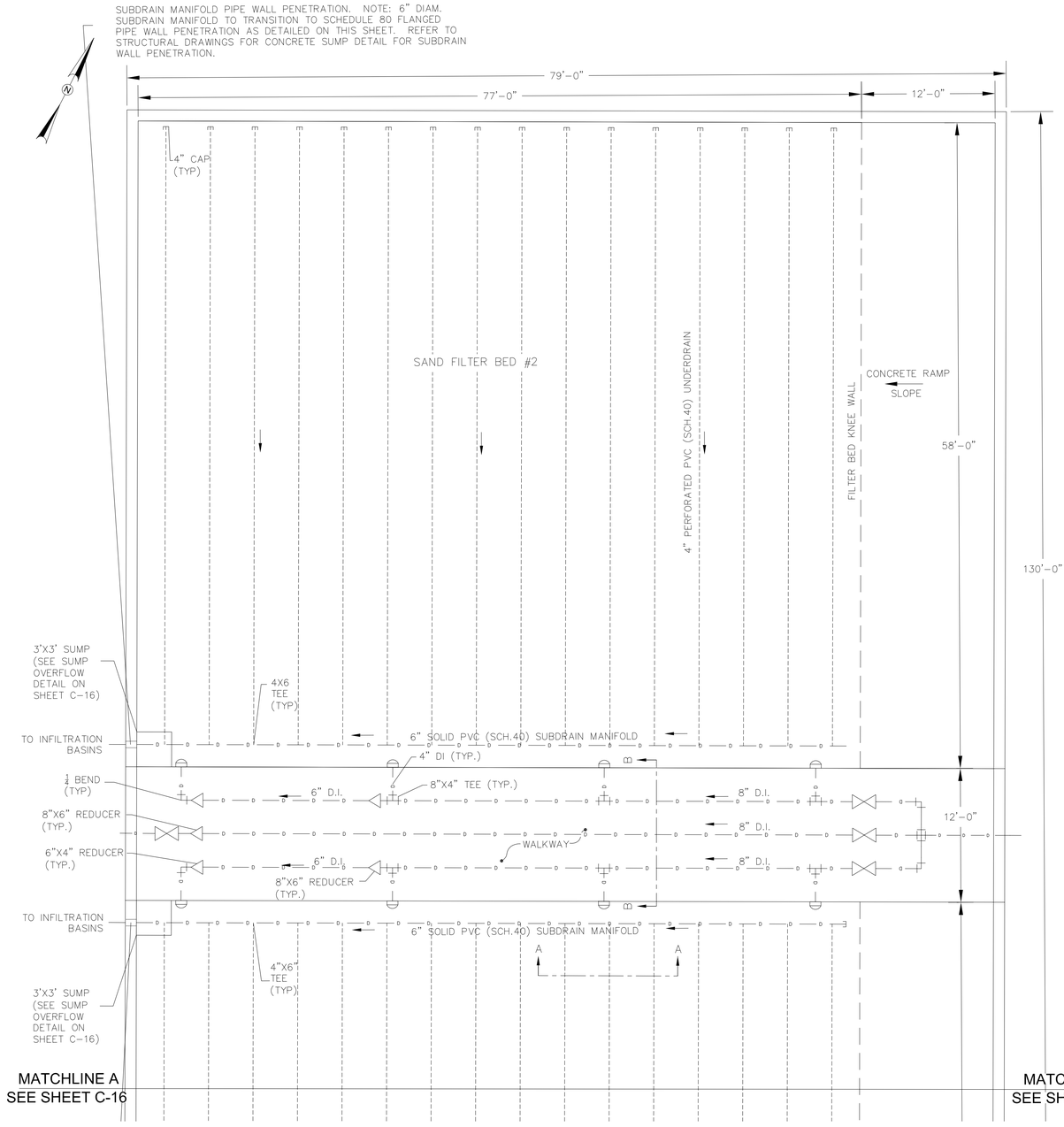
PERFORATION HOLE PLACEMENT DETAIL FOR FILTER BED UNDERDRAIN
SCALE: N.T.S.



SECTION A - A
SCALE: NTS



6-INCH SUBDRAIN MANIFOLD WALL PENETRATION DETAIL
SCALE: N.T.S.



FILTER BED PLAN VIEW
SCALE: NTS

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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS IV

DRAWING NO.:
C-15
SHEET NO. 19 OF 57

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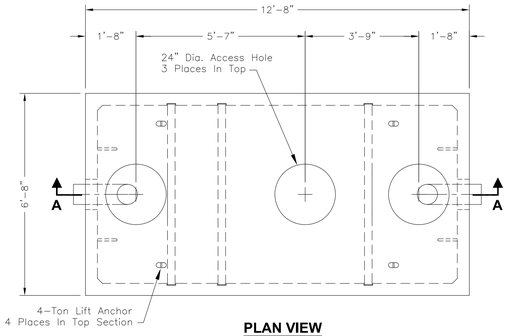
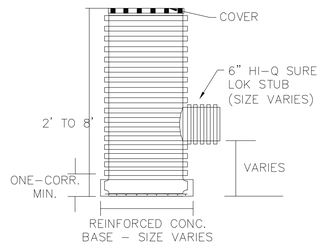
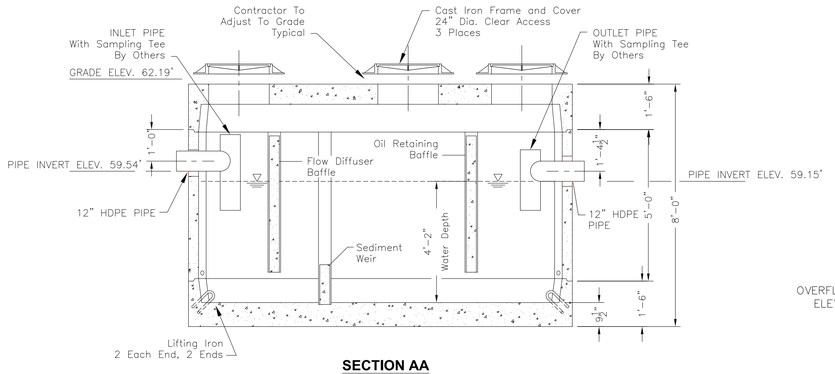


PLAN VIEW
Castings Not Shown



ROOF DRAIN ACCESS CLANOUT
SCALE: N.T.S.

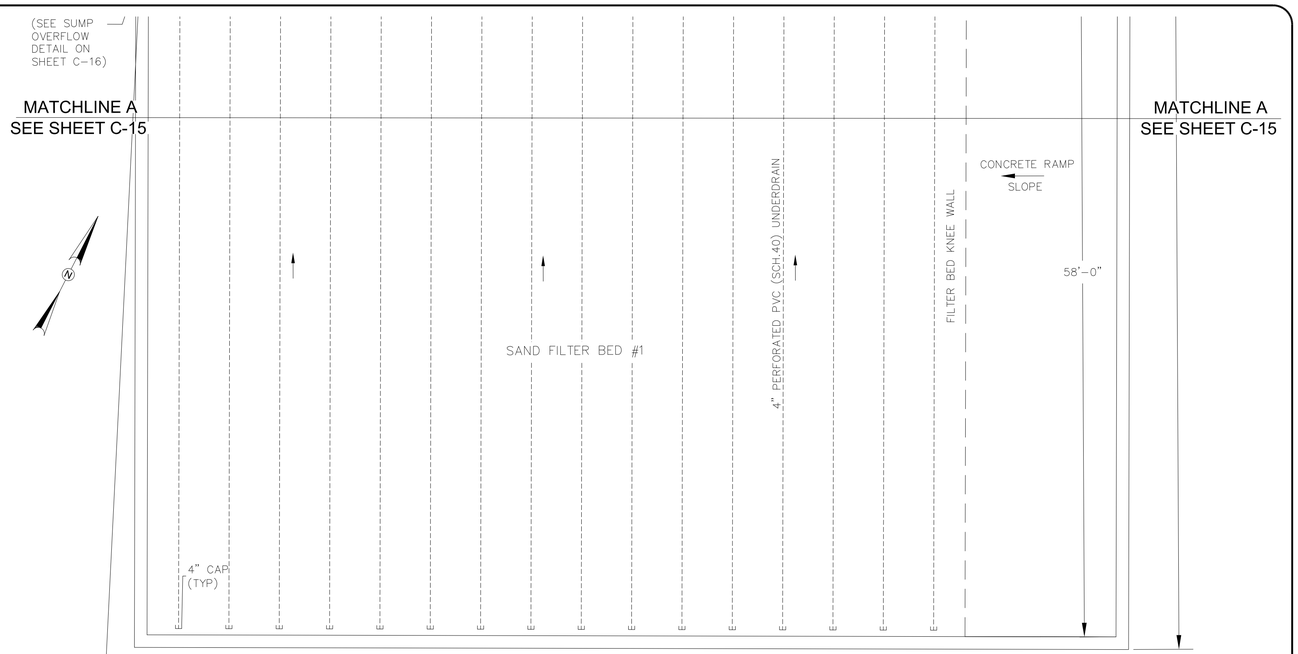


SECTION AA

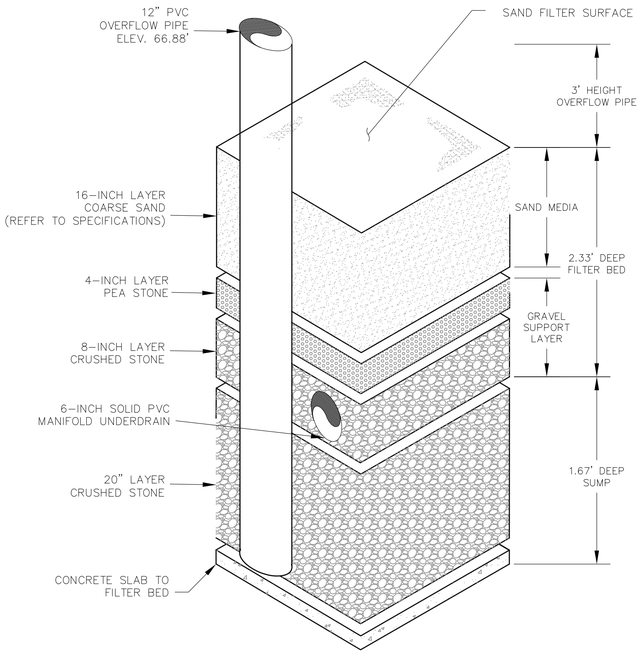
GENERAL NOTES:

1. CONCRETE: 28 DAY COMPRESSIVE STRENGTH f'c = 7,000 PSI
2. STEEL REINFORCEMENT: ATSMA-615 GRADE 60
3. MESH: ATSM A-185 GRADE 65
4. DESIGN: ACL-318-05 BUILDING CODE
   ATSM C-890 MINIMUM STRUCTURAL DESIGN
5. LOADS: HS-20 TRUCK WHEEL W/ 30% IMPACT PER AASHTO
6. OIL/GRIT SEPARATOR CAPACITY = 2,200 GALLONS
7. OIL/GRIT SEPARATOR UNIT SHALL BE OLDCASTLE PRECAST MODEL 612SA OR EQUAL.

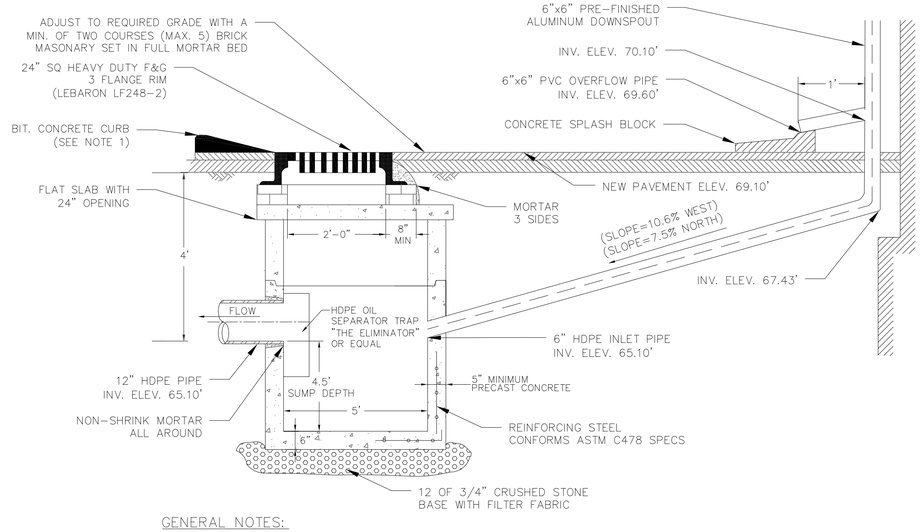
OIL / GRIT SEPARATOR
SCALE: 1" = 30'



FILTER BED PLAN VIEW
SCALE: 3/16" = 1'



SUMP OVERFLOW
SCALE: N.T.S.



GENERAL NOTES:

1. MANHOLE DESIGN TO CONFORM TO LASTEST ASTM C478 SPEC. FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".

PRECAST CONCRETE CATCH BAISN
SCALE: N.T.S.

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DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS V

DRAWING NO.:
C-16
SHEET NO. 20 OF 57

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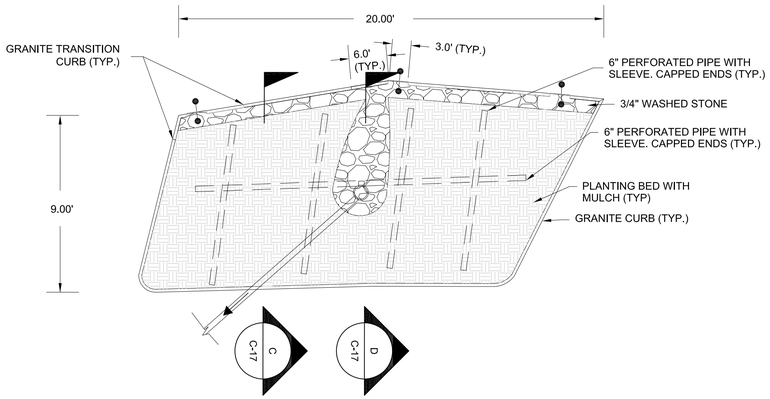
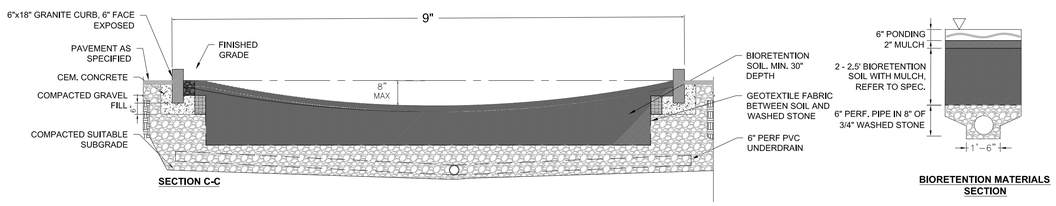
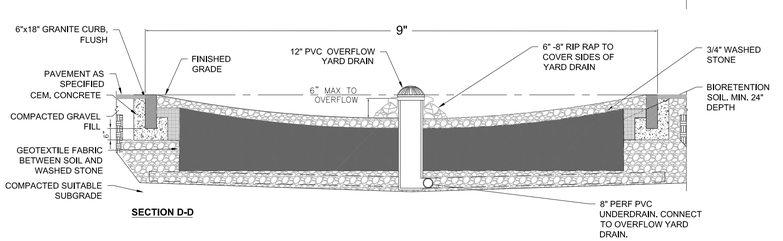


LAYOUT PLAN

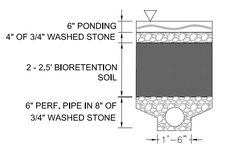


SECTION C-C

BIORETENTION MATERIALS SECTION



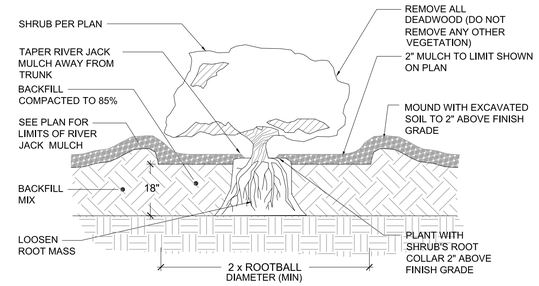
SECTION D-D



BIORETENTION MATERIALS SECTION

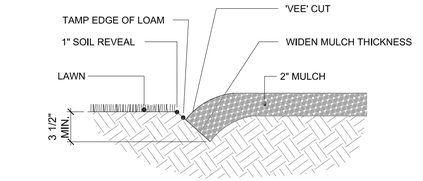
FILTERING RAIN GARDEN

SCALE: N.T.S.



CONTAINER GROWN TREE & SHRUB PLANTING

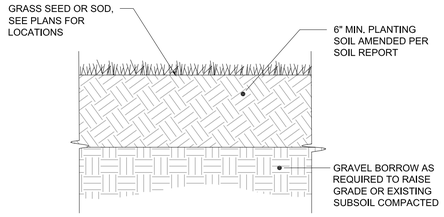
SCALE: N.T.S.



NOTE; LOCATE BEDLINE AS SHOWN ON PLAN.

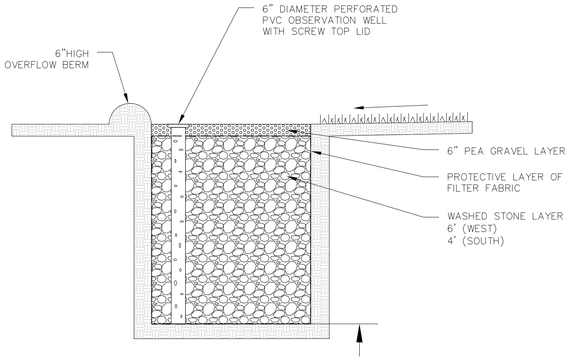
BEDLINE EDGE

SCALE: N.T.S.



LOAM AND SEED OR SOD

SCALE: N.T.S.

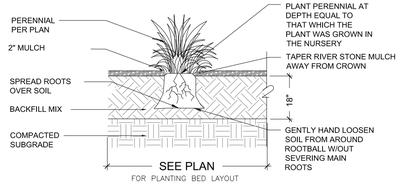


GENERAL NOTES:

1. STONE FILL SHALL BE 2"–5" IN DIAMETER.

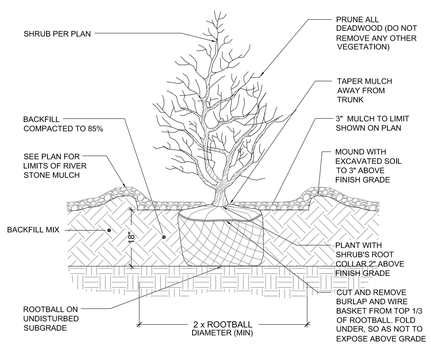
INFILTRATION TRENCH

SCALE: N.T.S.



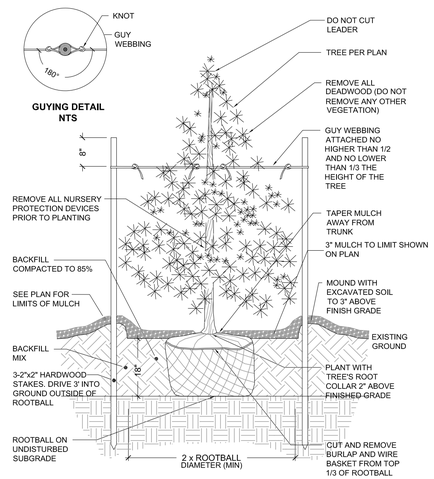
PERENNIAL AND GROUND COVER PLANTING

SCALE: N.T.S.



SHRUB PLANTING

SCALE: N.T.S.



NOTE:
AFTER THE GUARANTEE PERIOD THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REMOVAL OF STAKES AND GUY WEBBING.

EVERGREEN TREE STAKING & PLANTING

SCALE: N.T.S.

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REVISIONS

NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 36,116
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS VI

DRAWING NO.:
C-17

SHEET NO. 21 OF 57

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CODE REVIEW

APPLICABLE BUILDING CODES / REGULATIONS

BUILDING	780 CMR: MASSACHUSETTS STATE BUILDING CODE, 10TH E. INTERNATIONAL BUILDING CODE (IBC) 2021 INTERNATIONAL EXISTING BUILDING CODE (IEBC) 2021 INTERNATIONAL FIRE CODE (IFC) 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC) 2021	PLUMBING	248 CMR: MASSACHUSETTS PLUMBING CODE
		MECHANICAL	INTERNATIONAL MECHANICAL CODE (IMC) 2021
		ELECTRICAL	527 CMR 12.00: MASSACHUSETTS ELECTRICAL CODE NATIONAL ELECTRICAL CODE (NEC) 2018
ACCESSIBILITY	521 CMR MASSACHUSETTS ARCHITECTURAL ACCESS BOARD (MAAB) AMERICANS WITH DISABILITIES ACT GUIDELINES (ADAG)	GAS AND FOSSIL FUEL	248 CMR INTERNATIONAL FUEL GAS CODE (IFGC) 2015
FIRE PROTECTION	527 CMR: MASSACHUSETTS FIRE PREVENTION REGULATIONS NATIONAL FIRE PROTECTION ASSOCIATION (NFPA 1) 2015		

OCCUPANCY CLASSIFICATION AND SQUARE FOOTAGE

FLOOR LEVEL	OCCUPANCY	OCCUPANCY CLASS	SQ FT	CONSTRUCTION TYPE	NOTES	CODE SECTION
FIRST	HIGH HAZARD GROUP	H-4	4,026	2-B	PRE ENGINEERED METAL BUILDING, WITH STEEL FRAMING AND INSULATED METAL PANEL WALLS AND ROOF.	IBC SECTION 310

FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS

BUILDING ELEMENT	TYPE 2-B	NOTES	CODE SECTION
PRIMARY STRUCTURAL FRAME ()	0 HOUR	REFER TO SECTION 202 & FOOTNOTE "a"	IBC TABLE 601
BEARING WALL - EXTERIOR	0 HOUR	NOT LESS THAN FIRE-RESISTANCE RATING BASED ON DISTANCE SEPARATION (TABLE 602) & SECTION 704.10	IBC TABLE 601
BEARING WALL - INTERIOR	0 HOUR		IBC TABLE 601
NON-BEARING WALL & PARTITION - EXTERIOR	SEE TABLE 602		IBC TABLE 601
NON-BEARING WALL & PARTITION - INTERIOR	0 HOUR	NOT LESS THAN FIRE-RESISTANCE RATING REQUIRED BY OTHER SECTIONS OF THE IBC CODE	IBC TABLE 601
FLOOR CONSTRUCTION & ASSOCIATED SECONDARY MEMBERS	0 HOUR	REFER TO SECTION 202	IBC TABLE 601
ROOF CONSTRUCTION & ASSOCIATED SECONDARY MEMBERS	0 HOUR	REFER TO SECTION 202 & FOOTNOTE "b" & "c"	IBC TABLE 601
OCCUPANCY SEPARATION	1 HOUR	SEPARATION BETWEEN F-1 AND H-4 OCCUPANCIES.	IBC TABLE 508.4

ALLOWABLE BUILDING HEIGHT ABOVE GRADE PLANE

OCCUPANCY CLASSIFICATION	TYPE OF CONST.	ALLOWED BLDG. HEIGHT	REQS.	NOTES	CODE SECTION
H-4	TYPE 2-B	75 FEET	S	PROPOSED - 32' - 9"	IBC TABLE 504.3

NUMBER OF STORIES ABOVE GRADE PLANE

OCCUPANCY	TYPE OF CONSTRUCTION	ALLOWED STORIES	REQS.	NOTES	CODE SECTION
F-2	TYPE 2-B	4 STORIES	S	PROPOSED - 1 STORY	IBC TABLE 504.4

CODE REVIEW

OCCUPANT LOAD CALCULATIONS

LEVEL	FUNCTION OF SPACE	SQ FT	RATIO	OCCUPANTS	FUNCTION OF SPACE	NOTES	CODE SECTION
FIRST FLOOR	F-1	286	100 GROSS	3	INDUSTRIAL WATER TREATMENT PLANT		IBC TABLE 1004.1.2
FIRST FLOOR	H-4	3,740	100 GROSS	38	INDUSTRIAL WATER TREATMENT PLANT		
TOTAL OCCUPANT LOAD				41			

MEANS OF EGRESS

ELEMENT	FLOOR LEVEL	REQUIRED	PROVIDED	NOTES	CODE SECTION
MINIMUM AMOUNT OF EXITS	FIRST	2	4	FROM 1 TO 500 OCCUPANTS = 2 EXITS REQUIRED. TWO EXITS WHEN OCCUPANT LOAD OR THE COMMON PATH OF EGRESS TRAVEL DISTANCE EXCEEDS THE VALUES LISTED	IBC TABLE 1006.3.1 IBC TABLE 1006.2.1
MAXIMUM COMMON PATH OF EGRESS	FIRST	75 FT MAX.	47' - 0"	COMMON PATH EGRESS DISTANCE (H-4 OCCUPANCY)	IBC TABLE 1006.2(2)
MAX. EXIT ACCESS TRAVEL DISTANCE	FIRST	175 FT MAX.	66' - 0"	EGRESS TRAVEL DISTANCE (H-4 OCCUPANCY)	IBC TABLE 1017.2
EGRESS FROM CONTROL ROOM 102	ONE EGRESS FROM CONTROL ROOM 102 PERMITTED DUE TO ROOM BEING AT GRADE LEVEL AND DISCHARGING DIRECTLY TO EXTERIOR OF BUILDING. CONTROL ROOM CANNOT EGRESS THROUGH WATER TREATMENT FACILITY DUE TO BEING A HIGHER HAZARD SPACE.				IBC 1006.3.4 SINGLE EXITS

MINIMUM CLEAR WIDTH OF MEANS OF EGRESS COMPONENTS

EGRESS COMPONENT	REQUIRED	PROVIDED	NOTES	CODE SECTION
DOOR	32"	36" / 36" / 36" / 36"	SWINGING DOORS CLEAR OPENINGS SHALL BE MEASURED FROM THE DOOR FACE TO THE STOP, WHEN DOOR OPEN 90 DEGREES	IBC 1010.1.1

OPAQUE THERMAL ENVELOPE INSULATION COMPONENTS INSULATION MIN. REQS. (R-VALUE METHOD)

CLIMATE ZONE	5A	PROJECT SHALL COMPLY WITH 9TH EDITION OF THE MASSACHUSETTS STATE BUILDING CODE 780 AND THE 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC) AS AMENDED			
BUILDING ELEMENT		TYPE OF CONSTRUCTION	REQUIRED R-VALUE	NOTES	CODE SECTION
ROOF		METAL BUILDINGS	R-30		IECC TABLE C402.1.3
WALLS ABOVE GRADE		METAL BUILDINGS	R-27 CI	CI = CONTINUOUS INSULATION / WALLS TO BE R-30	IECC TABLE C402.1.3
WALLS BELOW GRADE			R-7.5		IECC TABLE C402.1.3
SLAB ON GRADE		UNHEATED SLAB	R-15		IECC TABLE C402.1.3

BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS (C402.4)

CLIMATE ZONE	5A	PROJECT SHALL COMPLY WITH 9TH EDITION OF THE MASSACHUSETTS STATE BUILDING CODE 780 AND THE 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC) AS AMENDED			
FENESTRATION VALUE		TYPE OF CONSTRUCTION	REQUIRED VALUE	NOTES	CODE SECTION
U VALUE FIXED FENESTRATION		VERTICAL FENESTRATION	U=0.36		IECC TABLE C402.4
SHGC FIXED FENESTRATION		FIXED PF<0.2	SHGC=0.38		IECC TABLE C402.4

CHEMICAL STORAGE

THE FOLLOWING CHEMICALS WILL BE STORED IN THE FACILITY. THESE CHEMICALS, IN EXCESS OF THE QUANTITY DEFINED IN TABLE 307.1(2), TRIGGERS THE REQUIREMENT OF H-4 OCCUPANCY, HIGH HAZARD GROUP FOR HEALTH HAZARDS:

- POTASSIUM HYDROXIDE (KOH) 45% - BULK STORAGE - 4,000 GALLONS, DAY TANK - 200 GALLONS CORROSIVE, NFPA RATINGS (HEALTH 3, FIRE 0, REACTIVITY 1)
- SODIUM HYPOCHLORITE (NaOCl) 12.5% - BULK STORAGE - 800 GALLONS, DAY TANK - 50 GALLONS NFPA RATINGS (HEALTH 2, FIRE 0, REACTIVITY 1)

FIRE PROTECTION REQUIREMENTS

BUILDING ELEMENT	REQUIRED	PROVIDED	NOTES	CODE SECTION
SPRINKLER SYSTEM	YES	YES	FULLY SPRINKLERED, SEE MEP DRAWINGS	
PORTABLE FIRE EXTINGUISHERS	YES	YES	PROVIDED 1 PORTABLE FIRE EXTINGUISHER WITHIN EACH KITCHEN.	IBC 906
FIRE ALARM & DETECTION	YES	YES	PROVIDED, SEE MEP DRAWINGS	IBC 907

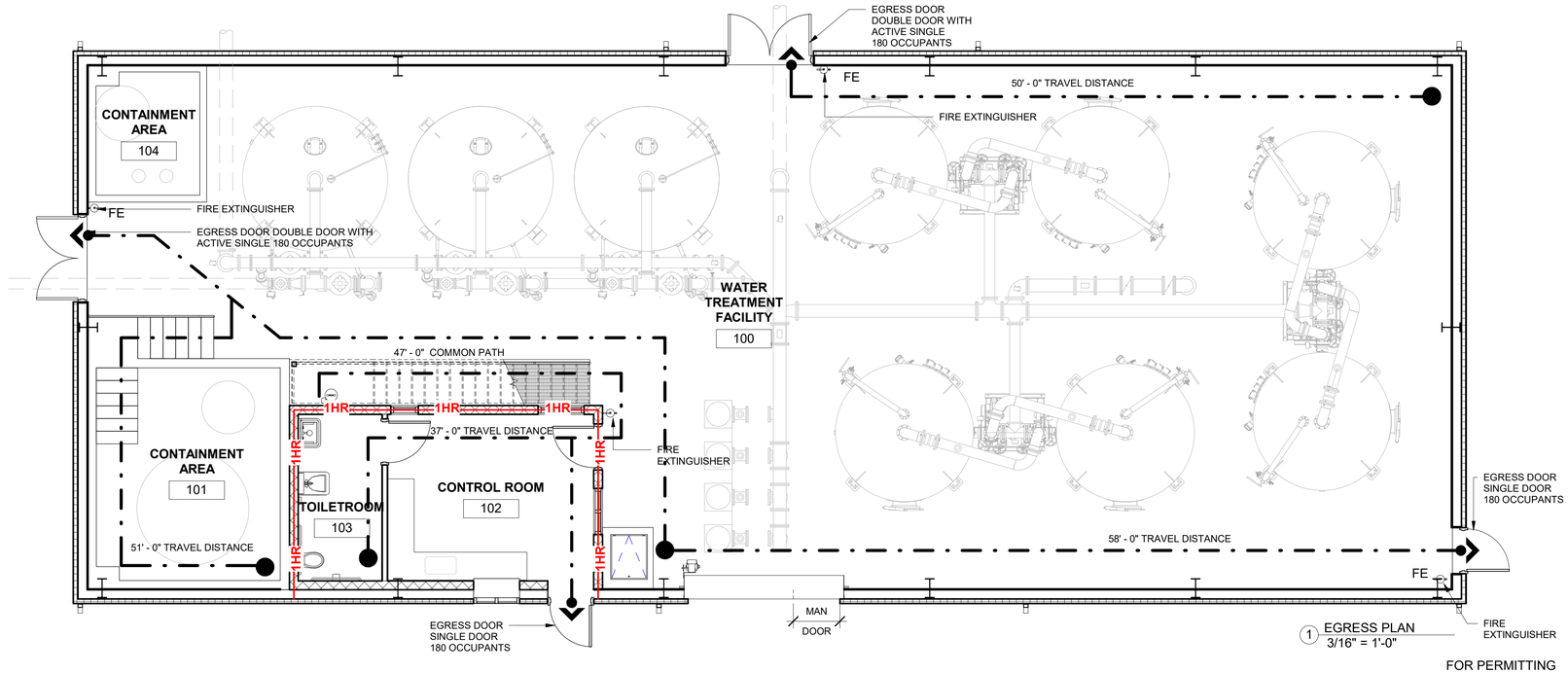
GENERAL NOTES

1. ALL MATERIALS AND WORK FOR THIS PROJECT SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE CONTRACT DOCUMENTS.
2. ALL MATERIALS AND WORK IN THIS PROJECT SHALL BE IN STRICT ACCORDANCE WITH MASSACHUSETTS BUILDING CODE AND MASSACHUSETTS ARCHITECTURAL ACCESS BOARD.
3. CONTRACTOR AND SUBCONTRACTORS SHALL INSPECT PROJECT'S SITE AND BUILDING'S PREMISES TO BE AWARE OF ALL EXISTING CONDITIONS BEFORE SUBMITTING THE BID PROPOSAL FOR THIS PROJECT. REFER TO CODE REVIEW MEMORANDUM.
4. CONTRACTOR COORDINATION OF ALL TRADES SHALL BE DONE IN A WAY TO AVOID CONFLICTS BETWEEN EACH OTHER AND TO A SMOOTH AND CONTINUOUS DELIVERY.
5. CONTRACTOR IS RESPONSIBLE FOR QUALITY CONTROL ASSURANCE.
6. THE WORK SHALL BE DONE IN SUCH A MANNER AS TO MAINTAIN AREAS CLEAN AND REDUCE FIRE HAZARDS, POLLUTION, ACCIDENTS AND STRUCTURAL LOAD INCREASE TO A MINIMUM. CONTRACTOR SHALL REMOVE ANY CONSTRUCTION DEBRIS, DUST AND ANY OTHER GARBAGE FROM THE PROJECT SITE AND DISPOSE IT PROPERLY, IN A LEGAL WAY. NO ACCUMULATION OF DEBRIS OR GARBAGE WILL BE ALLOWED AT THE PROJECT PREMISES AT ANY TIME.
7. ALL DIMENSIONS SHOWN IN CONTRACT DRAWINGS ARE TO BE FIELD VERIFIED, DO NOT SCALE DIMENSIONS FROM DRAWINGS. IF ANY REQUIRED DIMENSIONS ARE MISSING, GC SHALL ASK ARCHITECT FOR CLARIFICATION.
8. NOTIFY IMMEDIATELY TO THE CONSTRUCTION MANAGER / RESIDENT INSPECTOR AND THE ARCHITECT IF ANY DISCREPANCY WITH THE CONSTRUCTION DOCUMENTS IS ENCOUNTERED.
9. SHOWN ELEVATIONS ARE GIVEN IN LOCAL SYSTEM, FROM GROUND FLOOR LEVEL. REFER TO CIVIL DRAWINGS FOR FINISH FLOOR ELEVATIONS.
10. GENERAL CONTRACTOR IS RESPONSIBLE TO DELIVER THE PROJECT IN A OPERATIONAL STATE. WORKS SPECIFIED UNDER ANY OF THE TRADES, INCLUDED IN CONTRACT DOCUMENTS, IS THE RESPONSIBILITY OF THE CONTRACTOR IN THE SAME WAY AS IT'S OWN TRADE.
11. ALL ITEMS, MATERIALS, BUILDING COMPONENTS AND SYSTEMS SHOWN IN THE CONTRACT DOCUMENTS ARE NEW, UNLESS OTHERWISE NOTED AS EXISTING.
12. IN THE EVENT OF ANY DISCREPANCY BETWEEN THE CONSTRUCTION DOCUMENTS, THE PROJECT SPECIFICATIONS WILL TAKE PRECEDENT.
13. PRE ENGINEERED METAL BUILDING (PEMB) SHOWN FOR GENERAL REQUIREMENTS ONLY. PEMB MANUFACTURER TO DESIGN ALL FINAL CONNECTIONS, STRUCTURE, AND ELEMENTS TO GUARANTEE ALL APPLICABLE CODES ARE MET. SEE STRUCTURAL DRAWINGS FOR STRUCTURAL REQUIREMENTS OF THE PEMB.
14. ALL ENVELOPE METAL FABRICATIONS OF THE PEMB TO BE BY PEMB MANUFACTURER, AND PAINTED TO MATCH.

SCOPE OF WORK

WELL 3 & 4 WATER TREATMENT FACILITY IS A 4,026 S.F. STRUCTURE SUPPORTING THE BARNSTABLE FIRE DISTRICT WATER DEPARTMENT, LOCATED IN BARNSTABLE, MASSACHUSETTS.

THE BUILDING WILL BE BUILT ON A CONCRETE SLAB WITH CONCRETE FOOTINGS WITH EXTERIOR WALLS CONSISTING OF A STEEL FRAMED INSULATED METAL PANEL PRE ENGINEERED METAL BUILDING. THE ROOF CONSISTS OF INSULATED METAL PANELS WITH STANDING SEAM JOINTS OVER STEEL FRAMING. THE BUILDING INCLUDES INSULATED HOLLOW METAL DOORS, AND REMOVABLE WALL PANELS INSULATED TRANSLUCENT PANEL TO BRING NATURAL LIGHT INTO THE SPACE, FOR ANY REQUIRED EQUIPMENT MAINTENANCE OR REMOVAL.



1 EGRESS PLAN
3/16" = 1'-0"

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

studio umbra architecture

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS

NO.	DATE	DESCRIPTION

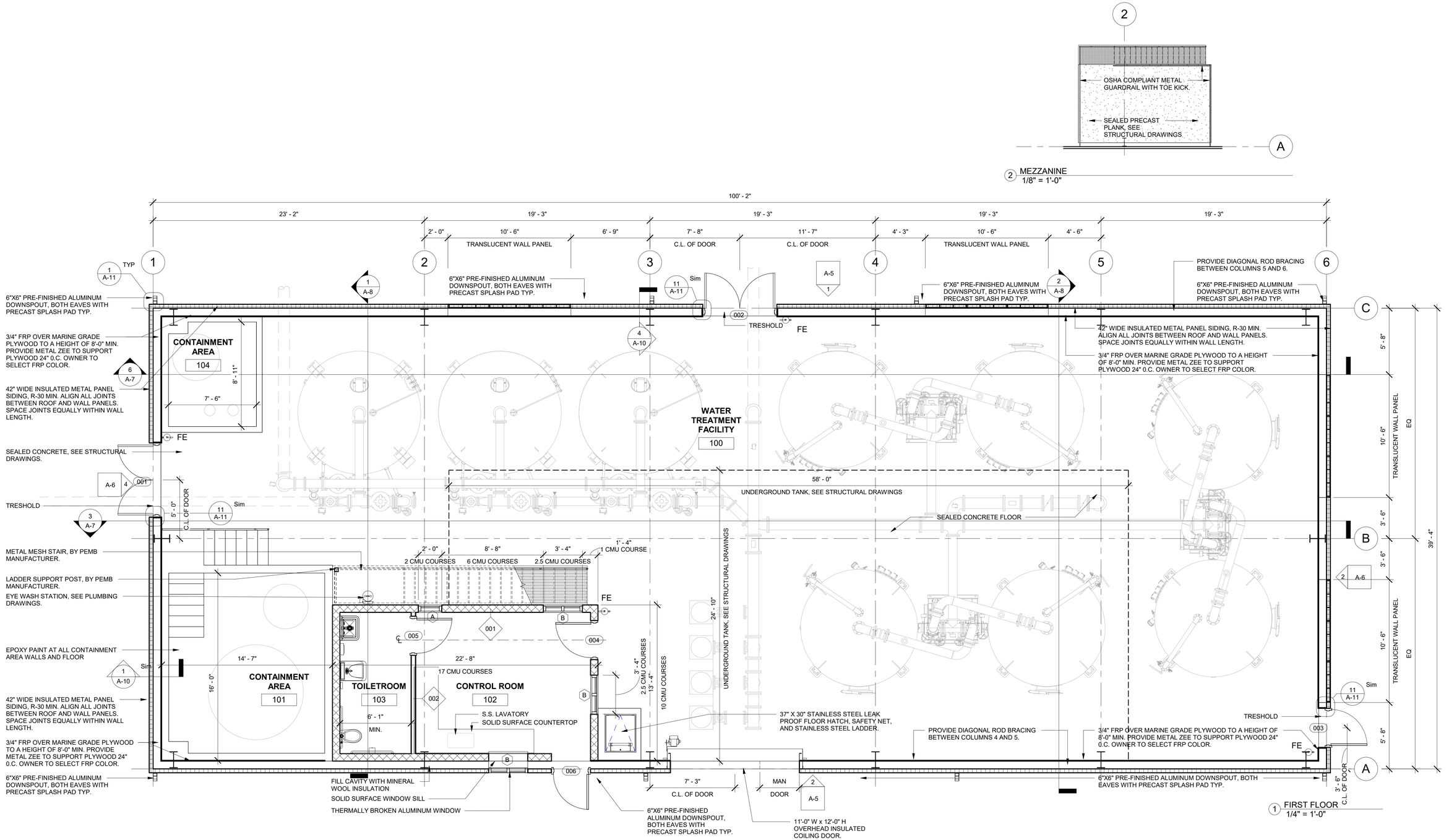
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	As indicated
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
CODE REVIEW

DRAWING NO.:
A-1

SHEET NO. 22 OF 57



FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

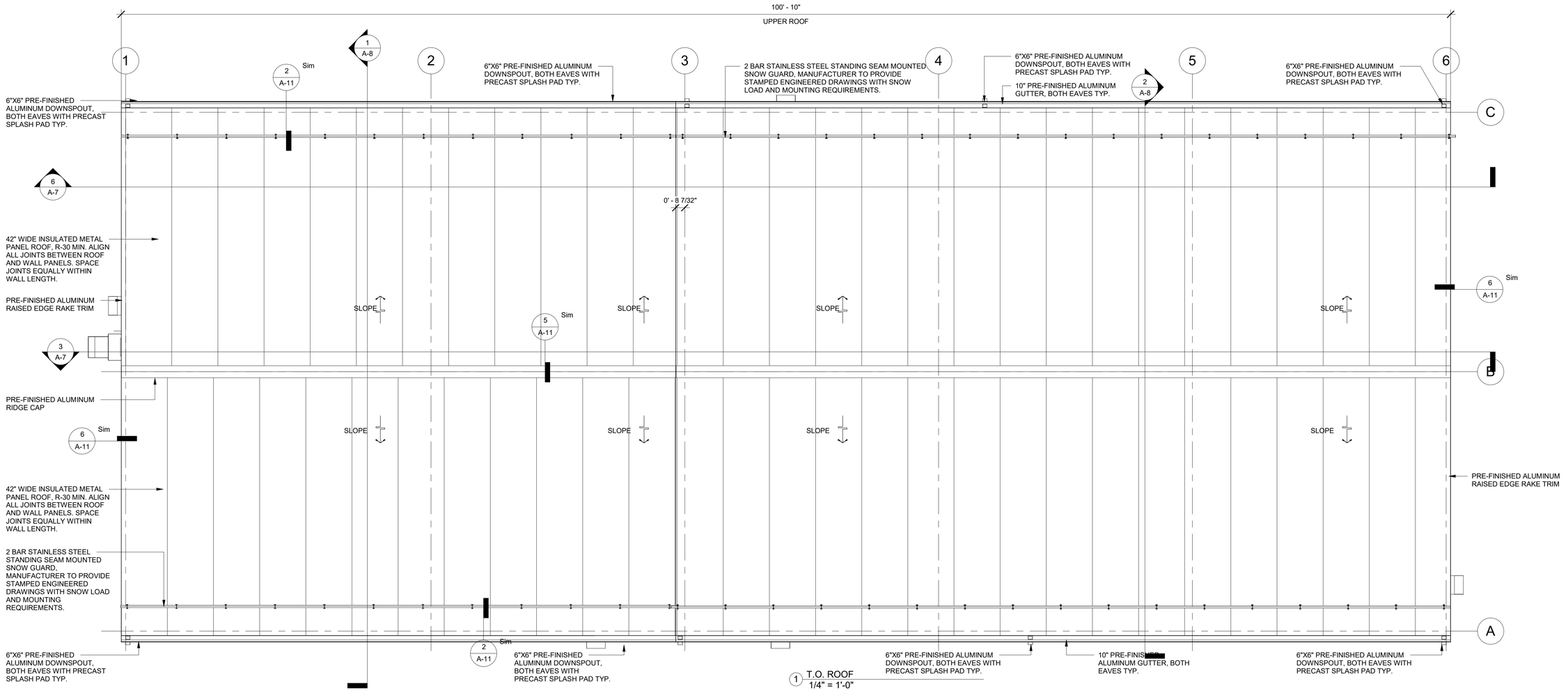
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	As indicated
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
FLOOR PLAN

DRAWING NO.:
A-2

SHEET NO. 23 OF 57



FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

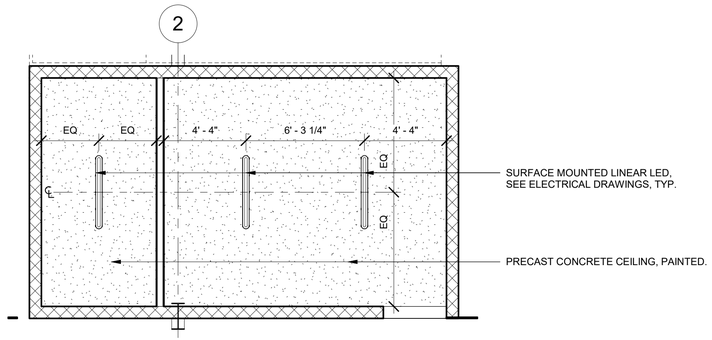
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

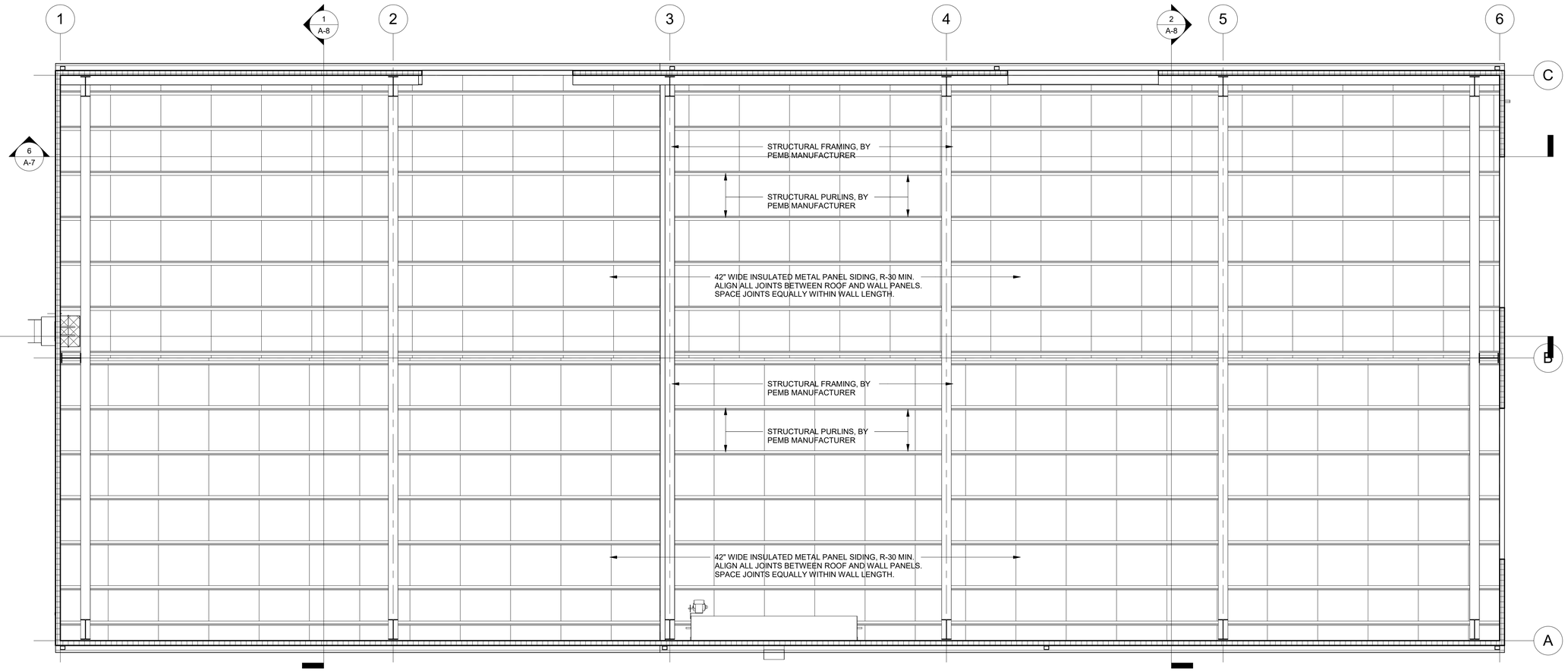
DRAWING TITLE:
ROOF PLAN

DRAWING NO.:
A-3

SHEET NO. 24 OF 57



2 CONTROL / TOILETROOM REFLECTED CEILING PLAN
1/4" = 1'-0"



1 FIRST FLOOR REFLECTED CEILING PLAN
1/4" = 1'-0"

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

studio umbra architecture

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. ALLEN
REGISTERED PROFESSIONAL ENGINEER
6/19/26

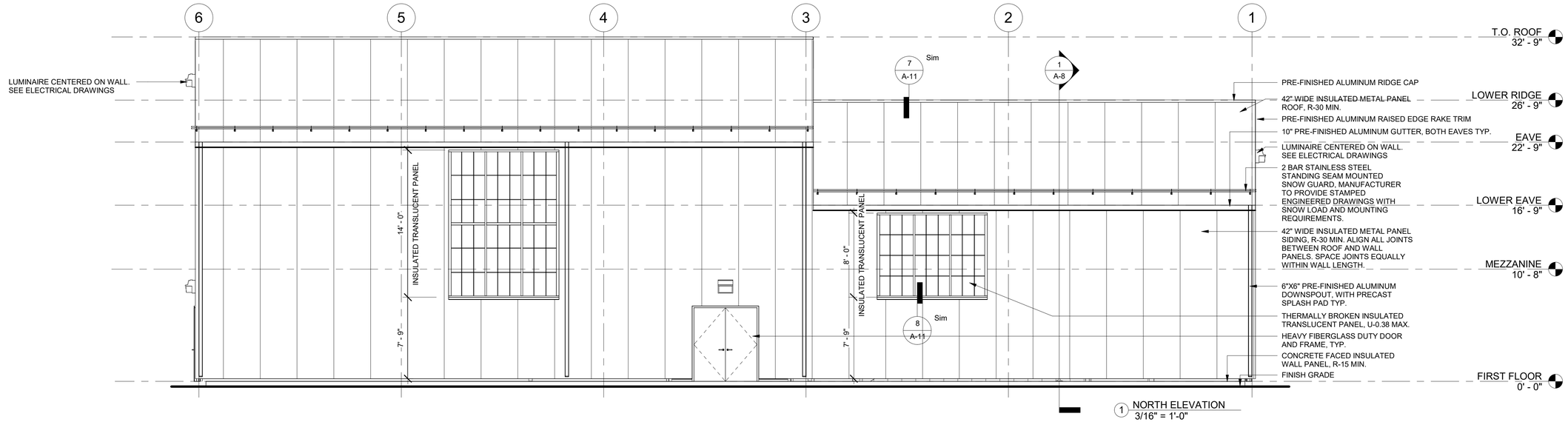
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

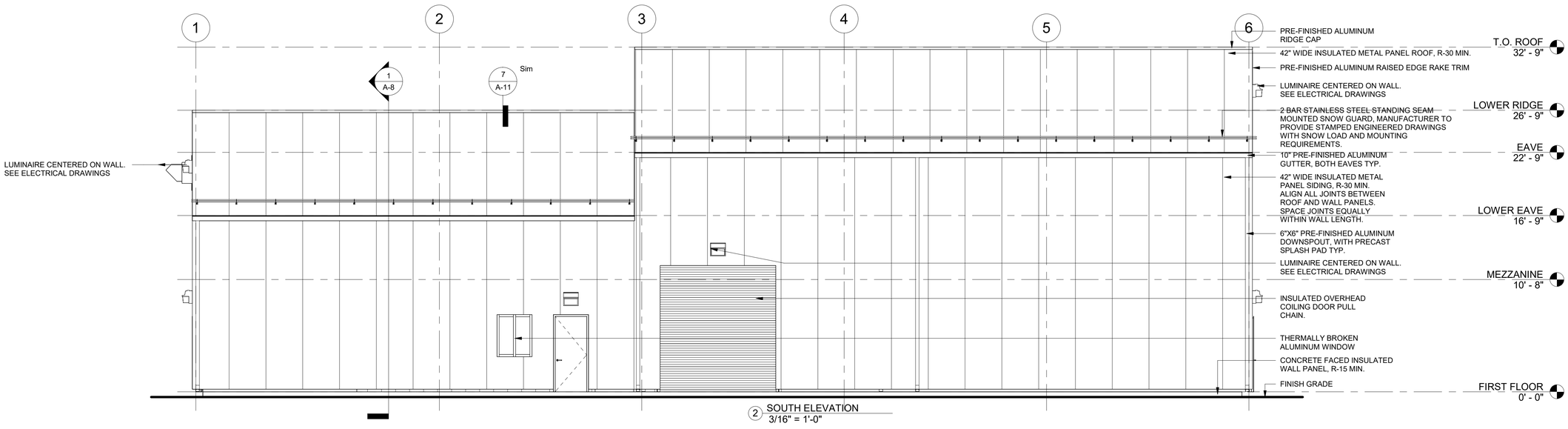
DRAWING TITLE:
REFLECTED CEILING PLANS

DRAWING NO.:
A-4

SHEET NO. 25 OF 57



1 NORTH ELEVATION
3/16" = 1'-0"



2 SOUTH ELEVATION
3/16" = 1'-0"

FOR PERMITTING

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DRINKING WATER PROFESSIONALS

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

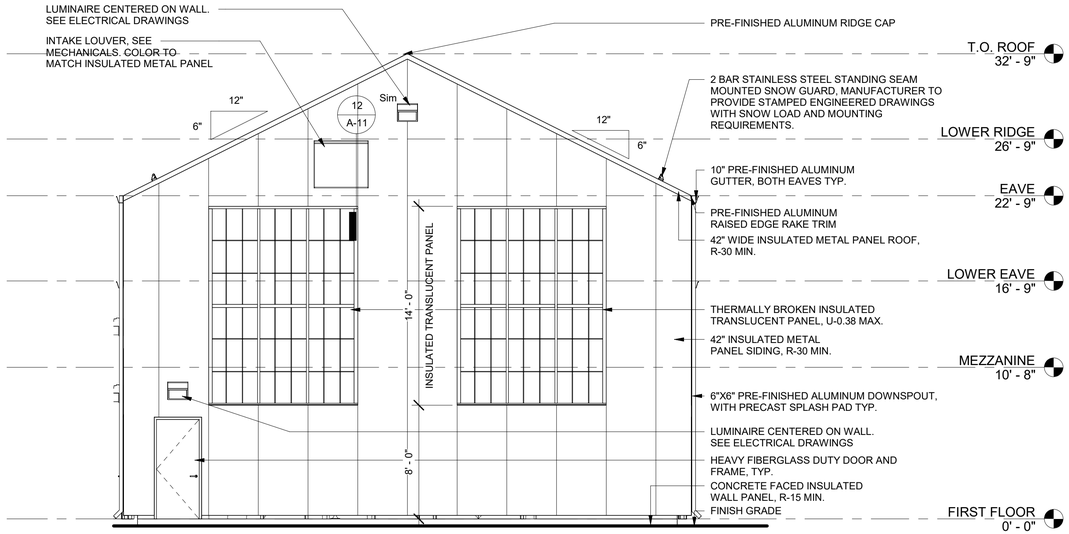
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

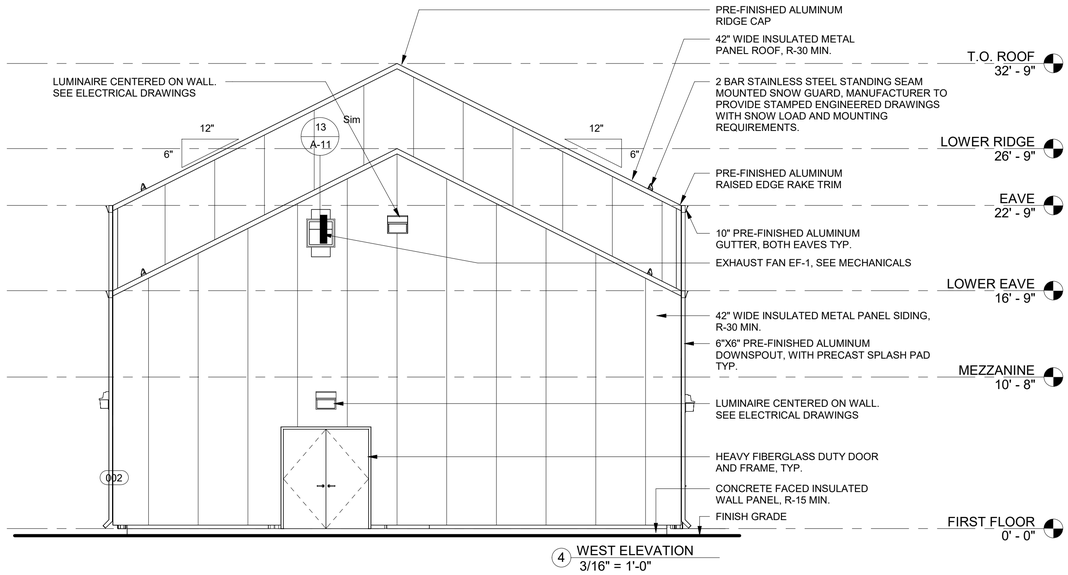
DRAWING TITLE:
EXTERIOR ELEVATIONS

DRAWING NO.:
A-5

SHEET NO. 26 OF 57



2 EAST ELEVATION
3/16" = 1'-0"



4 WEST ELEVATION
3/16" = 1'-0"

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEVEN F. C.
REGISTERED PROFESSIONAL ENGINEER
6/19/26

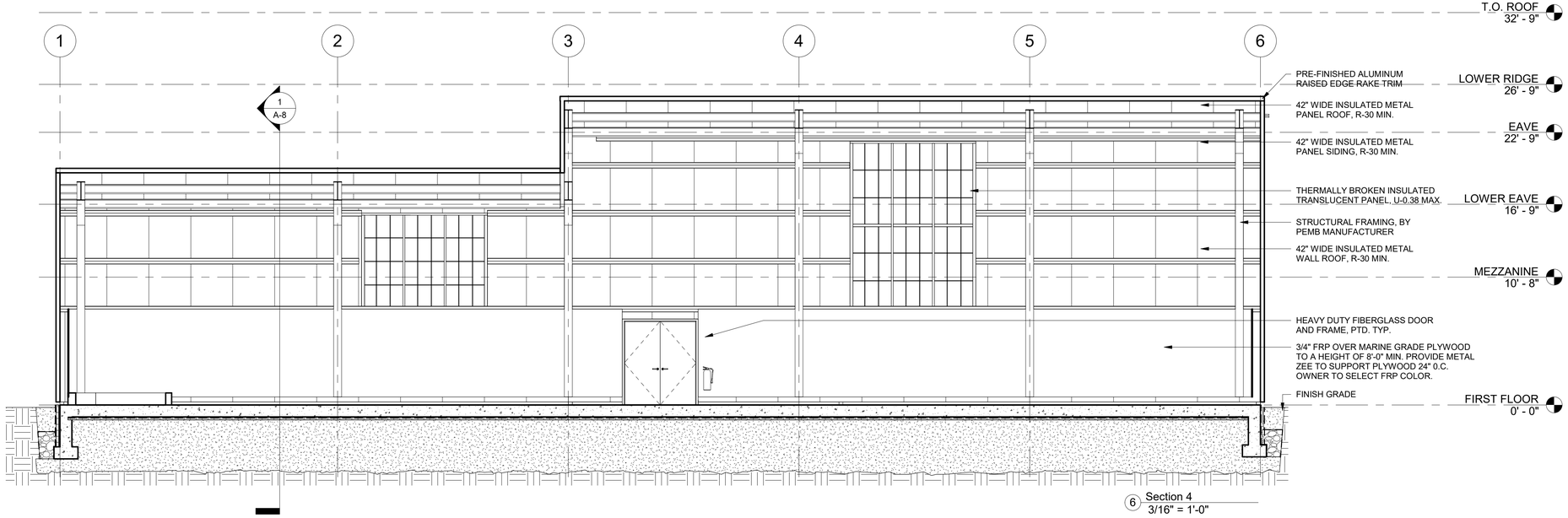
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

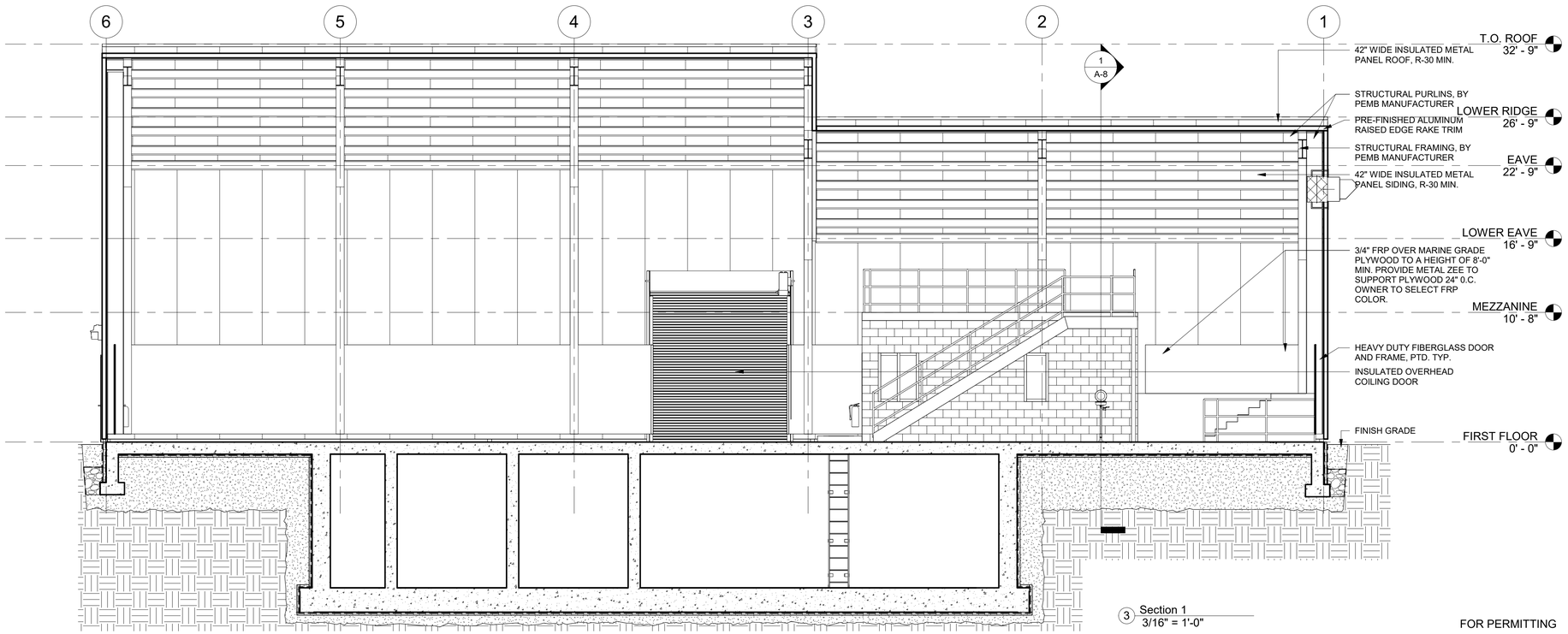
DRAWING TITLE:
EXTERIOR ELEVATIONS

DRAWING NO.:
A-6

SHEET NO. 27 OF 57



6 Section 4
3/16" = 1'-0"



3 Section 1
3/16" = 1'-0"

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DRINKING WATER PROFESSIONALS

studio umbra
architecture

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

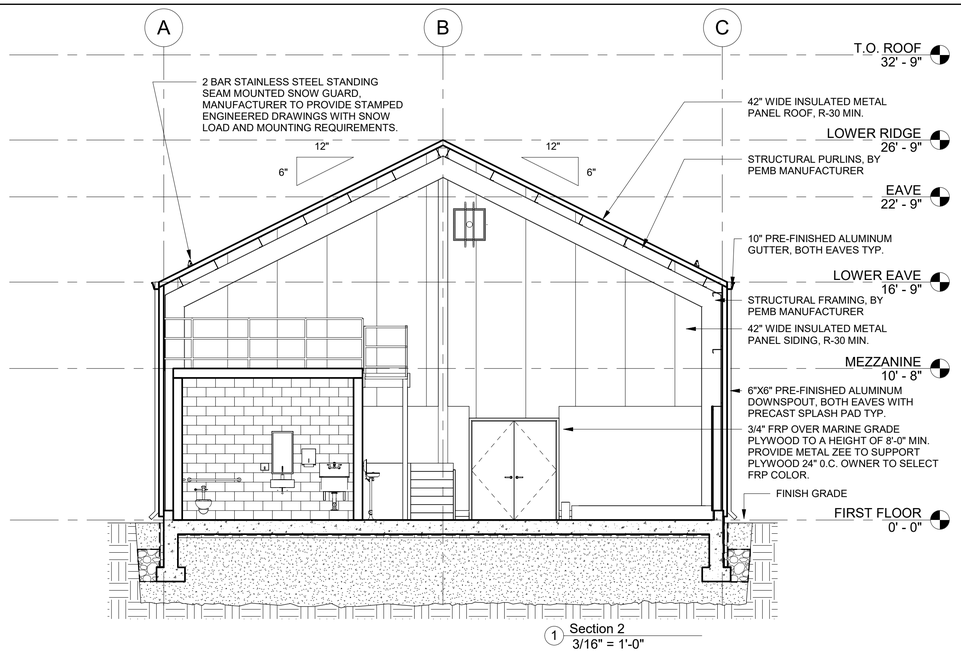
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

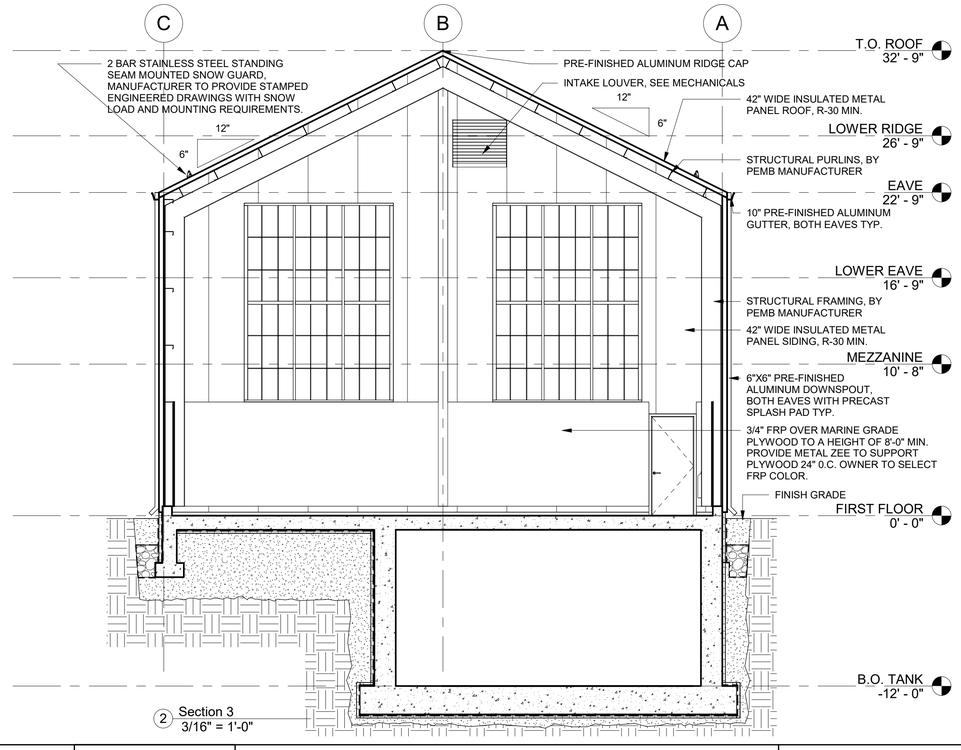
DRAWING TITLE:
BUILDING SECTIONS

DRAWING NO.:
A-7

SHEET NO. 28 OF 57



1 Section 2
3/16" = 1'-0"



2 Section 3
3/16" = 1'-0"

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DRINKING WATER PROFESSIONALS

studio umbra architecture

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

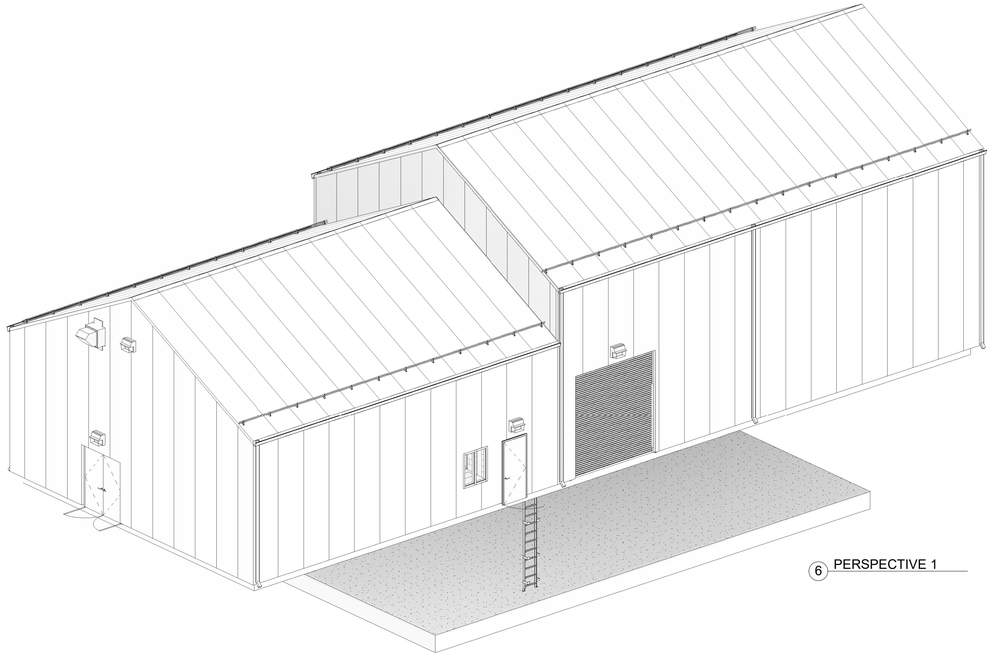
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

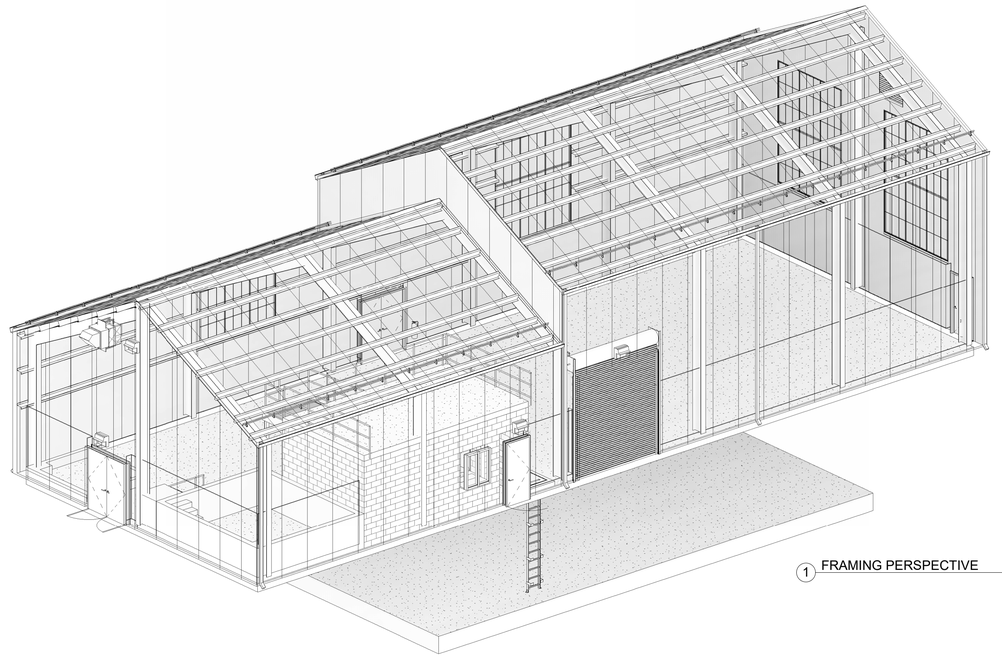
DRAWING TITLE:
BUILDING SECTIONS

DRAWING NO.:
A-8

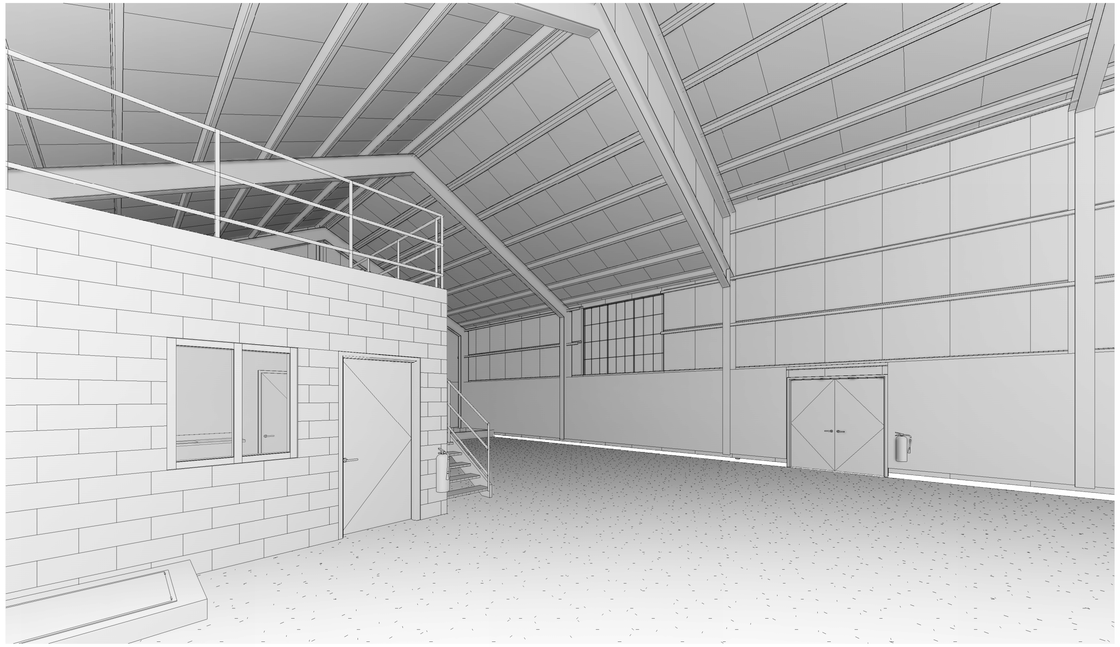
SHEET NO. 29 OF 57



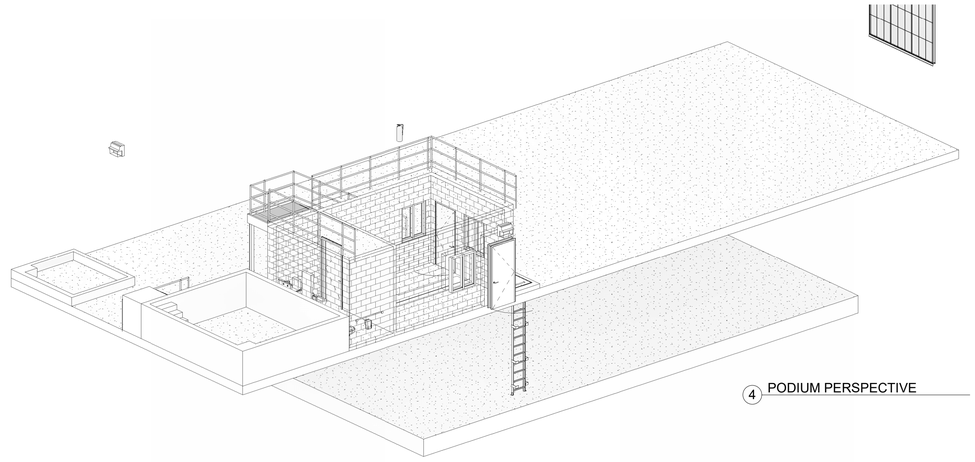
6 PERSPECTIVE 1



1 FRAMING PERSPECTIVE



2 3D View 2



4 PODIUM PERSPECTIVE

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN E. OLSON
No. 49,363
REGISTERED PROFESSIONAL ENGINEER
6/4/26

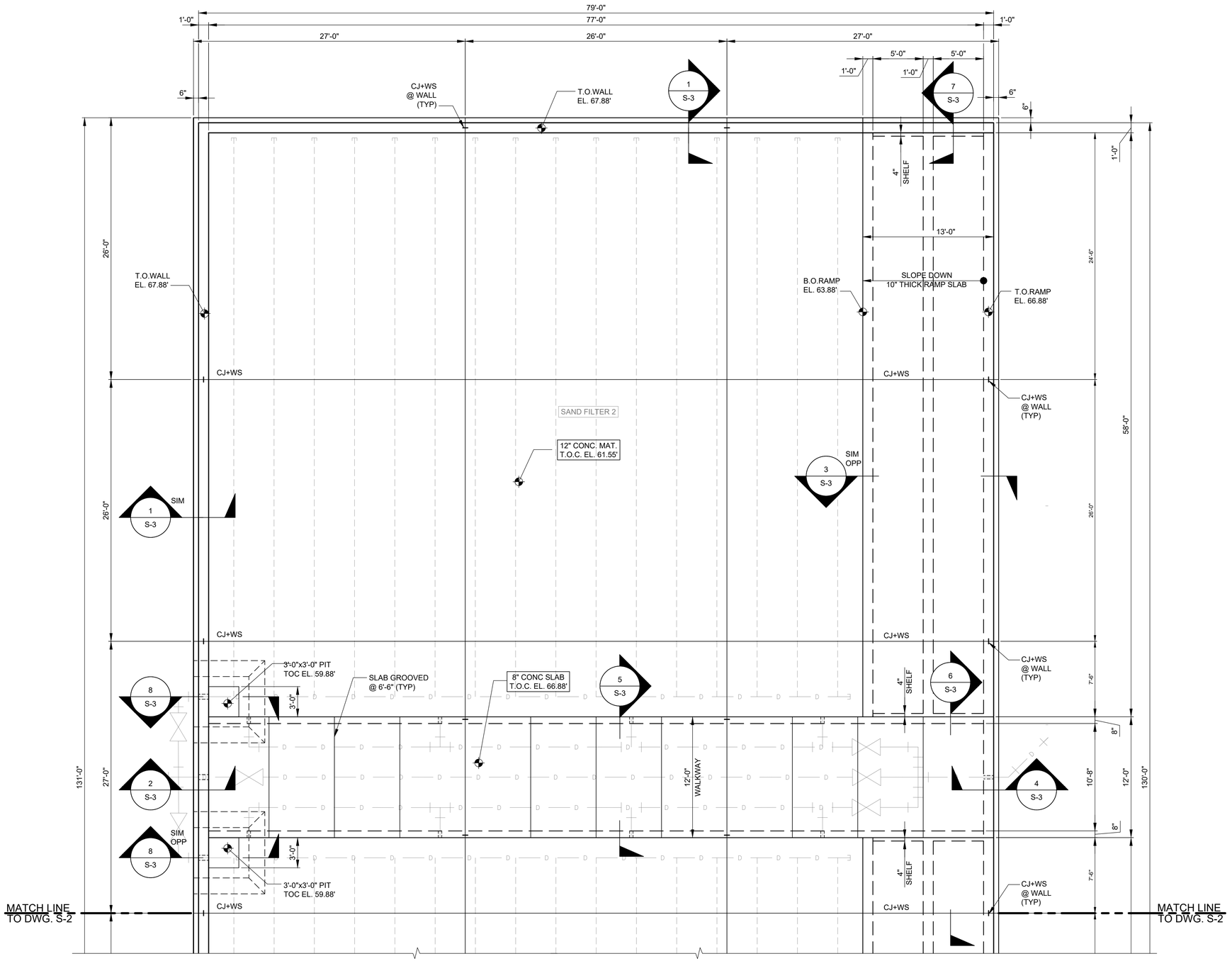
PROJECT NO.:	127.23.01
DATE:	APRIL 2026
SCALE:	
DESIGNED BY:	EFV
CHECKED BY:	EFV
DRAWN BY:	EFV
APPROVED BY:	EFV

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
PERSPECTIVES

DRAWING NO.:
A-9

SHEET NO. 30 OF 57



FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

LIN ASSOCIATES, INC.
CONSULTING ENGINEERS
(617)566-4216 FAX: (617)566-6038
BROCKTON MASSACHUSETTS

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
GREGORY KOLOJESKI
No. 52135
REGISTERED PROFESSIONAL ENGINEER
6/19/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

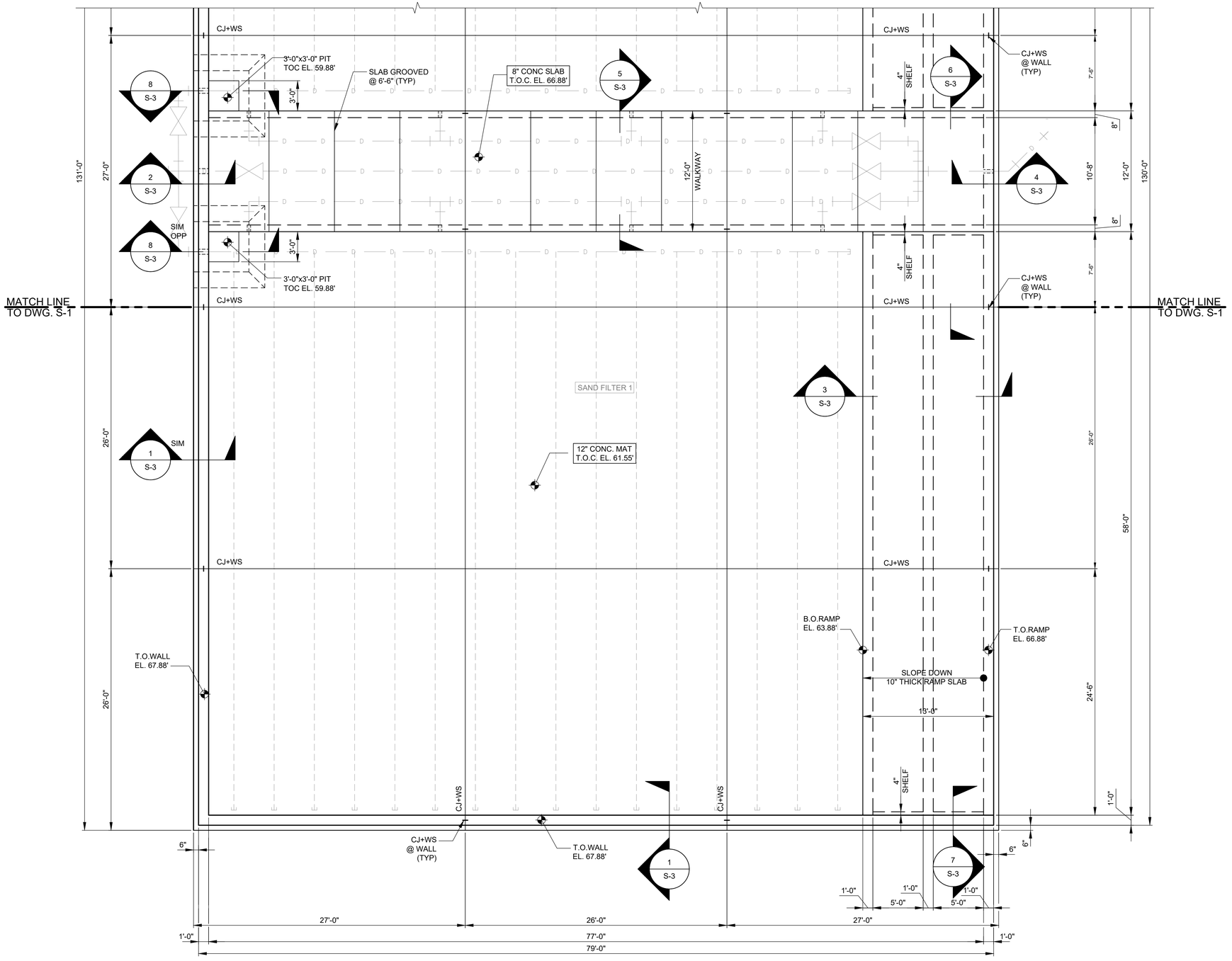
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SAND FILTERS
FOUNDATION PLAN (1)

DRAWING NO.:
S-1

SHEET NO. 31 OF 57

E:\2025.030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUB\FD WTP_S-1 and S-2 Sand Filters Foundation Plan.dwg



E:\2025.030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUB\FD WTP_S-1 and S-2 Sand Filters Foundation Plan.dwg

FOR PERMITTING

H2Olson Engineering, Inc.
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www.h2olsonengineering.com
(508) 375-7007

LIN ASSOCIATES, INC.
CONSULTING ENGINEERS
(617)566-4216 FAX: (617)566-8038
BRIGHTON MASSACHUSETTS

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

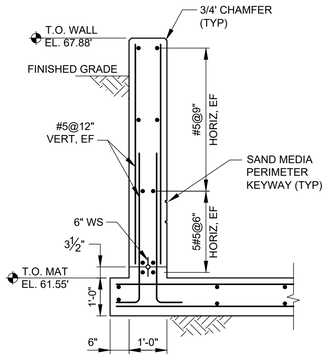
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	3/16" = 1'-0"
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

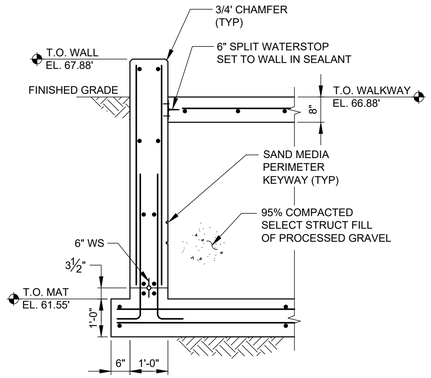
DRAWING TITLE:
SAND FILTERS
FOUNDATION PLAN (2)

DRAWING NO.:
S-2

SHEET NO. 32 OF 57

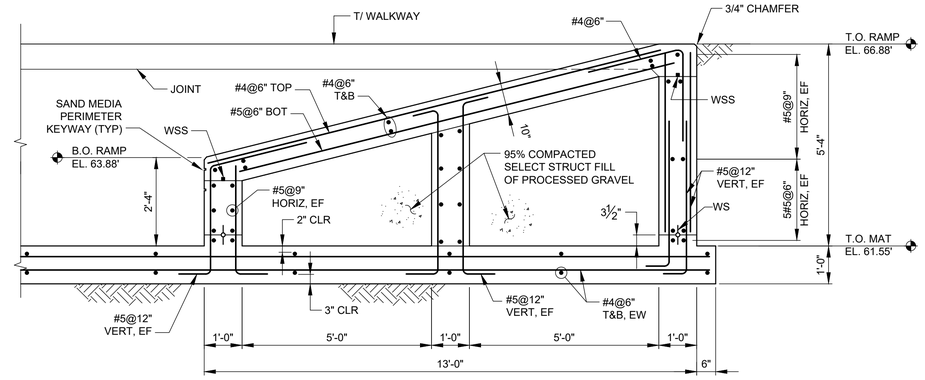


SECTION 1 / S-1
SCALE: 1/2"=1'-0"

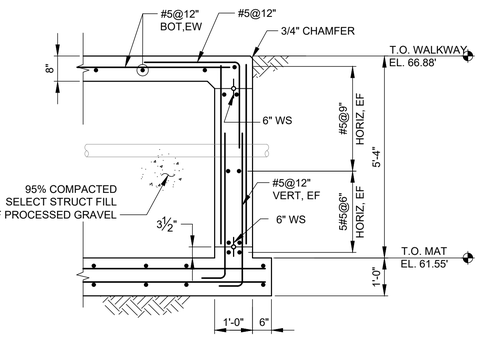


NOTE:
1. FOR WALL AND MAT REINF. SEE SECTION 1 ON THIS SHEET.

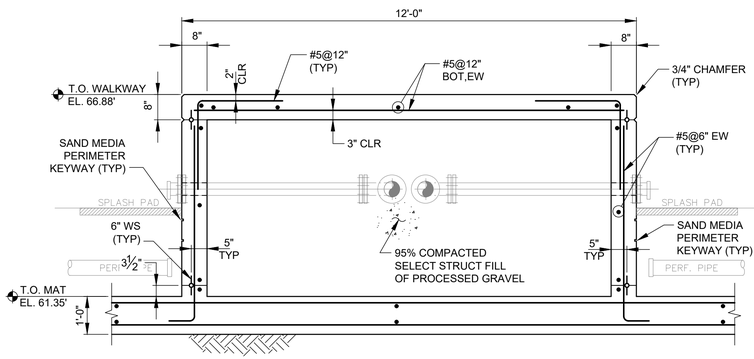
SECTION 2 / S-1
SCALE: 1/2"=1'-0"



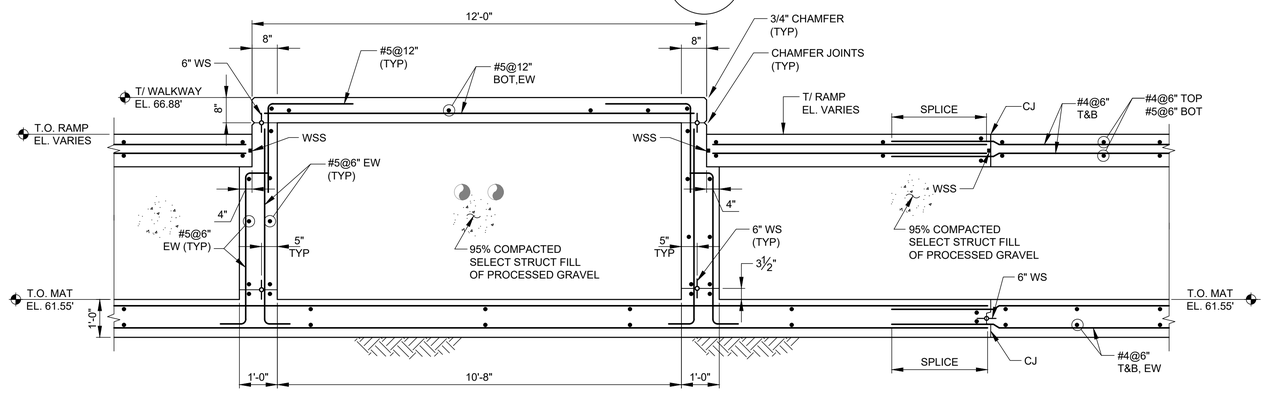
SECTION 3 / S-1
SCALE: 1/2"=1'-0"



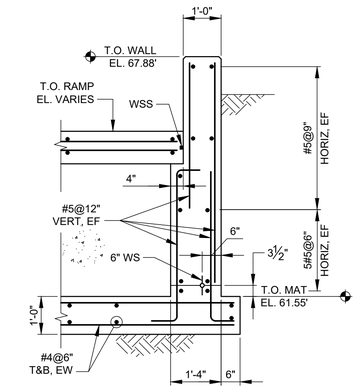
SECTION 4 / S-1
SCALE: 1/2"=1'-0"



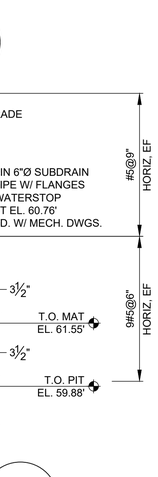
SECTION 5 / S-1
SCALE: 1/2"=1'-0"



SECTION 6 / S-1
SCALE: 1/2"=1'-0"



SECTION 7 / S-1
SCALE: 1/2"=1'-0"



SECTION 8 / S-1
SCALE: 1/2"=1'-0"

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

LIN ASSOCIATES, INC.
CONSULTING ENGINEERS
(617)566-4216 FAX: (617)566-8038
BRIGHTON MASSACHUSETTS

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	AS SHOWN
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

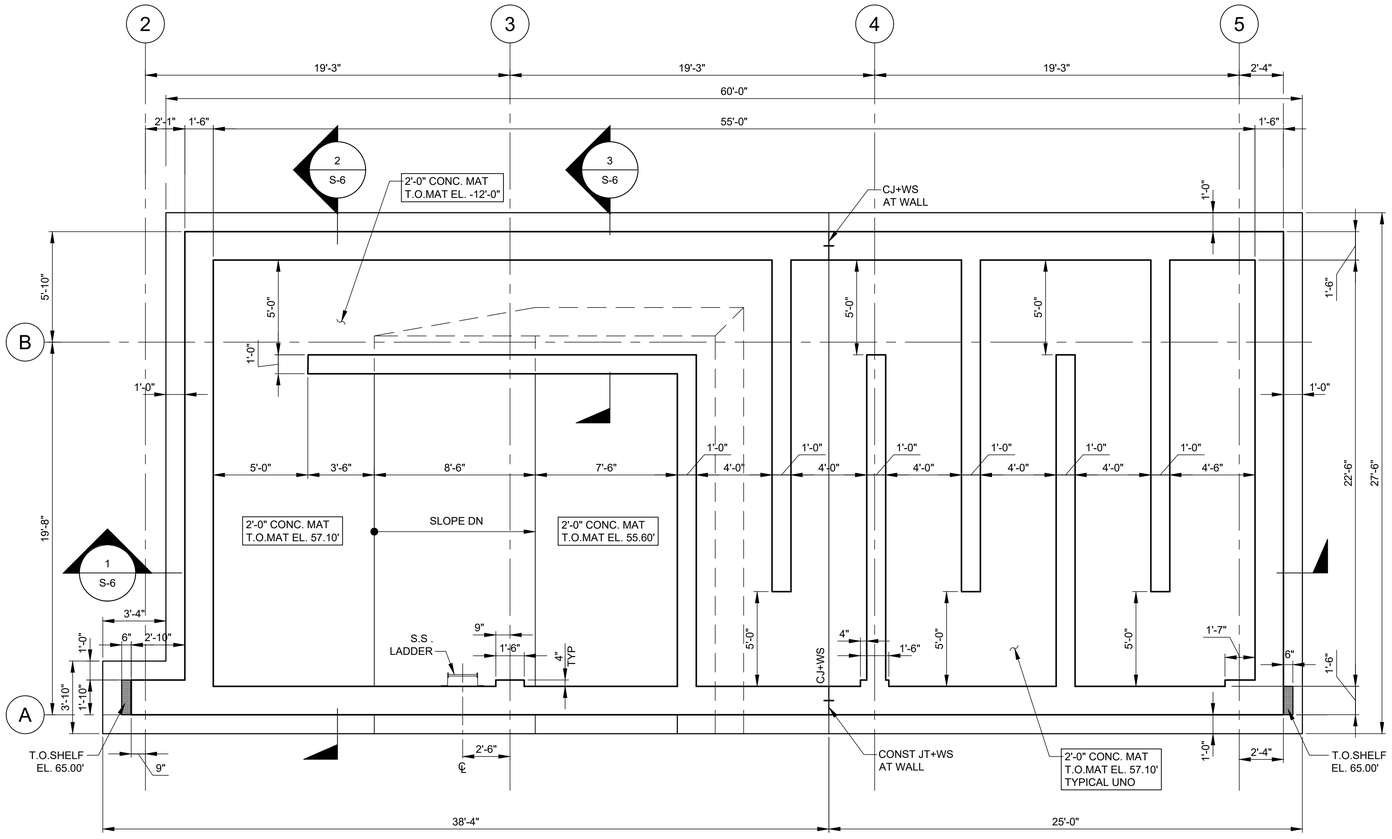
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SAND FILTERS
SECTIONS AND DETAILS

DRAWING NO.:
S-3

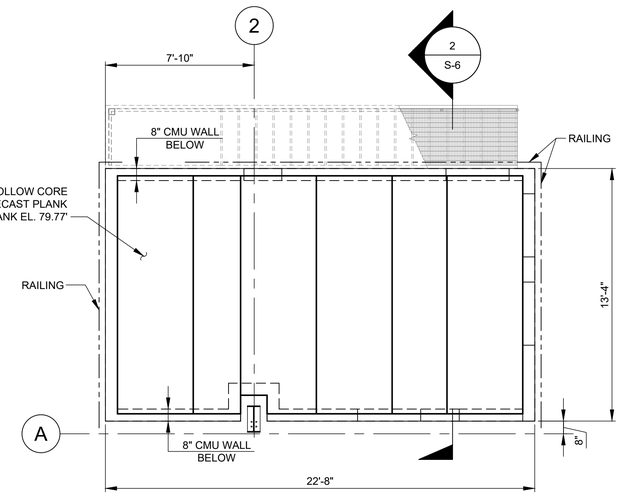
SHEET NO. 33 OF 57

E:\2025.030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUB\FD WTP_S-3 Sand Filters Sections and Details.dwg



LOWER LEVEL PLAN

SCALE: 1/4" = 1'-0"



NOTES:
1. FOR PRECAST PLANK SUPPORT DETAILS SEE TYPICAL DETAIL ON DRAWING S-12.

UPPER LEVEL PLAN

SCALE: 1/4" = 1'-0"

E:\2025\030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUBFD WTP_S-4 Building Lower Level and Upper Level Plans.dwg

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BRIGHTON MASSACHUSETTS

SCALE ADJUSTMENT GUIDE
0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
GREGORY KLIMA
No. 49033
REGISTERED PROFESSIONAL ENGINEER
6/19/26

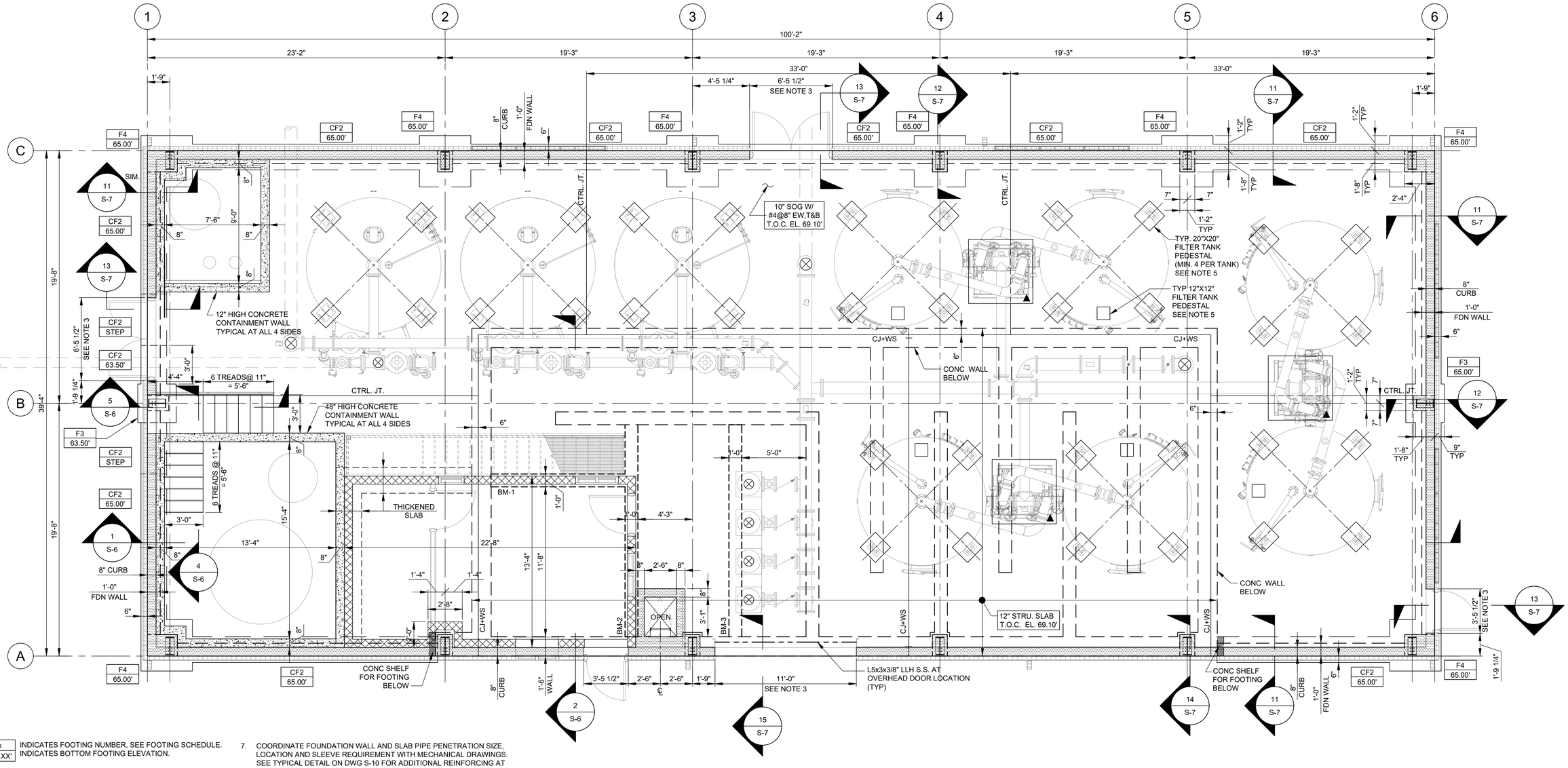
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
BUILDING LOWER LEVEL AND UPPER LEVEL PLANS

DRAWING NO.:
S-4

SHEET NO. 34 OF 57



NOTES:

1. Fx / XXX.XX' INDICATES FOOTING NUMBER, SEE FOOTING SCHEDULE. INDICATES BOTTOM FOOTING ELEVATION.
2. REFER TO A-DRAWINGS FOR LAYOUT, DIMENSIONS AND WALL TYPE. ARCHITECTURAL AND MECHANICAL LAYOUT SHOWN SCREENED IN BACKGROUND FOR REFERENCE ONLY.
3. INDICATES 8" HIGH CONCRETE CURB. COORDINATE WITH A-DRAWINGS FOR CURB LAYOUT AND DOOR OPENING WIDTH AND LOCATION. SEE CURB TYPICAL DETAILS ON DWG. S-10.
4. INDICATES CONCRETE PAD. SIZE AND LOCATION TO SUIT EQUIPMENT. SEE APPLICABLE CONC. EQUIPMENT PAD DETAILS ON DWG. S-10.
5. FOR FILTER TANK PEDESTAL SEE DETAIL ON DWG S-10, SIZE AND LOCATION TO SUIT MANUFACTURER REQUIREMENTS.
6. FOR CONCRETE PIER SIZES AND DETAILS SEE DWG. S-8.
7. COORDINATE FOUNDATION WALL AND SLAB PIPE PENETRATION SIZE, LOCATION AND SLEEVE REQUIREMENT WITH MECHANICAL DRAWINGS. SEE TYPICAL DETAIL ON DWG S-10 FOR ADDITIONAL REINFORCING AT OPENING.
8. Fx / STEP INDICATES FOOTING NUMBER, SEE FOOTING SCHEDULE. INDICATES STEPPED FOOTING ELEVATION. SEE TYP DET ON DWG. S-10.
9. FOR THE FINISH GRADE ELEVATION COORDINATE WITH CIVIL DRAWINGS.

FOOTING SCHEDULE		
TYPE	SIZE	REINFORCING
F3	3'-0" X 3'-0" X 1'-0" DEEP	#5 @ 6" E.W. BOTTOM
F4	4'-0" X 4'-0" X 1'-0" DEEP	#5 @ 6" E.W. BOTTOM
CF2	2'-0" X 1'-0" DEEP X CONT.	3-#5 LONG. & #5@12" TRANS. BOTT.

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BRIGHTON MASSACHUSETTS

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0" 1"
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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. GLEASON
No. 37,999
REGISTERED PROFESSIONAL ENGINEER
6/1/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

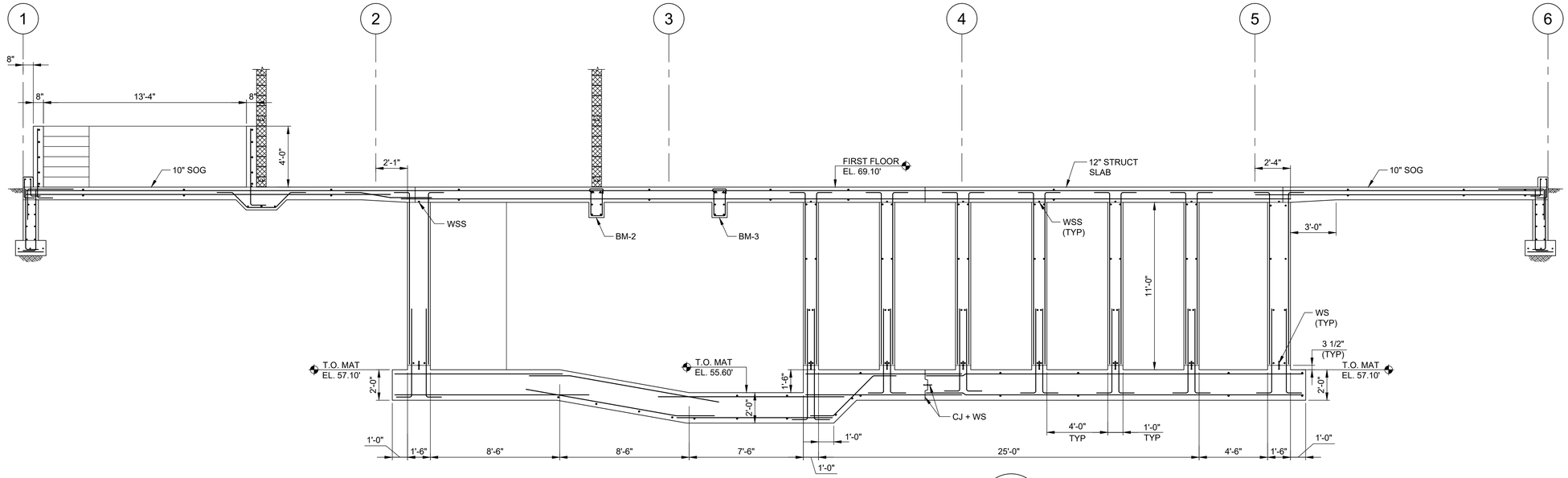
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
BUILDING FIRST FLOOR PLAN

DRAWING NO.:
S-5

SHEET NO. 35 OF 57

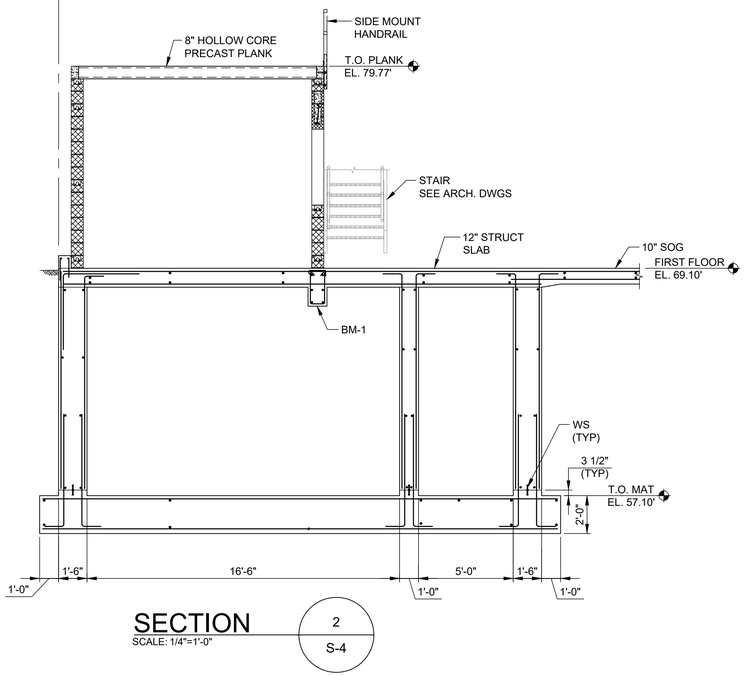
E:\2025.030 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUBFD WTP_S-5 Building First Floor Plan.dwg



SECTION

SCALE: 1/4"=1'-0"

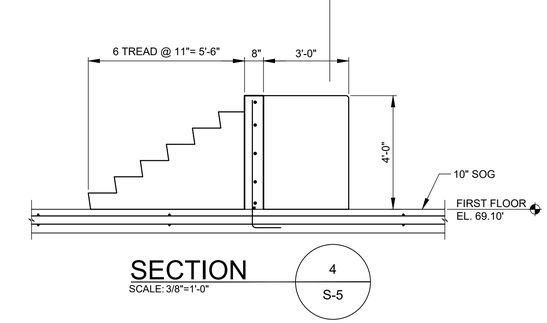
1
S-4



SECTION

SCALE: 1/4"=1'-0"

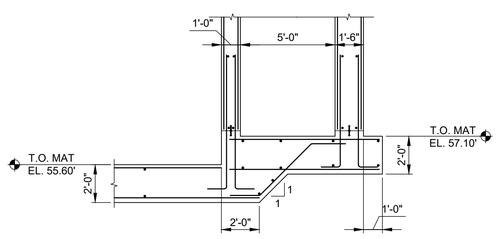
2
S-4



SECTION

SCALE: 3/8"=1'-0"

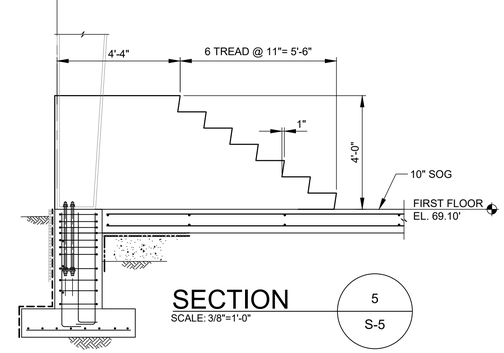
4
S-5



SECTION

SCALE: 1/4"=1'-0"

3
S-4



SECTION

SCALE: 3/8"=1'-0"

5
S-5

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PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	AS SHOWN
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

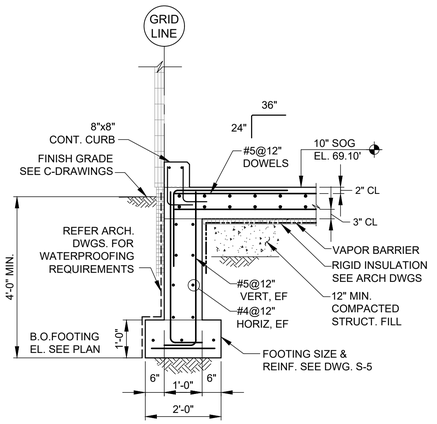
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
BUILDING
SECTIONS AND DETAIL (1)

DRAWING NO.:
S-6

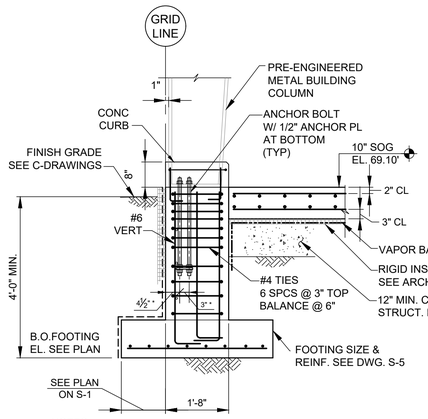
SHEET NO. 36 OF 57

E:\2025.000 Barnstable Fire District Well 3 & 4 WTP (H2Olson)\STRUB\PD WTP_S-6 Building Sections and Details.dwg



SECTION 11 / S-5

SCALE: 1/2"=1'-0"

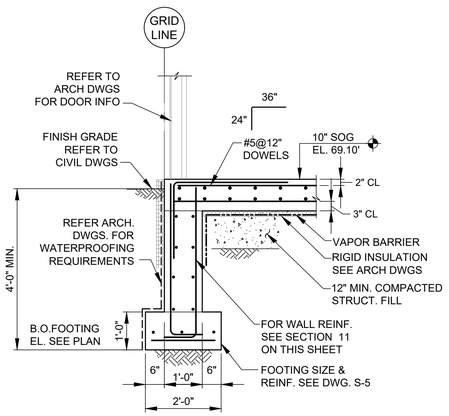


NOTES:

1. (*) ASTERISKS INDICATES ANCHOR BOLTS AND PIERS DIMENSIONS TO BE COORDINATED WITH METAL BUILDING REQUIREMENTS.
2. ANCHOR BOLTS DESIGNED AND FURNISHED BY METAL BUILDING SUPPLIER.

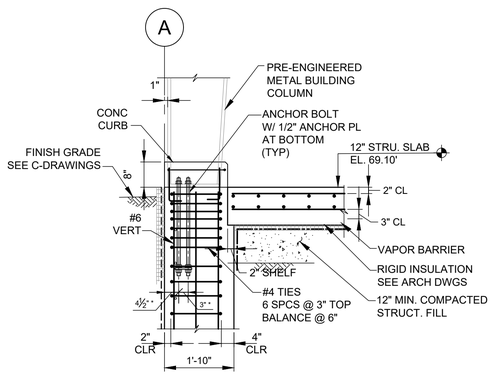
SECTION 12 / S-5

SCALE: 1/2"=1'-0"



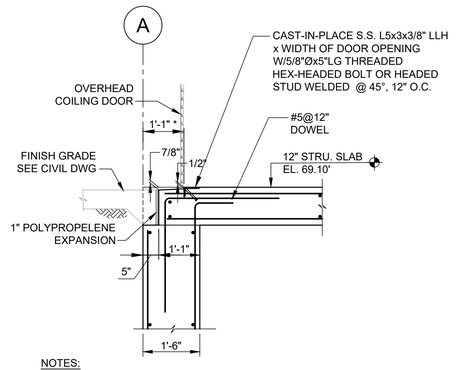
SECTION 13 / S-5

SCALE: 1/2"=1'-0"



SECTION 14 / S-5

SCALE: 1/2"=1'-0"



NOTES:

1. (*) ASTERISKS INDICATES DIMENSIONS FOR STAINLESS STEEL ANGLE TO BE COORDINATED WITH ARCHITECTURAL AND COILING DOOR MANUFACTURER.

SECTION 15 / S-5

SCALE: 1/2"=1'-0"

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NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. KLEIN — REGISTERED PROFESSIONAL ENGINEER — 6/19/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	AS SHOWN
DESIGNED BY:	GK
CHECKED BY:	GK
DRAWN BY:	RWK
APPROVED BY:	GK

BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
BUILDING SECTIONS AND DETAIL (2)

DRAWING NO.:
S-7

SHEET NO. 37 OF 57

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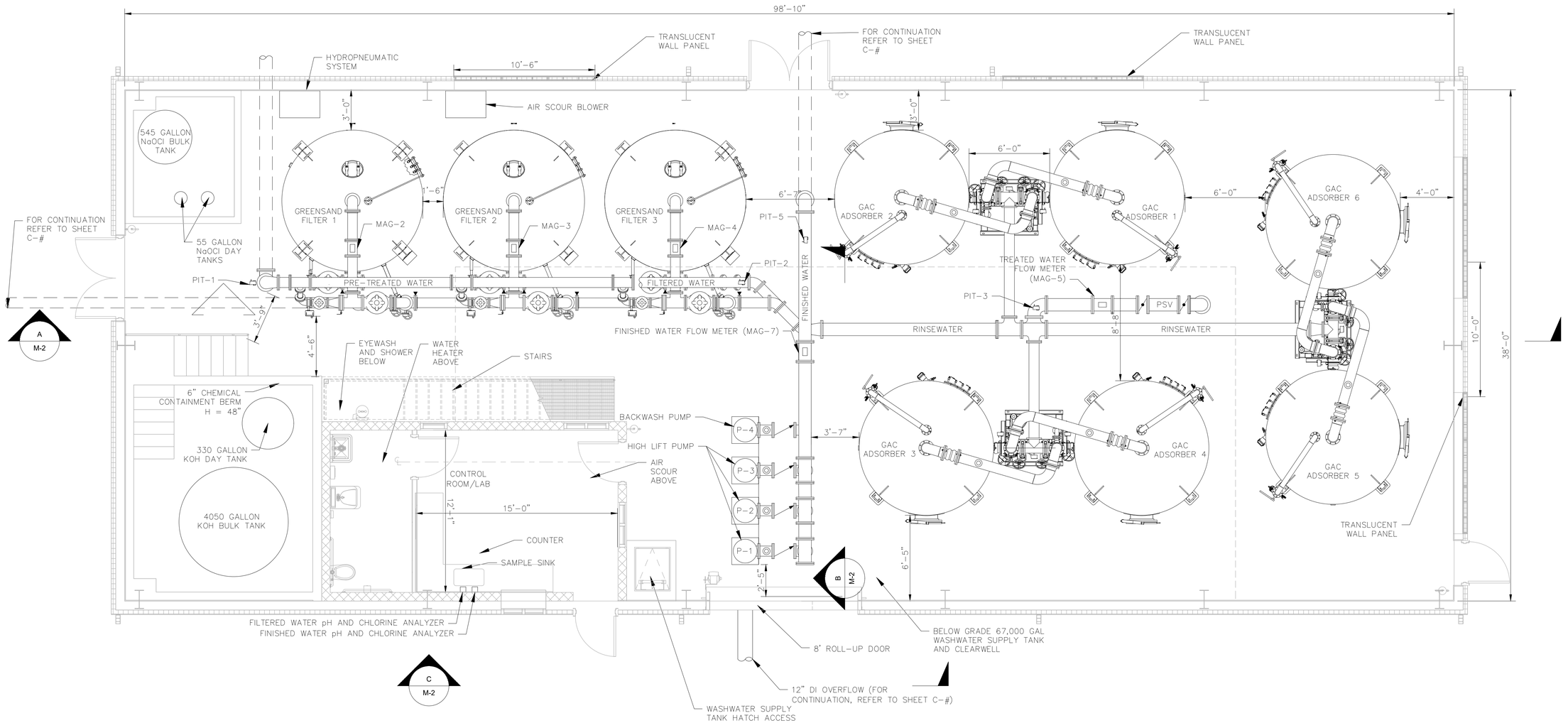

PRELIMINARY FLOOR PLAN

SCALE: 1/4" = 1'

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PROJECT NO.:	127.25.01
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DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: FLOOR PLAN

DRAWING NO.: M-1

SHEET NO. 38 OF 57

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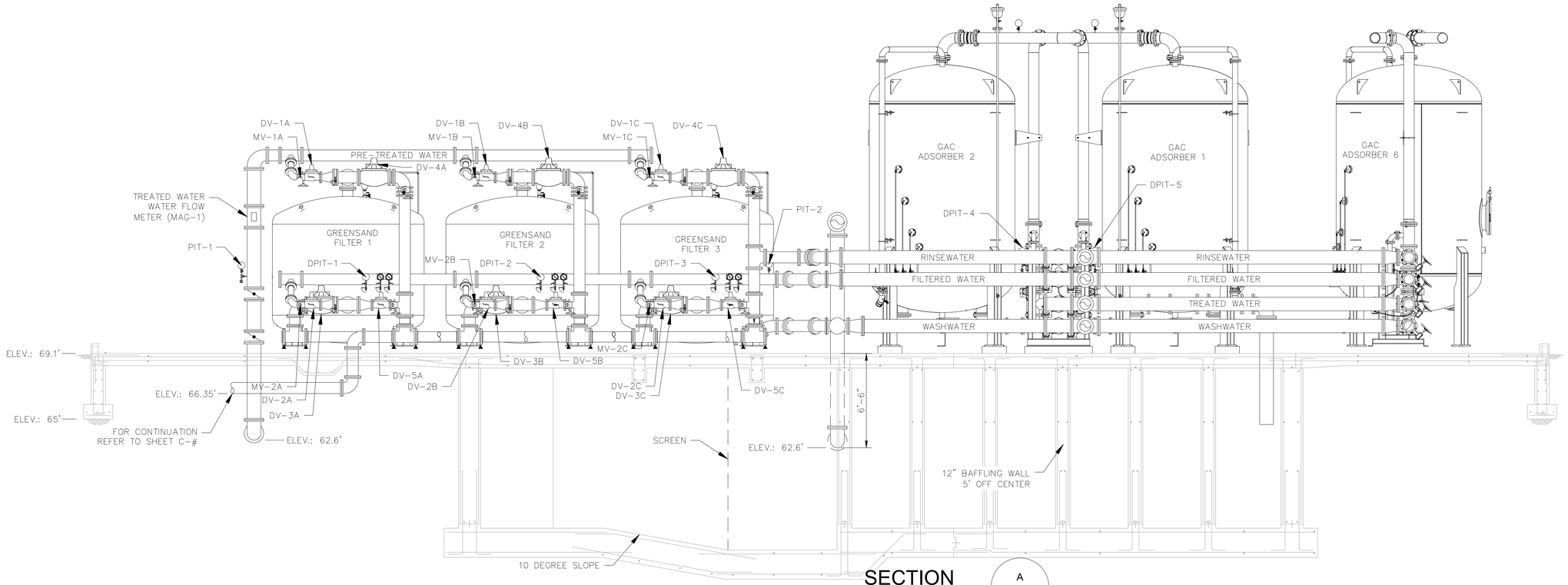
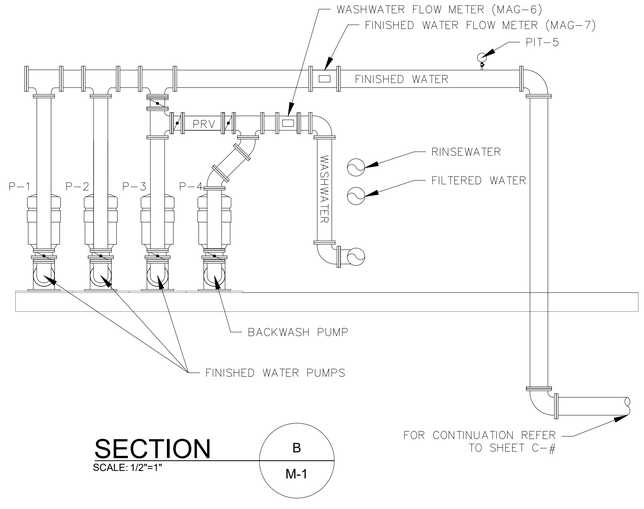
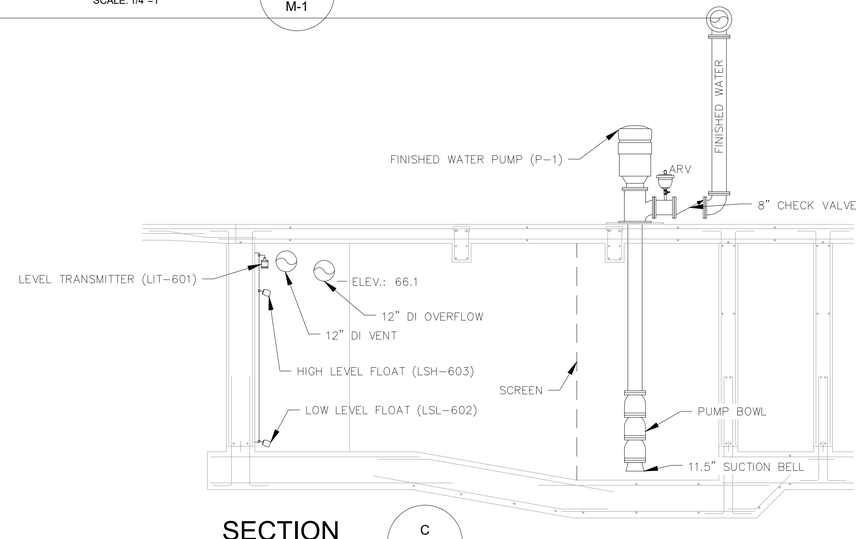


SECTION A
SCALE: 1/4"=1"
M-1



SECTION B
SCALE: 1/2"=1"
M-1



SECTION C
SCALE: 1/2"=1"
M-1

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NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. OLSON — REGISTERED PROFESSIONAL ENGINEER — 6/19/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SECTION VIEW
NO. 1

DRAWING NO.:
M-2

SHEET NO. 39 OF 57

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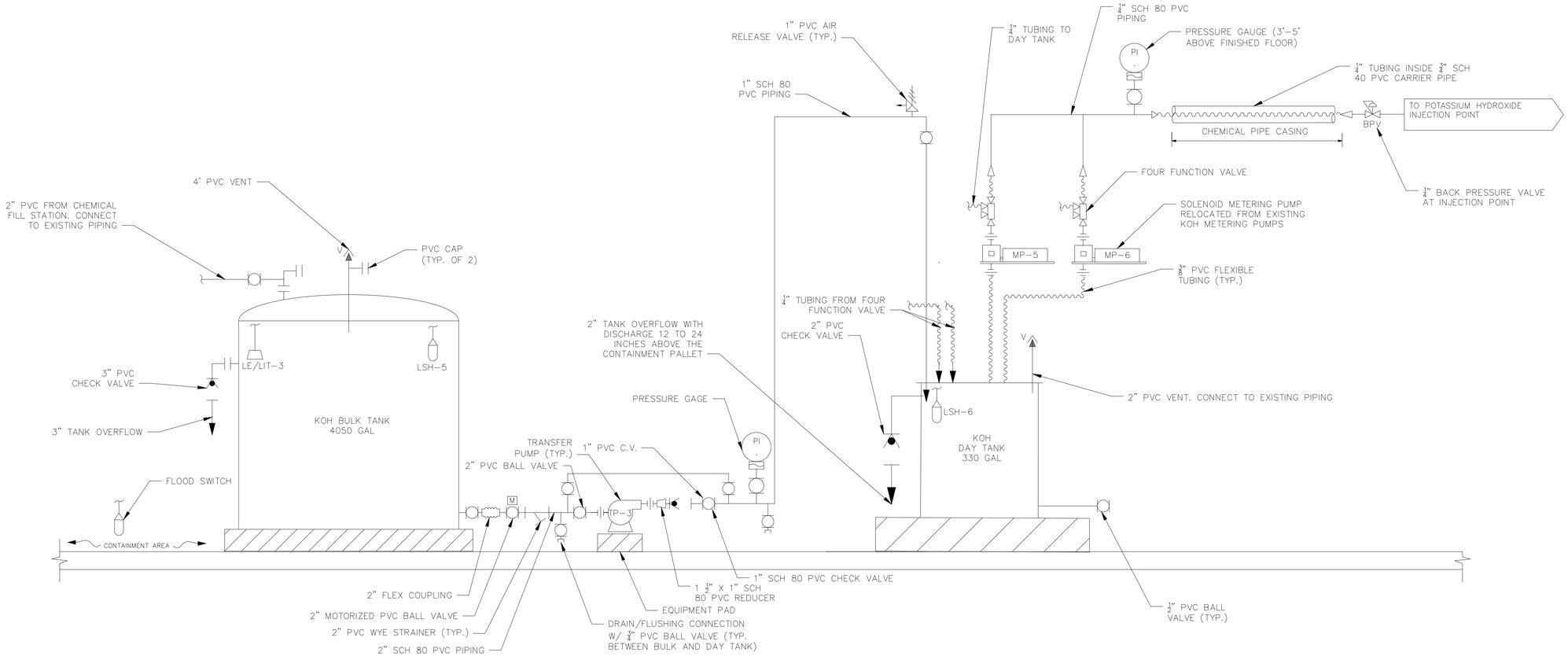

POTASSIUM HYDROXIDE (KOH) CHEMICAL FEED PIPING SCHEMATIC

SCALE: N.T.S.

CHEMICAL FEED PROCESS MECHANICAL NOTES:

1. ALL CHEMICAL FEED LINES, VENT LINES, AND PLANT WATER LINES SHALL BE SUPPORTED AS REQUIRED.
2. PIPING AND EQUIPMENT SUPPORTS SHALL BE INSTALLED AS DETERMINED BY THE CONTRACTOR FOLLOWING MANUFACTURER'S RECOMMENDATIONS FOR THE INTENDED SERVICE.
3. PROVIDE M.S.D.S. SHEETS, AND ALL OTHER ACCESSORIES TO MEET OSHA STANDARDS.
4. CONTRACTOR SHALL PROVIDE A VENT FOR EACH CHEMICAL STORAGE TANK. VENT SHALL BE FITTED WITH A GOOSE NECK AND 24-MESH (STAINLESS STEEL-NaOH AND PVC-CI AND CORROSION CONTROL) INSECT SCREEN. VENT SHALL SLOPE BACK TOWARD TANK. REFER TO INDIVIDUAL PIPING SCHEMATICS FOR SIZING.
5. ALL EQUIPMENT REQUIRING VENTING TO ATMOSPHERE SHALL HAVE VENTS LOCATED AWAY FROM ANY BUILDING OPENINGS.
6. ALL BULK TANKS AND DAY TANKS TO BE PROVIDED WITH EMERGENCY OVERFLOW LINES TO SECONDARY CONTAINMENT AREA. REFER TO INDIVIDUAL PIPING SCHEMATICS FOR SIZING. OVERFLOW CHECK VALVES SHALL BE SPRING LOADED AND MOUNTED IN HORIZONTAL POSITION.
7. INSTALL AIR RELEASE VALVE AT HIGH POINT BETWEEN TRANSFER PUMP AND DAY STORAGE TANK. AIR RELEASE SHALL BE PIPED BACK INTO DAY TANK.
8. PIPE ROUTING IS TO BE DETERMINED BY THE CONTRACTOR EXCEPT AS SHOWN ON PIPING SCHEMATICS. PIPE ROUTING SHALL BE ACCEPTED BY OWNER BEFORE INSTALLATION. PIPE ROUTING MUST NOT INTERFERE WITH ACCESS TO OPERATION OF ANY OTHER PIPE, VALVE, OR EQUIPMENT. PIPING SHALL NOT BE INSTALLED ABOVE ELECTRICAL EQUIPMENT AND CONTROL PANELS.
9. PIPING SHALL BE INSTALLED TO ALLOW FOR EXPANSION AND CONTRACTION WITHOUT APPLYING STRESS TO THE EQUIPMENT OR PIPING.
10. PVC WYE STRAINERS SHALL BE INSTALLED AT A MINIMUM OF 1'-0" OFF THE FINISHED FLOOR. REFER TO INDIVIDUAL CHEMICAL FEED PIPING SCHEMATICS FOR SIZES.
11. BULK TANK FILL LINE SHALL SLOPE TOWARD BULK TANK AFTER FILL PIPE GETS TO HEIGHT ABOVE TANK.
12. SUCTION AND INLET REDUCERS/INCREASERS SHALL BE PROVIDED, AS REQUIRED, AT TRANSFER PUMP CONNECTIONS TO PROPOSED CHEMICAL PIPING SYSTEMS.
13. PIPE UNIONS SHALL BE INSTALLED AT ALL PIPING CONNECTIONS TO AND FROM EQUIPMENT AND AS SHOWN ON PIPING SCHEMATIC.
14. BULK CHEMICAL STORAGE TANK PAD SHALL BE SUPPLIED BY TANK MANUFACTURER. PAD SHALL BE CUSTOM FIT TO MATCH THE TANK DIAMETER AND PAD MATERIAL SHALL BE COMPATIBLE WITH THE CHEMICAL BEING STORED.
15. METERING PUMP BRACKETS AND SHELVES SHALL BE INSTALLED 3' ABOVE FINISHED FLOOR.
17. TUBING CARRIER CONTAINMENT PIPE SHALL BE SCH. 80 PVC SOLVENT WELD JOINTS. CONTRACTOR SHALL MAKE ALL CHANGES IN DIRECTION OF THE CARRIER PIPE BY BENDING THE PIPE (MIN. 18" RADIUS) AND INSTALL "PULL BOXES" AT 15' INTERVALS ALONG THE ENTIRE LENGTH OF CONTAINMENT PIPING. PULL BOX SHALL INCLUDE TEE WITH THREADED CAP FOR ACCESS TO TUBING.
18. ALL CALIBRATION COLUMNS SHALL BE INSTALLED FOR GRAVITY FILL BY DAY TANK.

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REVISIONS

NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	NTS
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
POTASSIUM HYDROXIDE SCHEMATIC

DRAWING NO.:
M-3

SHEET NO. 40 OF 57

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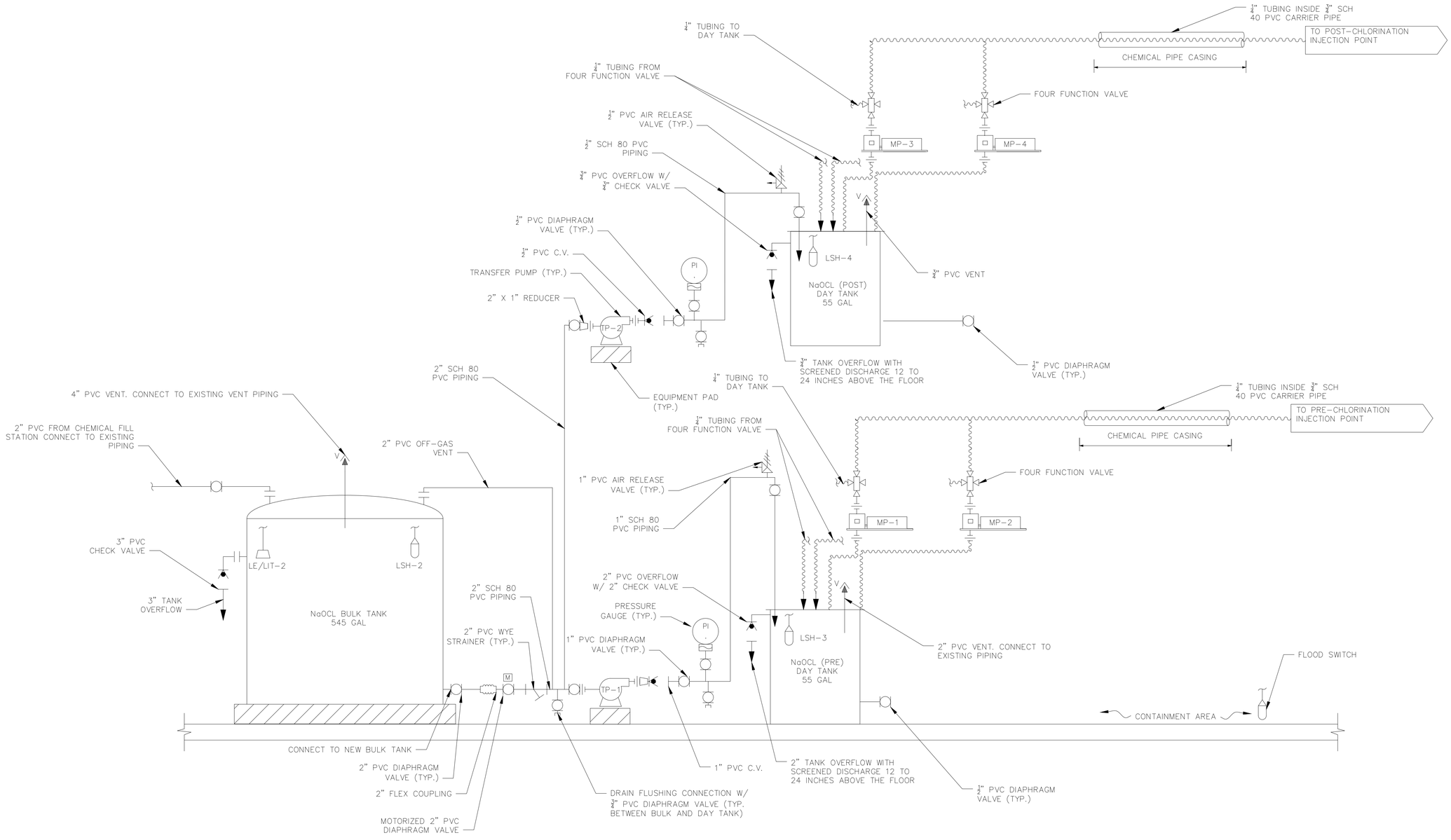

SODIUM HYPOCHLORITE PIPING SCHEMATIC

SCALE: N.T.S.

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REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	NTS
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SODIUM HYPOCHLORITE SCHEMATIC

DRAWING NO.:
M-4

SHEET NO. 41 OF 57

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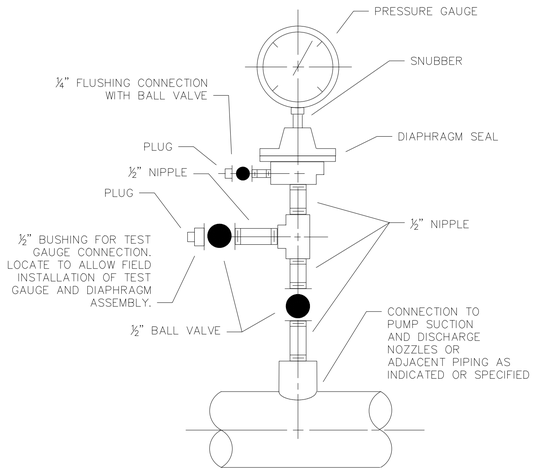
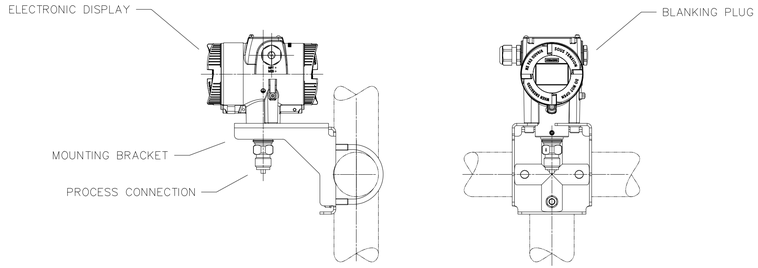


PRESSURE GAUGE MOUNTING DETAIL

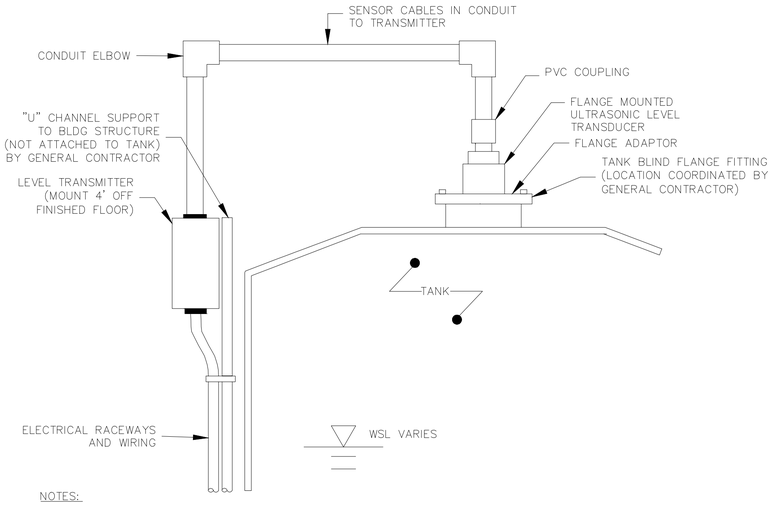
SCALE: N.T.S.



1. SEE NOTE 1 ON SHEET M-3

PRESSURE TRANSMITTER MOUNTING DETAIL

SCALE: N.T.S.

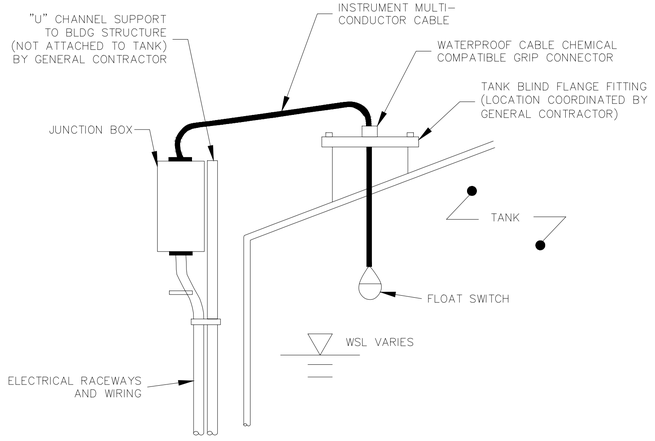


NOTES:

1. ELECTRICAL CONTRACTOR TO SUPPLY AND INSTALL ALL DIVISION 16 DEVICES, EQUIPMENT, COMPONENTS, AND ANCILLARY ITEMS ASSOCIATED WITH POWER AND SIGNAL WIRING FOR I&C DEVICES.
2. THE MOUNTING DETAILS PROVIDED ARE GENERIC FOR ULTRASONIC DEVICES OF VARIOUS MANUFACTURERS. THE INSTALLING CONTRACTOR MUST STRICTLY COMPLY WITH MANUFACTURER'S INSTRUCTION IN THE INSTALLATION OF THESE DEVICES. IF THERE ARE ANY ENGINEERING ISSUES THEY MUST BE REFERRED TO THE ENGINEER PRIOR TO INSTALLATION.

CHEMICAL TANK ULTRASONIC LEVEL DETAIL

SCALE: N.T.S.

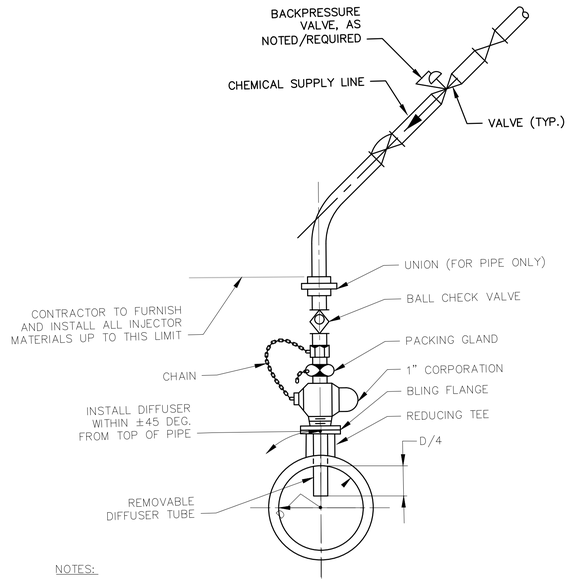


NOTES:

1. ELECTRICAL CONTRACTOR TO SUPPLY AND INSTALL ALL DIVISION 16 DEVICES, EQUIPMENT, COMPONENTS, AND ANCILLARY ITEMS ASSOCIATED WITH POWER AND SIGNAL WIRING FOR I&C DEVICES.
2. THE MOUNTING DETAILS PROVIDED ARE GENERIC FOR LEVEL SWITCH DEVICES OF VARIOUS MANUFACTURERS. THE INSTALLING CONTRACTOR MUST STRICTLY COMPLY WITH MANUFACTURER'S INSTRUCTION IN THE INSTALLATION OF THESE DEVICES. IF THERE ARE ANY ENGINEERING ISSUES THEY MUST BE REFERRED TO THE ENGINEER PRIOR TO INSTALLATION.

CHEMICAL TANK FLOAT SWITCH DETAIL

SCALE: N.T.S.

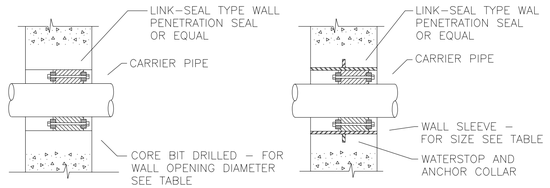


NOTES:

1. CHEMICAL INJECTORS INSTALLED IN 6-INCH PIPE OR SMALLER SHALL USE REDUCER TEE FOR INSTALLATION OF DIFFUSER.

CHEMICAL INJECTOR DETAILS

SCALE: N.T.S.



EXISTING CONCRETE WALL
SCALE: NTS

NEW CONCRETE WALL
SCALE: NTS

CARRIER PIPE NOMINAL SIZE	CARRIER PIPE O.D.	WALL SLEEVE SIZE	CORE DRILLED I.D.
2"	2.50"	4"	4"
4"	4.80"	8"	8"
6"	6.90"	10"	10"
8"	9.05"	12"	12"
16"	17.40"	20"	20"
18"	19.50"	24"	24"
24"	25.80"	30"	29"

NOTES:

1. SIZES SHOWN ARE FOR DUCTILE IRON PIPE, FOR OTHER MATERIALS AND PIPE SIZES CONSULT MANUFACTURER'S SPECIFICATIONS.
2. SOME APPLICATIONS MAY REQUIRE STANDARD WALL CASTINGS.
3. FOR WATER-TIGHT APPLICATIONS, PROVIDE NON-SHRINK GROUT ON EXTERIOR (NON-WATER SIDE) OF LINK-SEAL TYPE WALL PENETRATION.

TYPICAL WALL PENETRATION DETAIL

SCALE: N.T.S.

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 49,xxx
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	NTS
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	RAT
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
DETAILS

DRAWING NO.:
M-5

SHEET NO. 42 OF 57

C:\Users\Ryan\H2Olson Engineering, Inc\H2O - Documents\03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\M-Sheets\M Sheets.dwg

GENERAL NOTES

1. PROJECT SCOPE: PROVIDE COMPLETE AND OPERATIONAL SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS INCLUDING ALL NECESSARY MATERIAL, LABOR, AND EQUIPMENT.
2. CONSTRUCTION\CONTRACT DOCUMENTS: CONTRACT DOCUMENTS INCLUDING PLANS, DETAILS, AND ONE-LINE DIAGRAMS SHOW THE GENERAL LOCATION AND ARRANGEMENT OF THE WORK. THESE DOCUMENTS ARE DIAGRAMMATIC AND DO NOT SHOW ALL CONNECTORS, FITTINGS, HANGERS, AND ADDITIONAL ELEMENTS WHICH THE CONTRACTOR MUST PROVIDE TO COMPLETE THE SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN, THAT MAY EXIST, THUS REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE PROJECT AREA BEFORE PERFORMING THE WORK. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BY FIELD MEASUREMENTS.
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   A. THE CONTRACTOR SHALL COORDINATE THEIR WORK WITH ALL CONSTRUCTION DOCUMENTS AND OTHER TRADES ASSOCIATED WITH THE PROJECT.
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   C. BEFORE SELECTING MATERIAL, EQUIPMENT AND PROCEEDING WITH WORK, INSPECT AREAS WHERE MATERIAL AND EQUIPMENT ARE TO BE INSTALLED TO INSURE SUITABILITY, AND CHECK NEEDED SPACE FOR PLACEMENT, CLEARANCES AND INTERCONNECTIONS.
   D. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN THAT MAY EXIST; THUS, REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE SPACE BEFORE PERFORMING THE WORK.
   E. BEFORE CUTTING OR DRILLING INTO BUILDING ELEMENTS INSPECT AND LAYOUT WORK TO AVOID DAMAGING STRUCTURAL ELEMENTS AND BUILDING UTILITIES.
   F. ARRANGE FOR CHASES, SLOTS, AND OPENINGS IN OTHER BUILDING COMPONENTS DURING PROGRESS OF CONSTRUCTION, TO ALLOW FOR PROPER SYSTEM INSTALLATIONS.
   G. COORDINATE THE INSTALLATION OF REQUIRED SUPPORTING DEVICES AND SLEEVES TO BE SET IN POURED IN PLACE CONCRETE AND OTHER STRUCTURAL COMPONENTS, AS THEY ARE CONSTRUCTED.
   H. H) SEQUENCE, COORDINATE, AND INTEGRATE INSTALLATIONS OF MATERIALS AND EQUIPMENT FOR EFFICIENT FLOW OF THE WORK. GIVE PARTICULAR ATTENTION TO LARGE EQUIPMENT REQUIRING POSITIONING PRIOR TO CLOSING IN THE BUILDING.
   I. FAILURE OF THE CONTRACTOR TO ACQUAINT HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE ABOVE CONDITIONS AND NOT PERFORMING PROPER COORDINATION WILL NOT RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY FOR ESTIMATING THE DIFFICULTIES AND COSTS FOR SUCCESSFULLY PERFORMING THE COMPLETE WORK UNDER THIS PROJECT.
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6. PERMITS: THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED PERMITS AND ARRANGE FOR ALL REQUIRED INSPECTIONS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES.
7. WORKMAN: ALL WORK SHALL BE DONE WITH LICENSED WORKMEN IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES CODES AND REGULATIONS.
8. SUBMITTALS: THE CONTRACTOR SHALL PROVIDE SUBMITTALS FOR ALL EQUIPMENT AND MATERIALS BEING PROVIDED BEFORE SUCH EQUIPMENT AND MATERIALS ARE PURCHASED AND INSTALLED. THE SUBMITTALS SHALL BE REVIEWED AND RETURNED BY THE OWNER'S REPRESENTATIVE WITH APPROPRIATE COMMENTS. SUBMITTALS SHALL BE SUBMITTED ELECTRONICALLY IN PDF FORMAT AND WILL BE RETURNED WITH COMMENTS TO THE CONTRACTOR IN PDF FORMAT.
9. AS-BUILT DOCUMENTATION: THE CONTRACTOR SHALL PROVIDE ONE MARK-UP SET OF CONSTRUCTION DOCUMENTS SHOWING FINAL AS-BUILT CONDITIONS. DOCUMENTS SHALL CLEARLY SHOW THE CHANGES MADE TO THE INSTALLED SYSTEMS.
10. EQUIPMENT WARRANTIES, MAINTENANCE MANUALS AND INSTALLATION MANUALS: TURN OVER TO THE OWNER ALL MANUFACTURERS' WARRANTIES, MAINTENANCE MANUALS, AND INSTALLATION MANUALS FOR EQUIPMENT AND MATERIALS PROVIDED.
11. PHOTOGRAPHS: PHOTOGRAPHS ARE PROVIDED TO SHOW CURRENT CONDITION OF BUILDING SYSTEMS TO ASSIST THE CONTRACTOR. PHOTOGRAPHS DO NOT SHOW ALL AREAS OF THE BUILDING OR ALL SYSTEM CONDITIONS, THUS REQUIRING THE CONTRACTOR TO VISIT THE SITE BEFORE PERFORMING WORK. PHOTOGRAPHS ARE NOT INTENDED TO SHOW SCOPE OF WORK. PLANS, NOTES, SPECIFICATIONS AND OTHER BID DOCUMENTS INDICATE SCOPE OF WORK.
12. TERMINOLOGY:
   A. THE TERM "INDICATED" SHALL MEAN, "AS SHOWN ON CONTRACT DOCUMENTS (SPECIFICATIONS, DRAWINGS, AND RELATED ATTACHMENTS)".
   B. THE TERM "PROVIDE" SHALL MEAN, "TO FURNISH, INSTALL, AND CONNECT COMPLETELY".
   C. THE TERM "COORDINATE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "TO MANAGE, INTERFACE, COMMUNICATE, MAKE ARRANGEMENT, BRING INTO ORDER, ADMINISTER AND HANDLE COMPLETELY".
   D. THE TERM "INTERIOR" IS AN INTERIOR LOCATION WHERE ITS ENVIRONMENT IS HEATED AND/OR AIR CONDITIONED AND NOT SUBJECT TO OUTSIDE WEATHER CONDITIONS.
   E. THE TERM "EXTERIOR" IS ALL LOCATIONS, WHICH ARE NOT INTERIOR, OR UNDERGROUND.
   F. THE TERM "INTERIOR FINISHED SPACE" IS INTERIOR SPACES, WHICH ARE USED FOR OFFICES, CORRIDORS, LOBBIES, TOILETS, STORAGE AND FILING ROOMS, LOUNGES, MECHANICAL ROOMS, ELECTRICAL ROOMS, ETC.
13. DEMOLITION: DEMOLITION OF INDICATED ITEMS INCLUDES THE REMOVAL AND PROPER DISPOSAL OF THOSE ITEMS AND ALL ASSOCIATED PIPING, DUCTWORK, WIRING AND HANGERS. ELECTRICAL BRANCH, CONTROL, TELEPHONE, AND ALARM WIRING SHALL BE REMOVED BACK TO PANELBOARDS OR RELATED SYSTEM PANELS OR BACKBOARDS.
14. EQUIPMENT AND MATERIAL INSTALLATIONS:
   A. ALL EQUIPMENT AND MATERIALS SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING AND MANUFACTURER'S REQUIREMENTS.
   B. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
   C. IF AN EQUIPMENT MANUFACTURER REQUIRES LARGER CAPACITY, CIRCUITRY AND/OR EQUIPMENT, THE CONTRACTOR SHALL PROVIDE SUCH CAPACITY AND/OR EQUIPMENT UNDER HIS CONTRACT AT NO ADDITIONAL COST TO THE OWNER.
   D. LOCATE ALL EQUIPMENT, WHICH REQUIRES SERVICING IN FULLY ACCESSIBLE POSITIONS. IF REQUIRED FOR BETTER ACCESSIBILITY, FURNISH ACCESS DOORS FOR THAT PURPOSE.
   E. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR BETTER ACCESSIBILITY.
   F. ALL WORK IN INTERIOR FINISHED SPACES SHALL BE CONCEALED BEHIND WALLS, ABOVE CEILINGS OR HUNG CEILINGS, OR UNDER THE FLOOR. PROVIDE ALL NECESSARY CUTTING, PATCHING, REPAINTING AND/OR REPLACEMENT OF CEILING TILES AS REQUIRED TO PERFORM WORK.
   G. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO CONFORM WITH APPROVED SUBMITTAL DATA, INCLUDING COORDINATION DRAWINGS (IF REQUIRED), TO GREATEST EXTENT POSSIBLE. CONFORM TO ARRANGEMENTS INDICATED BY THE CONTRACT DOCUMENTS, RECOGNIZING THAT PORTIONS OF THE WORK ARE SHOWN ONLY IN DIAGRAMMATIC FORM. WHERE COORDINATION REQUIREMENTS CONFLICT WITH INDIVIDUAL SYSTEM REQUIREMENTS, REFER CONFLICT TO THE ARCHITECT/ENGINEER.
   H. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT LEVEL AND PLUMB, PARALLEL AND PERPENDICULAR TO OTHER BUILDING SYSTEMS AND COMPONENTS, WHERE INSTALLED EXPOSED IN FINISHED SPACES
   I. INSTALL EQUIPMENT TO FACILITATE SERVICING, MAINTENANCE, AND REPAIR OR REPLACEMENT OF EQUIPMENT COMPONENTS. AS MUCH AS PRACTICAL, CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM OF INTERFERENCE WITH OTHER INSTALLATIONS.
   J. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT GIVING RIGHT OF WAY PRIORITY TO SYSTEMS REQUIRED TO BE INSTALLED AT A SPECIFIED SLOPE.
   K. K) WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE.
   L. ASCERTAIN FROM EXAMINATION OF THE DRAWINGS, ANY SPECIAL TEMPORARY OPENINGS IN THE BUILDING REQUIRED FOR THE ADMISSION OF APPARATUS PROVIDED UNDER THIS DIVISION. NOTIFY THE CONTRACTOR WITH SUFFICIENT NOTICE TO PROVIDE THESE OPENINGS. IN THE EVENT OF FAILURE TO GIVE SUFFICIENT NOTICE, THE CONTRACTOR SHALL ASSUME ALL COSTS OF PROVIDING SUCH OPENINGS THEREAFTER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DISASSEMBLY AND ASSEMBLY OF EQUIPMENT AS REQUIRED TO PLACE EQUIPMENT IN THEIR FINAL LOCATIONS.
   M. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UNDERGROUND UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
15. FIRE RATINGS: THE CONTRACTOR SHALL REVIEW ALL CONTRACT DOCUMENTS FOR FIRE SEPARATION AND FIRE RATED ASSEMBLIES. ALL PIPING, DUCTWORK AND CONDUITS PASSING THROUGH OR PENETRATING WALLS, CEILINGS AND FLOORS SHALL BE PROVIDED WITH A UL LISTED FIRE STOPPING ASSEMBLIES. UL LISTED FIRE STOPPING ASSEMBLIES SHALL BE SUITABLE FOR THE CONDITIONS ENCOUNTERED AND SHALL BE RATED EQUAL TO THE RATING OF THE WALL, CEILING OR FLOOR. REVIEW FIRE RATED ASSEMBLIES THAT ALLOW PENETRATIONS OF ITEMS SUCH AS OUTLET BOXES AND CONDUITS THAT DO NOT REQUIRE FIRE STOPPING. SPACE AND POSITION THESE DEVICES AS ALLOWED PER THE ASSEMBLY'S UL RATING.
16. SERVICE LABELING: LABEL EQUIPMENT, PIPING, CONDUITS, INCLUDING FANS, AIR HANDLERS, TERMINAL UNITS, PANELBOARDS, ETC. WITH LABELS MADE OF SELF-STICKING, PLASTIC FILM DESIGNED FOR PERMANENT INSTALLATION. LABELS SHALL MATCH DESIGNATIONS AS INDICATED ON CONTRACT DRAWINGS. IDENTIFY PIPING AND CONDUITS IN ACCORDANCE WITH OSHA 29 CFR 1910.144, EXCEPT THAT LABELS OR TAPES MAY BE USED IN LIEU OF PAINTING OR STENCILING. SPACING OF IDENTIFICATION MARKING ON RUNS SHALL NOT EXCEED 50 FEET. MATERIALS FOR LABELS AND TAPES SHALL CONFORM TO CID A-A-1689, AND SHALL BE GENERAL PURPOSE TYPE AND COLOR CLASS.
   A. IN ADDITION IDENTIFY SERVICES AS INDICATED BELOW:
   B. EACH POINT OF ENTRY AND EXIT OF PIPE OR CONDUITS PASSING THROUGH WALLS.
   C. EACH CHANGE IN DIRECTION, I.E., ELBOWS, TEES.
   D. IN CONGESTED OR HIDDEN AREAS AND AT ALL ACCESS PANELS AT EACH POINT REQUIRED TO CLARIFY SERVICE OR INDICATED HAZARD.
   E. IN LONG STRAIGHT RUNS, LOCATE LABELS AT DISTANCES WITHIN EYESIGHT OF EACH OTHER NOT TO EXCEED 50 FEET. ALL LABELS SHALL BE VISIBLE AND LEGIBLE FROM THE PRIMARY SERVICE AND OPERATING AREA.
17. MANUFACTURER'S NAMEPLATES: EACH ITEM OF EQUIPMENT SHALL HAVE A NAMEPLATE BEARING THE MANUFACTURER'S NAME, ADDRESS, MODEL NUMBER, AND SERIAL NUMBER SECURELY AFFIXED IN A CONSPICUOUS PLACE; THE NAMEPLATE OF THE DISTRIBUTING AGENT WILL NOT BE ACCEPTABLE.
18. POSTED OPERATING INSTRUCTIONS: PROVIDE FOR EACH SYSTEM AND PRINCIPAL ITEM OF EQUIPMENT AS SPECIFIED FOR USE BY OPERATION AND MAINTENANCE PERSONNEL. PRINT OR ENGRAVE OPERATING INSTRUCTIONS AND FRAME UNDER GLASS OR IN APPROVED LAMINATED PLASTIC. POST INSTRUCTIONS WHERE DIRECTED. FOR OPERATING INSTRUCTIONS EXPOSED TO THE WEATHER, PROVIDE WEATHER-RESISTANT MATERIALS OR WEATHERPROOF ENCLOSURES. OPERATING INSTRUCTIONS SHALL NOT FADE WHEN EXPOSED TO SUNLIGHT AND SHALL BE SECURED TO PREVENT EASY REMOVAL OR PEELING. THE OPERATING INSTRUCTIONS SHALL INCLUDE THE FOLLOWING.
   A. WIRING DIAGRAMS, CONTROL DIAGRAMS, AND CONTROL SEQUENCE FOR EACH PRINCIPAL SYSTEM AND ITEM OF EQUIPMENT.
   B. START UP, PROPER ADJUSTMENT, OPERATING, LUBRICATION, AND SHUTDOWN PROCEDURES.
   C. SAFETY PRECAUTIONS.
   D. THE PROCEDURE IN THE EVENT OF EQUIPMENT FAILURE.
   E. OTHER ITEMS OF INSTRUCTION AS RECOMMENDED BY THE MANUFACTURER OF EACH SYSTEM OR ITEM OF EQUIPMENT.
19. WARNING SIGNS: PROVIDE WARNING SIGNS FOR THE ENCLOSURES OF ELECTRICAL EQUIPMENT INCLUDING SUBSTATIONS, PAD-MOUNTED TRANSFORMERS, PAD-MOUNTED SWITCHES, GENERATORS, AND SWITCHGEAR HAVING A NOMINAL RATING EXCEEDING 600 VOLTS.
20. EXTERIOR FERROUS MATERIALS: ALL EXTERIOR FERROUS MATERIALS SHALL BE PROTECTED FROM CORROSION BY ONE OF THE FOLLOWING METHODS:
   A. COVERED WITH A NON-FERROUS OR NON-CORRODING MATERIAL.
   B. MATERIALS THAT ARE INSULATED ON THE EXTERIOR.
   C. MATERIALS THAT ARE GALVANIZED.
   D. MATERIALS THAT ARE PAINTED. EXTERIOR PAINTING SHALL CONSIST OF A BASE COAT OF AN APPROPRIATE PRIMER AND TWO COATS OF FINAL PAINT. FINAL PAINT COLOR SHALL BE SELECTED BY THE OWNER'S REPRESENTATIVE.

GENERAL SYMBOLS

PLAN TITLES

A / A8

SCALE: 1/8" = 1'-0" 0 4' 8' 16'

A / A8 — SECTION MARKERS

NORTH ARROW

ITEMS TO BE DEMOLISHED

CODE REQUIREMENTS

ALL CONSTRUCTION SHALL FOLLOW THE 10TH ADDITION OF THE MASSACHUSETTS STATE BUILDING CODE AS FOLLOWS:
MASSACHUSETTS STATE BUILDING CODE (780 CMR),
MASSACHUSETTS ELECTRICAL CODE (527 CMR 12.00),
UNIFORM STATE PLUMBING CODE (248 CMR 10.00),
MASSACHUSETTS FUEL GAS CODE (248 CMR 4.00)
MASSACHUSETTS COMPREHENSIVE FIRE SAFETY CODE (527 CMR 1.00),
MASSACHUSETTS SANITARY CODE (105 CMR 410),
ARCHITECTURAL ACCESS BOARD (521 CMR),
MASSACHUSETTS STRETCH ENERGY CODE.

THE MASSACHUSETTS CODE AMENDS AND REFERENCES THE FOLLOWING CODES:
2021 INTERNATIONAL BUILDING CODE
2021 INTERNATIONAL RESIDENTIAL CODE (IRC):
2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
2021INTERNATIONAL EXISTING BUILDING CODE (IEBC)
2021INTERNATIONAL MECHANICAL CODE (IMC):
2023 NFPA 70 (NATIONAL ELECTRICAL CODE)

PLUMBING PIPE SYMBOLS

4" DCW	DOMESTIC COLD WATER
4" DHW	DOMESTIC HOT WATER
4" SAN	SANITARY SEWER DRAIN
4" SAN	SANITARY SEWER DRAIN BELOW
4" V	VENT
4" STRM	STORM DRAIN
4" STRM	STORM DRAIN BELOW

PLUMBING SYMBOLS

	ELBOW UP
	ELBOW DOWN
	TEE
	TEE UP
	TEE DOWN
	HOSE BIBB
	CONCENTRIC TRANSITION
	ECCENTRIC TRANSITION
	END CAP
	UNION
	BALL VALVE
	BUTTERFLY VALVE
	CHECK VALVE
	GLOBE VALVE
	GATE VALVE NRS
	GATE VALVE OS&Y
	PLUG VALVE LEVER
	PRESSURE REGULATING VALVE
	PRESSURE RELIEF VALVE
	RELIEF VALVE
	END OF LINE CLEANOUT
	CLEANOUT TO GRADE

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. GLAZIER — REGISTERED PROFESSIONAL ENGINEER — 6/4/26

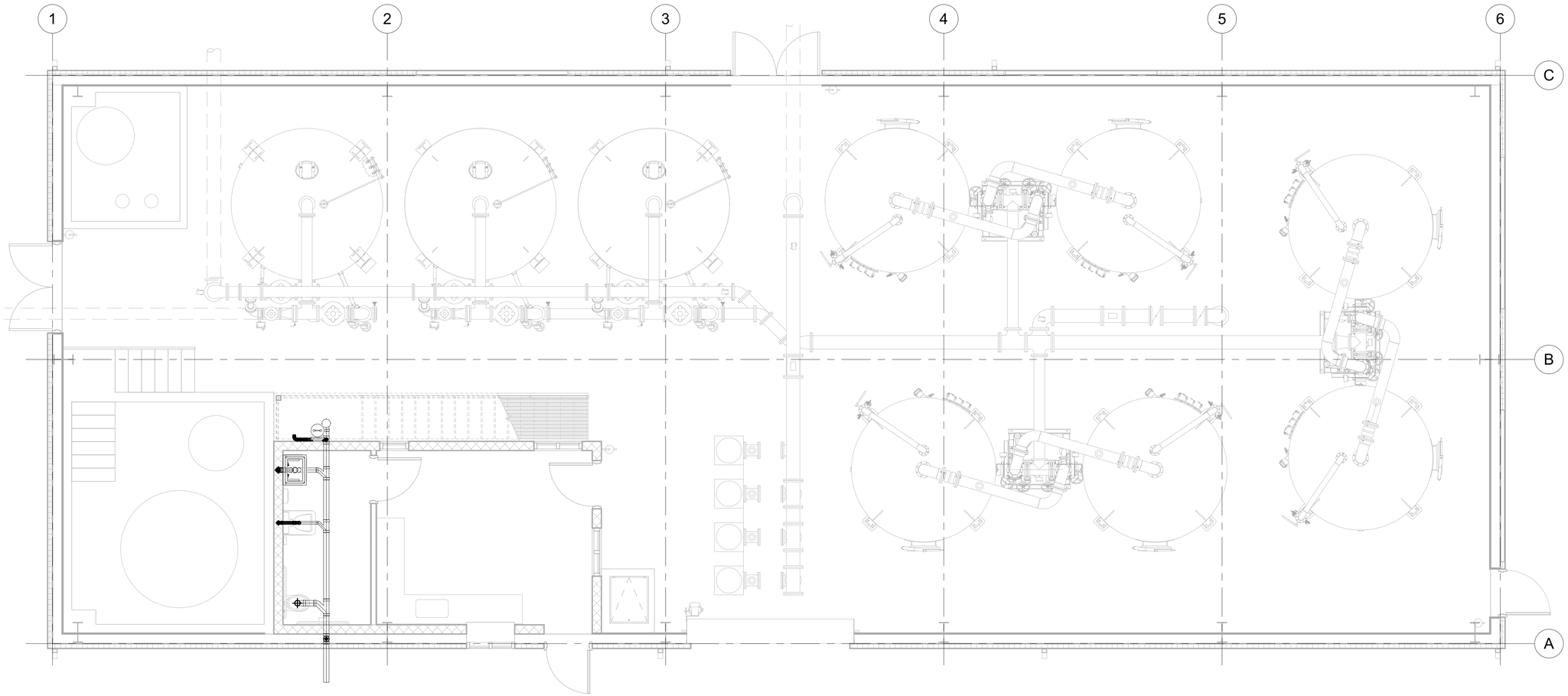
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	12" = 1'-0"
DESIGNED BY:	BAB
CHECKED BY:	BAB
DRAWN BY:	GJG
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
PLUMBING NOTES & SYMBOLS

DRAWING NO.:
P-1

SHEET NO. 43 OF 57



1
P-2

PLUMBING PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS

NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	BAB
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
PLUMBING PLANS

DRAWING NO.:
P-2

SHEET NO. 44 OF 57

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4. SHUTDOWNS: WRITTEN REQUESTS FOR APPROVAL FOR PLANNED SHUTDOWNS OR INTERRUPTION OF OWNER'S UTILITIES, SYSTEMS AND EQUIPMENT SHALL BE MADE 72 HOURS PRIOR TO THE START OF THE REQUESTED SHUTDOWN PERIODS.
5. CODES AND STANDARDS: THE CONTRACTOR SHALL FOLLOW ALL FEDERAL, STATE AND LOCAL CODES THAT HAVE JURISDICTION WHERE THE WORK IS BEING PERFORMED. THROUGHOUT THE CONTRACT DOCUMENTS CERTAIN CODES AND STANDARDS ARE REFERENCED. THE CONTRACTOR SHALL USE THE LATEST VERSIONS OF CODES AND STANDARDS REFERENCED UNLESS OTHERWISE NOTED. IF THE CONTRACTOR IS NOT FAMILIAR WITH THE REFERENCED STANDARD THEY SHALL CONTACT THE OWNER'S REPRESENTATIVE FOR DIRECTION.
6. PERMITS: THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED PERMITS AND ARRANGE FOR ALL REQUIRED INSPECTIONS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES.
7. WORKMAN: ALL WORK SHALL BE DONE WITH LICENSED WORKMEN IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES CODES AND REGULATIONS.
8. SUBMITTALS: THE CONTRACTOR SHALL PROVIDE SUBMITTALS FOR ALL EQUIPMENT AND MATERIALS BEING PROVIDED BEFORE SUCH EQUIPMENT AND MATERIALS ARE PURCHASED AND INSTALLED. THE SUBMITTALS SHALL BE REVIEWED AND RETURNED BY THE OWNER'S REPRESENTATIVE WITH APPROPRIATE COMMENTS. SUBMITTALS SHALL BE SUBMITTED ELECTRONICALLY IN PDF FORMAT AND WILL BE RETURNED WITH COMMENTS TO THE CONTRACTOR IN PDF FORMAT.
9. AS-BUILT DOCUMENTATION: THE CONTRACTOR SHALL PROVIDE ONE MARK-UP SET OF CONSTRUCTION DOCUMENTS SHOWING FINAL AS-BUILT CONDITIONS. DOCUMENTS SHALL CLEARLY SHOW THE CHANGES MADE TO THE INSTALLED SYSTEMS.
10. EQUIPMENT WARRANTIES, MAINTENANCE MANUALS AND INSTALLATION MANUALS: TURN OVER TO THE OWNER ALL MANUFACTURERS' WARRANTIES, MAINTENANCE MANUALS, AND INSTALLATION MANUALS FOR EQUIPMENT AND MATERIALS PROVIDED.
11. PHOTOGRAPHS: PHOTOGRAPHS ARE PROVIDED TO SHOW CURRENT CONDITION OF BUILDING SYSTEMS TO ASSIST THE CONTRACTOR. PHOTOGRAPHS DO NOT SHOW ALL AREAS OF THE BUILDING OR ALL SYSTEM CONDITIONS, THUS REQUIRING THE CONTRACTOR TO VISIT THE SITE BEFORE PERFORMING WORK. PHOTOGRAPHS ARE NOT INTENDED TO SHOW SCOPE OF WORK. PLANS, NOTES, SPECIFICATIONS AND OTHER BID DOCUMENTS INDICATE SCOPE OF WORK.
12. TERMINOLOGY:
   A. THE TERM "INDICATED" SHALL MEAN, "AS SHOWN ON CONTRACT DOCUMENTS (SPECIFICATIONS, DRAWINGS, AND RELATED ATTACHMENTS)".
   B. THE TERM "PROVIDE" SHALL MEAN, "TO FURNISH, INSTALL, AND CONNECT COMPLETELY".
   C. THE TERM "COORDINATE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "TO MANAGE, INTERFACE, COMMUNICATE, MAKE ARRANGEMENT, BRING INTO ORDER, ADMINISTER AND HANDLE COMPLETELY".
   D. THE TERM "INTERIOR" IS AN INTERIOR LOCATION WHERE ITS ENVIRONMENT IS HEATED AND/OR AIR CONDITIONED AND NOT SUBJECT TO OUTSIDE WEATHER CONDITIONS.
   E. THE TERM "EXTERIOR" IS ALL LOCATIONS, WHICH ARE NOT INTERIOR, OR UNDERGROUND.
   F. THE TERM "INTERIOR FINISHED SPACE" IS INTERIOR SPACES, WHICH ARE USED FOR OFFICES, CORRIDORS, LOBBIES, TOILETS, STORAGE AND FILING ROOMS, LOUNGES, MECHANICAL ROOMS, ELECTRICAL ROOMS, ETC.
13. DEMOLITION: DEMOLITION OF INDICATED ITEMS INCLUDES THE REMOVAL AND PROPER DISPOSAL OF THOSE ITEMS AND ALL ASSOCIATED PIPING, DUCTWORK, WIRING AND HANGERS. ELECTRICAL BRANCH, CONTROL, TELEPHONE, AND ALARM WIRING SHALL BE REMOVED BACK TO PANELBOARDS OR RELATED SYSTEM PANELS OR BACKBOARDS.
14. EQUIPMENT AND MATERIAL INSTALLATIONS:
   A. ALL EQUIPMENT AND MATERIALS SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING AND MANUFACTURER'S REQUIREMENTS.
   B. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
   C. IF AN EQUIPMENT MANUFACTURER REQUIRES LARGER CAPACITY, CIRCUITRY AND/OR EQUIPMENT, THE CONTRACTOR SHALL PROVIDE SUCH CAPACITY AND/OR EQUIPMENT UNDER HIS CONTRACT AT NO ADDITIONAL COST TO THE OWNER.
   D. LOCATE ALL EQUIPMENT, WHICH REQUIRES SERVICING IN FULLY ACCESSIBLE POSITIONS. IF REQUIRED FOR BETTER ACCESSIBILITY, FURNISH ACCESS DOORS FOR THAT PURPOSE.
   E. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR BETTER ACCESSIBILITY.
   F. ALL WORK IN INTERIOR FINISHED SPACES SHALL BE CONCEALED BEHIND WALLS, ABOVE CEILINGS OR HUNG CEILINGS, OR UNDER THE FLOOR. PROVIDE ALL NECESSARY CUTTING, PATCHING, REPAINTING AND/OR REPLACEMENT OF CEILING TILES AS REQUIRED TO PERFORM WORK.
   G. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO CONFORM WITH APPROVED SUBMITTAL DATA, INCLUDING COORDINATION DRAWINGS (IF REQUIRED), TO GREATEST EXTENT POSSIBLE. CONFORM TO ARRANGEMENTS INDICATED BY THE CONTRACT DOCUMENTS, RECOGNIZING THAT PORTIONS OF THE WORK ARE SHOWN ONLY IN DIAGRAMMATIC FORM. WHERE COORDINATION REQUIREMENTS CONFLICT WITH INDIVIDUAL SYSTEM REQUIREMENTS, REFER CONFLICT TO THE ARCHITECT/ENGINEER.
   H. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT LEVEL AND PLUMB, PARALLEL AND PERPENDICULAR TO OTHER BUILDING SYSTEMS AND COMPONENTS, WHERE INSTALLED EXPOSED IN FINISHED SPACES
   I. INSTALL EQUIPMENT TO FACILITATE SERVICING, MAINTENANCE, AND REPAIR OR REPLACEMENT OF EQUIPMENT COMPONENTS. AS MUCH AS PRACTICAL, CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM OF INTERFERENCE WITH OTHER INSTALLATIONS.
   J. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT GIVING RIGHT OF WAY PRIORITY TO SYSTEMS REQUIRED TO BE INSTALLED AT A SPECIFIED SLOPE.
   K. K) WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE.
   L. ASCERTAIN FROM EXAMINATION OF THE DRAWINGS, ANY SPECIAL TEMPORARY OPENINGS IN THE BUILDING REQUIRED FOR THE ADMISSION OF APPARATUS PROVIDED UNDER THIS DIVISION. NOTIFY THE CONTRACTOR WITH SUFFICIENT NOTICE TO PROVIDE THESE OPENINGS. IN THE EVENT OF FAILURE TO GIVE SUFFICIENT NOTICE, THE CONTRACTOR SHALL ASSUME ALL COSTS OF PROVIDING SUCH OPENINGS THEREAFTER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DISASSEMBLY AND ASSEMBLY OF EQUIPMENT AS REQUIRED TO PLACE EQUIPMENT IN THEIR FINAL LOCATIONS.
   M. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UNDERGROUND UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
15. FIRE RATINGS: THE CONTRACTOR SHALL REVIEW ALL CONTRACT DOCUMENTS FOR FIRE SEPARATION AND FIRE RATED ASSEMBLIES. ALL PIPING, DUCTWORK AND CONDUITS PASSING THROUGH FIRE RATED WALLS, CEILINGS AND FLOORS SHALL BE PROVIDED WITH A UL LISTED FIRE STOPPING ASSEMBLIES. UL LISTED FIRE STOPPING ASSEMBLIES SHALL BE SUITABLE FOR THE CONDITIONS ENCOUNTERED AND SHALL BE RATED EQUAL TO THE RATING OF THE WALL, CEILING OR FLOOR. REVIEW FIRE RATED ASSEMBLIES THAT ALLOW PENETRATIONS OF ITEMS SUCH AS OUTLET BOXES AND CONDUITS THAT DO NOT REQUIRE FIRE STOPPING. SPACE AND POSITION THESE DEVICES AS ALLOWED PER THE ASSEMBLY'S UL RATING.
16. SERVICE LABELING: LABEL EQUIPMENT, PIPING, CONDUITS, INCLUDING FANS, AIR HANDLERS, TERMINAL UNITS, PANELBOARDS, ETC. WITH LABELS MADE OF SELF-STICKING, PLASTIC FILM DESIGNED FOR PERMANENT INSTALLATION. LABELS SHALL MATCH DESIGNATIONS AS INDICATED ON CONTRACT DRAWINGS. IDENTIFY PIPING AND CONDUITS IN ACCORDANCE WITH OSHA 29 CFR 1910.144, EXCEPT THAT LABELS OR TAPES MAY BE USED IN LIEU OF PAINTING OR STENCILING. SPACING OF IDENTIFICATION MARKING ON RUNS SHALL NOT EXCEED 50 FEET. MATERIALS FOR LABELS AND TAPES SHALL CONFORM TO CID A-A-1689, AND SHALL BE GENERAL PURPOSE TYPE AND COLOR CLASS.
   A. IN ADDITION IDENTIFY SERVICES AS INDICATED BELOW:
   B. EACH POINT OF ENTRY AND EXIT OF PIPE OR CONDUITS PASSING THROUGH WALLS.
   C. EACH CHANGE IN DIRECTION, I.E., ELBOWS, TEES.
   D. IN CONGESTED OR HIDDEN AREAS AND AT ALL ACCESS PANELS AT EACH POINT REQUIRED TO CLARIFY SERVICE OR INDICATED HAZARD.
   E. IN LONG STRAIGHT RUNS, LOCATE LABELS AT DISTANCES WITHIN EYESIGHT OF EACH OTHER NOT TO EXCEED 50 FEET. ALL LABELS SHALL BE VISIBLE AND LEGIBLE FROM THE PRIMARY SERVICE AND OPERATING AREA.
17. MANUFACTURER'S NAMEPLATES: EACH ITEM OF EQUIPMENT SHALL HAVE A NAMEPLATE BEARING THE MANUFACTURER'S NAME, ADDRESS, MODEL NUMBER, AND SERIAL NUMBER SECURELY AFFIXED IN A CONSPICUOUS PLACE; THE NAMEPLATE OF THE DISTRIBUTING AGENT WILL NOT BE ACCEPTABLE.
18. POSTED OPERATING INSTRUCTIONS: PROVIDE FOR EACH SYSTEM AND PRINCIPAL ITEM OF EQUIPMENT AS SPECIFIED FOR USE BY OPERATION AND MAINTENANCE PERSONNEL. PRINT OR ENGRAVE OPERATING INSTRUCTIONS AND FRAME UNDER GLASS OR IN APPROVED LAMINATED PLASTIC. POST INSTRUCTIONS WHERE DIRECTED. FOR OPERATING INSTRUCTIONS EXPOSED TO THE WEATHER, PROVIDE WEATHER-RESISTANT MATERIALS OR WEATHERPROOF ENCLOSURES. OPERATING INSTRUCTIONS SHALL NOT FADE WHEN EXPOSED TO SUNLIGHT AND SHALL BE SECURED TO PREVENT EASY REMOVAL OR PEELING. THE OPERATING INSTRUCTIONS SHALL INCLUDE THE FOLLOWING:
   A. WIRING DIAGRAMS, CONTROL DIAGRAMS, AND CONTROL SEQUENCE FOR EACH PRINCIPAL SYSTEM AND ITEM OF EQUIPMENT.
   B. START UP, PROPER ADJUSTMENT, OPERATING, LUBRICATION, AND SHUTDOWN PROCEDURES.
   C. SAFETY PRECAUTIONS.
   D. THE PROCEDURE IN THE EVENT OF EQUIPMENT FAILURE.
   E. OTHER ITEMS OF INSTRUCTION AS RECOMMENDED BY THE MANUFACTURER OF EACH SYSTEM OR ITEM OF EQUIPMENT.
19. WARNING SIGNS: PROVIDE WARNING SIGNS FOR THE ENCLOSURES OF ELECTRICAL EQUIPMENT INCLUDING SUBSTATIONS, PAD-MOUNTED TRANSFORMERS, PAD-MOUNTED SWITCHES, GENERATORS, AND SWITCHGEAR HAVING A NOMINAL RATING EXCEEDING 600 VOLTS.
20. EXTERIOR FERROUS MATERIALS: ALL EXTERIOR FERROUS MATERIALS SHALL BE PROTECTED FROM CORROSION BY ONE OF THE FOLLOWING METHODS:
   A. COVERED WITH A NON-FERROUS OR NON-CORRODING MATERIAL.
   B. MATERIALS THAT ARE INSULATED ON THE EXTERIOR.
   C. MATERIALS THAT ARE GALVANIZED.
   D. MATERIALS THAT ARE PAINTED. EXTERIOR PAINTING SHALL CONSIST OF A BASE COAT OF AN APPROPRIATE PRIMER AND TWO COATS OF FINAL PAINT. FINAL PAINT COLOR SHALL BE SELECTED BY THE OWNER'S REPRESENTATIVE.

GENERAL SYMBOLS

PLAN TITLES

A / A8

SCALE: 1/8" = 1'-0" 0 4' 8' 16'

A / A8 — SECTION MARKERS

NORTH ARROW

ITEMS TO BE DEMOLISHED

CODE REQUIREMENTS

ALL CONSTRUCTION SHALL FOLLOW THE 10TH ADDITION OF THE MASSACHUSETTS STATE BUILDING CODE AS FOLLOWS:
MASSACHUSETTS STATE BUILDING CODE (780 CMR),
MASSACHUSETTS ELECTRICAL CODE (527 CMR 12.00),
UNIFORM STATE PLUMBING CODE (248 CMR 10.00),
MASSACHUSETTS FUEL GAS CODE (248 CMR 4.00)
MASSACHUSETTS COMPREHENSIVE FIRE SAFETY CODE (527 CMR 1.00),
MASSACHUSETTS SANITARY CODE (105 CMR 410),
ARCHITECTURAL ACCESS BOARD (521 CMR),
MASSACHUSETTS STRETCH ENERGY CODE.

THE MASSACHUSETTS CODE AMENDS AND REFERENCES THE FOLLOWING CODES:
2021 INTERNATIONAL BUILDING CODE
2021 INTERNATIONAL RESIDENTIAL CODE (IRC):
2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
2021INTERNATIONAL EXISTING BUILDING CODE (IEBC)
2021INTERNATIONAL MECHANICAL CODE (IMC):
2023 NFPA 70 (NATIONAL ELECTRICAL CODE)

FIRE PROT. SYMBOLS

4" WET	WET PIPE
4" DRY	DRY PIPE
●	PENDENT HEAD
⊗	PENDENT & UPRIGHT HEAD (ABOVE & BELOW CEILING)
○	UPRIGHT HEAD
⊗	UPRIGHT HEAD WITH GUARD
▽	SIDEWALL HEAD
	BALL VALVE
	BUTTERFLY VALVE
	CHECK VALVE
	GLOBE VALVE
	PRESSURE REGULATING VALVE

FIRE PROTECTION SPRINKLER SYSTEM GENERAL NOTES AND REQUIREMENTS

1. PROVIDE AN AUTOMATIC SPRINKLER SYSTEM.
2. THE SPRINKLER SYSTEM IS A DESIGN/BUILD PROJECT REQUIRING THE CONTRACTOR TO DESIGN & INSTALL THE SPRINKLER SYSTEM.
3. PLANS/DRAWINGS DO NOT SHOW ALL REQUIRED SYSTEM EQUIPMENT, DEVICES & PIPING. PROVIDE ALL REQUIRED ELEMENTS PER NFPA 13 FOR A COMPLETE AND OPERATIONAL SYSTEM.
4. SPRINKLER HEADS SHOWN ON DRAWINGS MAY NOT REFLECT ALL REQUIRED HEADS. PROVIDE ADDITIONAL HEADS AS REQUIRED BY NFPA 13.
5. PIPE SIZING SHOWN ON DRAWINGS ARE FOR GENERAL INFORMATION. SIZE ALL PIPE BASED ON HYDRAULIC CALCULATIONS PER NFPA 13.
6. THE DESIGN-BUILD AUTOMATIC FIRE SPRINKLER SYSTEM SHALL BE DESIGNED, FABRICATED, AND INSTALLED IN FULL COMPLIANCE WITH THE CURRENT EDITION OF THE MASSACHUSETTS STATE BUILDING CODE (780 CMR), INCLUDING ALL APPLICABLE AMENDMENTS; NFPA 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS, THE FIRE PROTECTION PROJECT SPECIFICATIONS, AND ALL LOCAL AUTHORITY HAVING JURISDICTION (AHJ) REQUIREMENTS.
7. ALL WORK SHALL CONFORM TO THE PROJECT SPECIFICATION PACKAGE, DIVISION 21 FIRE SUPPRESSION, WHICH GOVERNS SYSTEM DESIGN CRITERIA, MATERIALS, HYDRAULIC PERFORMANCE, OCCUPANCY/HAZARD CLASSIFICATION, REQUIREMENTS TO OBTAIN WATER SUPPLY DATA, AND ANY SPECIAL REQUIREMENTS INCLUDING ANTIFREEZE SYSTEMS, FREEZE PROTECTION OR SPECIAL PROTECTION FEATURES AND MONITORING REQUIREMENTS. COORDINATE WITH ARCHITECTURAL CODE SHEET AND PERFORM FLOW DOWN OF CODES AND REQUIREMENTS
8. SHOP DRAWINGS SHALL BE PREPARED UNDER DESIGN-BUILD RESPONSIBILITY AND ARE BASED ON THE CONSTRUCTION DOCUMENTS AND SPECIFICATIONS ANY DEVIATIONS FROM THE PROJECT SPECIFICATIONS MUST BE CLEARLY NOTED AND SUBMITTED FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
9. THE INSTALLING CONTRACTOR SHALL HOLDS A VALID MASSACHUSETTS FIRE PROTECTION SYSTEMS LICENSE. SHOP DRAWINGS INCLUDE THE NAME(S), LICENSE NUMBER(S), AND LICENSE EXPIRATION DATE(S) OF THE CONTRACTOR(S) DESIGNING AND INSTALLING THE FIRE PROTECTION SYSTEM
10. THE SHOP DRAWING SUBMITTAL SHALL INCLUDED TIER 1 AND TIER II SHOP DRAWINGS PER 780 CMR 901.2.2. INSTALLATION SHALL NOT COMMENCE UNTIL SHOP DRAWINGS ARE REVIEWED AND ACCEPTED BY THE OWNER AND OWNERS ' REPRESENTATIVE AND APPROVED BY THE LOCAL BUILDING OFFICIAL, AND FIRE MARSHALL
11. SYSTEM DESIGN SHALL INCLUDE HYDRAULIC CALCULATIONS, EQUIPMENT SPECIFICATIONS, DETAILED LAYOUT, HANGER DETAILS (WHERE APPLICABLE), AND SEQUENCE OF OPERATIONS. ALL COMPONENTS SHALL BE LISTED/APPROVED FOR THE INTENDED USE.
12. UPON COMPLETION, TIER III RECORD (AS-BUILT) DRAWINGS SHALL BE PREPARED, SEALED/REVIEWED BY THE DESIGNER OR LEGALLY RECOGNIZED PROFESSIONAL PERFORMING CONSTRUCTION CONTROL AND PROVIDED TO THE OWNER PER 780 CMR REQUIREMENTS.
13. THE CONTRACTOR SHALL PROVIDE ALL TESTING, FLUSHING, AND ACCEPTANCE SHALL FOLLOW NFPA 13 AND PROJECT SPECIFICATIONS, WITH WITNESSED INSPECTIONS BY THE AHJ, FIRE MARSHAL AND OWNER'S REPRESENTATIVE.
14. SHOP DRAWING SHALL INCLUDED SPRINKLER SHOP DRAWING SUBMITTAL PACKAGE WITH TITLES, DATES WITH THE ACTUAL PROJECT REFERENCES. THE SUBMITTAL SHALL BE IN COMPLIANCE WITH MASSACHUSETTS THREE-TIER SUBMITTAL PROCESS AND LICENSING NOTATION MANDATE.

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS

NO.	DATE	DESCRIPTION

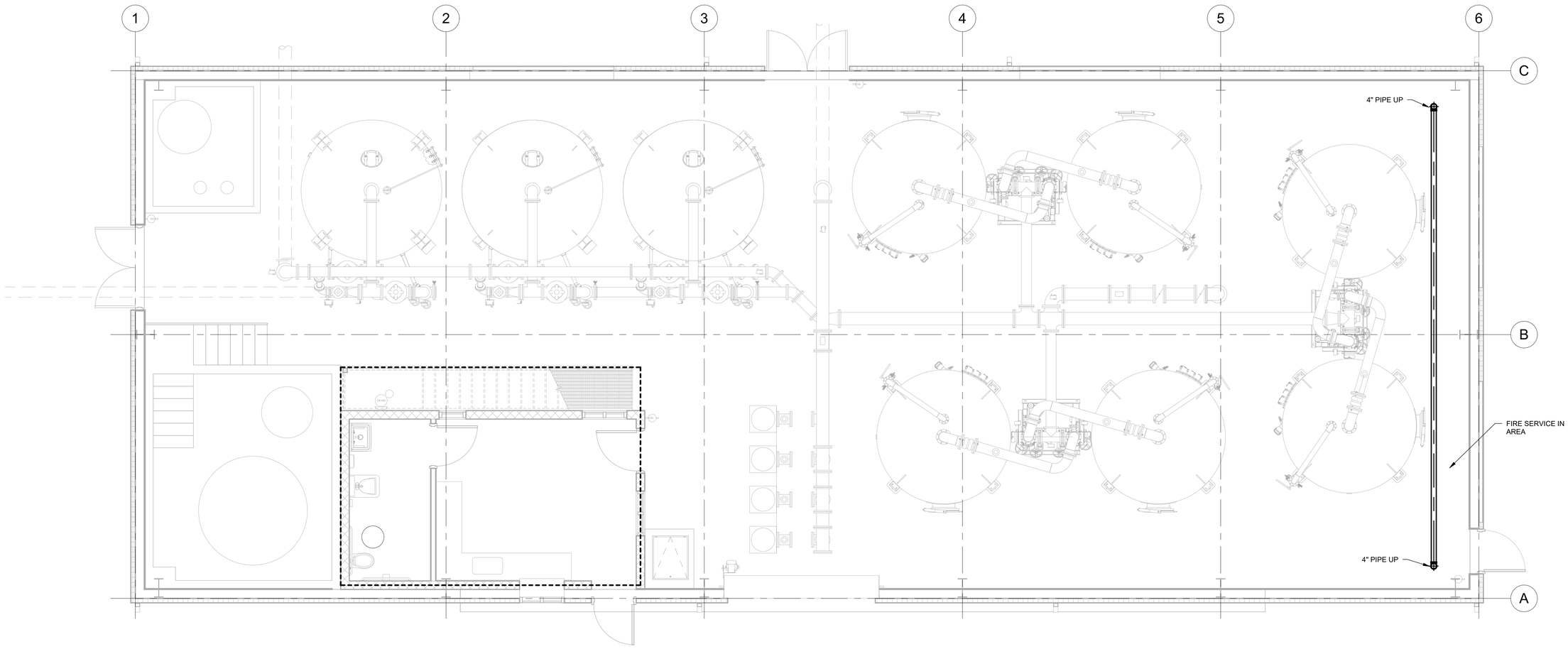
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	12" = 1'-0"
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	JPD
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
FIRE PROTECTION NOTES & SYMBOLS

DRAWING NO.:
FP-1

SHEET NO. 45 OF 57



1
FP-2

FIRST FLOOR FIRE PROTECTION PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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PROJECT NO.:	127.25.01
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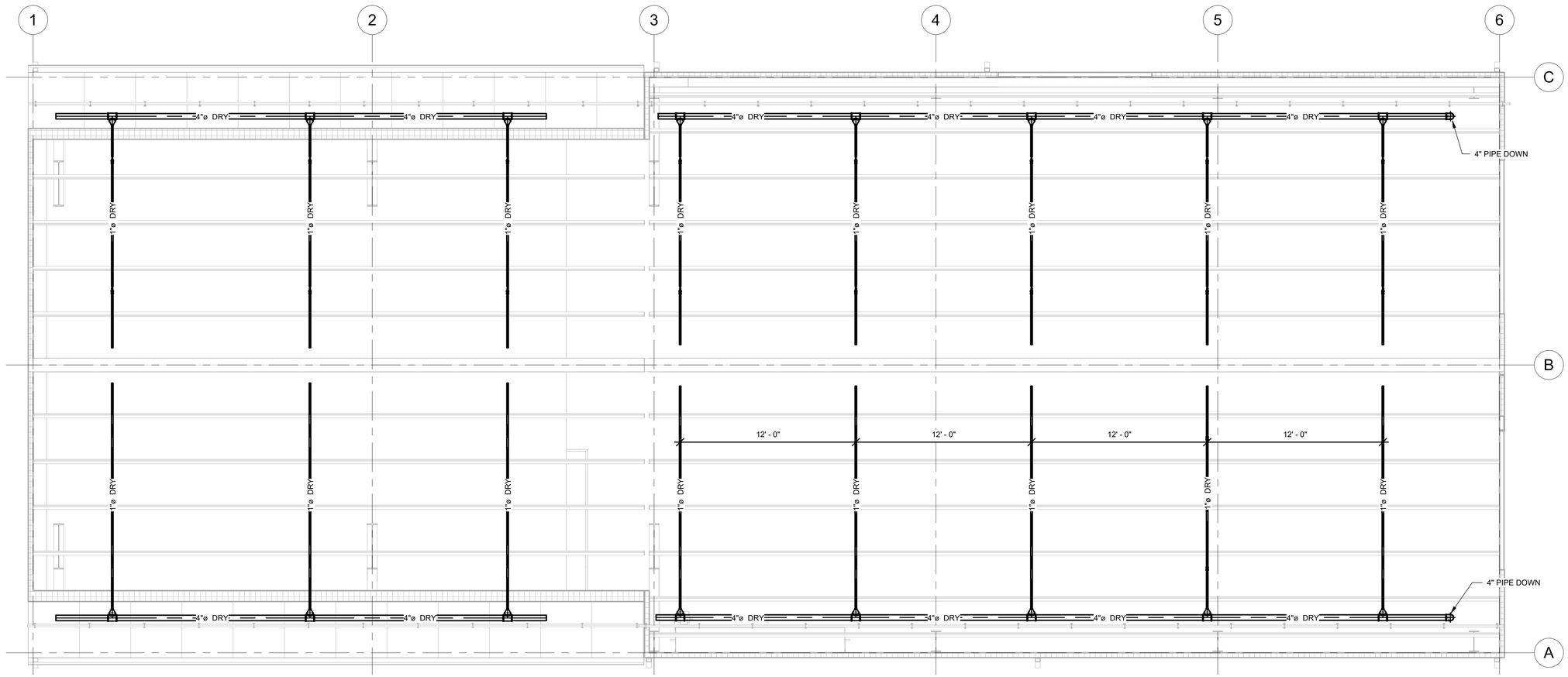
CHECKED BY:	KWK
DRAWN BY:	JPD
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
FIRE PROTECTION
FIRST FLOOR PLAN

DRAWING NO.:
FP-2

SHEET NO. 46 OF 57



MEZZANINE FIRE PROTECTION PLAN

1 / FP-3

Scale: 1/4" = 1'-0"

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	JPD
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
FIRE PROTECTION
UPPER CEILING PLAN

DRAWING NO.:
FP-3

SHEET NO. 47 OF 57

GENERAL NOTES

1. PROJECT SCOPE: PROVIDE COMPLETE AND OPERATIONAL SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS INCLUDING ALL NECESSARY MATERIAL, LABOR, AND EQUIPMENT.
2. CONSTRUCTION\CONTRACT DOCUMENTS: CONTRACT DOCUMENTS INCLUDING PLANS, DETAILS, AND ONE-LINE DIAGRAMS SHOW THE GENERAL LOCATION AND ARRANGEMENT OF THE WORK. THESE DOCUMENTS ARE DIAGRAMMATIC AND DO NOT SHOW ALL CONNECTORS, FITTINGS, HANGERS, AND ADDITIONAL ELEMENTS WHICH THE CONTRACTOR MUST PROVIDE TO COMPLETE THE SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN, THAT MAY EXIST, THUS REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE PROJECT AREA BEFORE PERFORMING THE WORK. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BY FIELD MEASUREMENTS.
3. COORDINATION:
   A. THE CONTRACTOR SHALL COORDINATE THEIR WORK WITH ALL CONSTRUCTION DOCUMENTS AND OTHER TRADES ASSOCIATED WITH THE PROJECT.
   B. THE CONTRACTOR SHALL VISIT THE SITE OF WORK AND FAMILIARIZE HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE NATURE OF THE INSTALLATION AND CONDITIONS.
   C. BEFORE SELECTING MATERIAL, EQUIPMENT AND PROCEEDING WITH WORK, INSPECT AREAS WHERE MATERIAL AND EQUIPMENT ARE TO BE INSTALLED TO INSURE SUITABILITY, AND CHECK NEEDED SPACE FOR PLACEMENT, CLEARANCES AND INTERCONNECTIONS.
   D. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN THAT MAY EXIST; THUS, REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE SPACE BEFORE PERFORMING THE WORK.
   E. BEFORE CUTTING OR DRILLING INTO BUILDING ELEMENTS INSPECT AND LAYOUT WORK TO AVOID DAMAGING STRUCTURAL ELEMENTS AND BUILDING UTILITIES.
   F. ARRANGE FOR CHASES, SLOTS, AND OPENINGS IN OTHER BUILDING COMPONENTS DURING PROGRESS OF CONSTRUCTION, TO ALLOW FOR PROPER SYSTEM INSTALLATIONS.
   G. COORDINATE THE INSTALLATION OF REQUIRED SUPPORTING DEVICES AND SLEEVES TO BE SET IN POURED IN PLACE CONCRETE AND OTHER STRUCTURAL COMPONENTS, AS THEY ARE CONSTRUCTED.
   H. H) SEQUENCE, COORDINATE, AND INTEGRATE INSTALLATIONS OF MATERIALS AND EQUIPMENT FOR EFFICIENT FLOW OF THE WORK. GIVE PARTICULAR ATTENTION TO LARGE EQUIPMENT REQUIRING POSITIONING PRIOR TO CLOSING IN THE BUILDING.
   I. FAILURE OF THE CONTRACTOR TO ACQUAINT HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE ABOVE CONDITIONS AND NOT PERFORMING PROPER COORDINATION WILL NOT RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY FOR ESTIMATING THE DIFFICULTIES AND COSTS FOR SUCCESSFULLY PERFORMING THE COMPLETE WORK UNDER THIS PROJECT.
4. SHUTDOWNS: WRITTEN REQUESTS FOR APPROVAL FOR PLANNED SHUTDOWNS OR INTERRUPTION OF OWNER'S UTILITIES, SYSTEMS AND EQUIPMENT SHALL BE MADE 72 HOURS PRIOR TO THE START OF THE REQUESTED SHUTDOWN PERIODS.
5. CODES AND STANDARDS: THE CONTRACTOR SHALL FOLLOW ALL FEDERAL, STATE AND LOCAL CODES THAT HAVE JURISDICTION WHERE THE WORK IS BEING PERFORMED. THROUGHOUT THE CONTRACT DOCUMENTS CERTAIN CODES AND STANDARDS ARE REFERENCED. THE CONTRACTOR SHALL USE THE LATEST VERSIONS OF CODES AND STANDARDS REFERENCED UNLESS OTHERWISE NOTED. IF THE CONTRACTOR IS NOT FAMILIAR WITH THE REFERENCED STANDARD THEY SHALL CONTACT THE OWNER'S REPRESENTATIVE FOR DIRECTION.
6. PERMITS: THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED PERMITS AND ARRANGE FOR ALL REQUIRED INSPECTIONS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES.
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   E. THE TERM "EXTERIOR" IS ALL LOCATIONS, WHICH ARE NOT INTERIOR, OR UNDERGROUND.
   F. THE TERM "INTERIOR FINISHED SPACE" IS INTERIOR SPACES, WHICH ARE USED FOR OFFICES, CORRIDORS, LOBBIES, TOILETS, STORAGE AND FILING ROOMS, LOUNGES, MECHANICAL ROOMS, ELECTRICAL ROOMS, ETC.
13. DEMOLITION: DEMOLITION OF INDICATED ITEMS INCLUDES THE REMOVAL AND PROPER DISPOSAL OF THOSE ITEMS AND ALL ASSOCIATED PIPING, DUCTWORK, WIRING AND HANGERS. ELECTRICAL BRANCH, CONTROL, TELEPHONE, AND ALARM WIRING SHALL BE REMOVED BACK TO PANELBOARDS OR RELATED SYSTEM PANELS OR BACKBOARDS.
14. EQUIPMENT AND MATERIAL INSTALLATIONS:
   A. ALL EQUIPMENT AND MATERIALS SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING AND MANUFACTURER'S REQUIREMENTS.
   B. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
   C. IF AN EQUIPMENT MANUFACTURER REQUIRES LARGER CAPACITY, CIRCUITRY AND/OR EQUIPMENT, THE CONTRACTOR SHALL PROVIDE SUCH CAPACITY AND/OR EQUIPMENT UNDER HIS CONTRACT AT NO ADDITIONAL COST TO THE OWNER.
   D. LOCATE ALL EQUIPMENT, WHICH REQUIRES SERVICING IN FULLY ACCESSIBLE POSITIONS. IF REQUIRED FOR BETTER ACCESSIBILITY, FURNISH ACCESS DOORS FOR THAT PURPOSE.
   E. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR BETTER ACCESSIBILITY.
   F. ALL WORK IN INTERIOR FINISHED SPACES SHALL BE CONCEALED BEHIND WALLS, ABOVE CEILINGS OR HUNG CEILINGS, OR UNDER THE FLOOR. PROVIDE ALL NECESSARY CUTTING, PATCHING, REPAINTING AND/OR REPLACEMENT OF CEILING TILES AS REQUIRED TO PERFORM WORK.
   G. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO CONFORM WITH APPROVED SUBMITTAL DATA, INCLUDING COORDINATION DRAWINGS (IF REQUIRED), TO GREATEST EXTENT POSSIBLE. CONFORM TO ARRANGEMENTS INDICATED BY THE CONTRACT DOCUMENTS, RECOGNIZING THAT PORTIONS OF THE WORK ARE SHOWN ONLY IN DIAGRAMMATIC FORM. WHERE COORDINATION REQUIREMENTS CONFLICT WITH INDIVIDUAL SYSTEM REQUIREMENTS, REFER CONFLICT TO THE ARCHITECT/ENGINEER.
   H. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT LEVEL AND PLUMB, PARALLEL AND PERPENDICULAR TO OTHER BUILDING SYSTEMS AND COMPONENTS, WHERE INSTALLED EXPOSED IN FINISHED SPACES
   I. INSTALL EQUIPMENT TO FACILITATE SERVICING, MAINTENANCE, AND REPAIR OR REPLACEMENT OF EQUIPMENT COMPONENTS. AS MUCH AS PRACTICAL, CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM OF INTERFERENCE WITH OTHER INSTALLATIONS.
   J. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT GIVING RIGHT OF WAY PRIORITY TO SYSTEMS REQUIRED TO BE INSTALLED AT A SPECIFIED SLOPE.
   K. K) WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE.
   L. ASCERTAIN FROM EXAMINATION OF THE DRAWINGS, ANY SPECIAL TEMPORARY OPENINGS IN THE BUILDING REQUIRED FOR THE ADMISSION OF APPARATUS PROVIDED UNDER THIS DIVISION. NOTIFY THE CONTRACTOR WITH SUFFICIENT NOTICE TO PROVIDE THESE OPENINGS. IN THE EVENT OF FAILURE TO GIVE SUFFICIENT NOTICE, THE CONTRACTOR SHALL ASSUME ALL COSTS OF PROVIDING SUCH OPENINGS THEREAFTER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DISASSEMBLY AND ASSEMBLY OF EQUIPMENT AS REQUIRED TO PLACE EQUIPMENT IN THEIR FINAL LOCATIONS.
   M. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
15. FIRE RATINGS: THE CONTRACTOR SHALL REVIEW ALL CONTRACT DOCUMENTS FOR FIRE SEPARATION AND FIRE RATED ASSEMBLIES. ALL PIPING, DUCTWORK AND CONDUITS PASSING THROUGH FIRE RATED WALLS, CEILINGS AND FLOORS SHALL BE PROVIDED WITH A UL LISTED FIRE STOPPING ASSEMBLIES. UL LISTED FIRE STOPPING ASSEMBLIES SHALL BE SUITABLE FOR THE CONDITIONS ENCOUNTERED AND SHALL BE RATED EQUAL TO THE RATING OF THE WALL, CEILING OR FLOOR. REVIEW FIRE RATED ASSEMBLIES THAT ALLOW PENETRATIONS OF ITEMS SUCH AS OUTLET BOXES AS CONDUITS THAT DO NOT REQUIRE FIRE STOPPING. SPACE AND POSITION THESE DEVICES AS ALLOWED PER THE ASSEMBLY'S UL RATING.
16. SERVICE LABELING: LABEL EQUIPMENT, PIPING, CONDUITS, INCLUDING FANS, AIR HANDLERS, TERMINAL UNITS, PANELBOARDS, ETC. WITH LABELS MADE OF SELF-STICKING, PLASTIC FILM DESIGNED FOR OUTDOOR USE. LABELS SHALL MATCH DESIGNATIONS AS INDICATED ON CONTRACT DRAWINGS. IDENTIFY PIPING AND CONDUITS IN ACCORDANCE WITH OSHA 29 CFR 1910.144, EXCEPT THAT LABELS OR TAPES MAY BE USED IN LIEU OF PAINTING OR STENCILING. SPACING OF IDENTIFICATION MARKING ON RUNS SHALL NOT EXCEED 50 FEET. MATERIALS FOR LABELS AND TAPES SHALL CONFORM TO CID A-A-1689, AND SHALL BE GENERAL PURPOSE TYPE AND COLOR CLASS.
   A. IN ADDITION IDENTIFY SERVICES AS INDICATED BELOW:
   B. EACH POINT OF ENTRY AND EXIT OF PIPE OR CONDUITS PASSING THROUGH WALLS.
   C. EACH CHANGE IN DIRECTION, I.E., ELBOWS, TEES.
   D. IN CONGESTED OR HIDDEN AREAS AND AT ALL ACCESS PANELS AT EACH POINT REQUIRED TO CLARIFY SERVICE OR INDICATED HAZARD.
   E. IN LONG STRAIGHT RUNS, LOCATE LABELS AT DISTANCES WITHIN EYESIGHT OF EACH OTHER NOT TO EXCEED 50 FEET. ALL LABELS SHALL BE VISIBLE AND LEGIBLE FROM THE PRIMARY SERVICE AND OPERATING AREA.
17. MANUFACTURER'S NAMEPLATES: EACH ITEM OF EQUIPMENT SHALL HAVE A NAMEPLATE BEARING THE MANUFACTURER'S NAME, ADDRESS, MODEL NUMBER, AND SERIAL NUMBER SECURELY AFFIXED IN A CONSPICUOUS PLACE; THE NAMEPLATE OF THE DISTRIBUTING AGENT WILL NOT BE ACCEPTABLE.
18. POSTED OPERATING INSTRUCTIONS: PROVIDE FOR EACH SYSTEM AND PRINCIPAL ITEM OF EQUIPMENT AS SPECIFIED FOR USE BY OPERATION AND MAINTENANCE PERSONNEL. PRINT OR ENGRAVE OPERATING INSTRUCTIONS AND FRAME UNDER GLASS OR IN APPROVED LAMINATED PLASTIC. POST INSTRUCTIONS WHERE DIRECTED. FOR OPERATING INSTRUCTIONS EXPOSED TO THE WEATHER, PROVIDE WEATHER-RESISTANT MATERIALS OR WEATHERPROOF ENCLOSURES. OPERATING INSTRUCTIONS SHALL NOT FADE WHEN EXPOSED TO SUNLIGHT AND SHALL BE SECURED TO PREVENT EASY REMOVAL OR PEELING. THE OPERATING INSTRUCTIONS SHALL INCLUDE THE FOLLOWING.
   A. WIRING DIAGRAMS, CONTROL DIAGRAMS, AND CONTROL SEQUENCE FOR EACH PRINCIPAL SYSTEM AND ITEM OF EQUIPMENT.
   B. START UP, PROPER ADJUSTMENT, OPERATING, LUBRICATION, AND SHUTDOWN PROCEDURES.
   C. SAFETY PRECAUTIONS.
   D. THE PROCEDURE IN THE EVENT OF EQUIPMENT FAILURE.
   E. OTHER ITEMS OF INSTRUCTION AS RECOMMENDED BY THE MANUFACTURER OF EACH SYSTEM OR ITEM OF EQUIPMENT.
19. WARNING SIGNS: PROVIDE WARNING SIGNS FOR THE ENCLOSURES OF ELECTRICAL EQUIPMENT INCLUDING SUBSTATIONS, PAD-MOUNTED TRANSFORMERS, PAD-MOUNTED SWITCHES, GENERATORS, AND SWITCHGEAR HAVING A NOMINAL RATING EXCEEDING 600 VOLTS.
20. EXTERIOR FERROUS MATERIALS: ALL EXTERIOR FERROUS MATERIALS SHALL BE PROTECTED FROM CORROSION BY ONE OF THE FOLLOWING METHODS:
   A. COVERED WITH A NON-FERROUS OR NON-CORRODING MATERIAL.
   B. MATERIALS THAT ARE INSULATED ON THE EXTERIOR.
   C. MATERIALS THAT ARE GALVANIZED.
   D. MATERIALS THAT ARE PAINTED. EXTERIOR PAINTING SHALL CONSIST OF A BASE COAT OF AN APPROPRIATE PRIMER AND TWO COATS OF FINAL PAINT. FINAL PAINT COLOR SHALL BE SELECTED BY THE OWNER'S REPRESENTATIVE.

DUCTWORK SPECIFICATION

PART 1 GENERAL

1.1 QUALITY ASSURANCE: EXCEPT AS OTHERWISE SPECIFIED, APPROVAL OF MATERIALS AND EQUIPMENT IS BASED ON MANUFACTURER'S PUBLISHED DATA.

A. WHERE MATERIALS AND EQUIPMENT ARE SPECIFIED TO CONFORM TO THE STANDARDS OF THE UNDERWRITERS LABORATORIES, THE LABEL OF OR LISTING WITH REEXAMINATION IN UL BLD MAT DIR. AND UL 6 IS ACCEPTABLE AS SUFFICIENT EVIDENCE THAT THE ITEMS CONFORM TO UNDERWRITERS LABORATORIES REQUIREMENTS. IN LIEU OF SUCH LABEL OR LISTING, SUBMIT A WRITTEN CERTIFICATE FROM ANY NATIONALLY RECOGNIZED TESTING AGENCY, ADEQUATELY EQUIPPED AND COMPETENT TO PERFORM SUCH SERVICES, STATING THAT THE ITEMS HAVE BEEN TESTED AND THAT THE UNITS CONFORM TO THE SPECIFIED REQUIREMENTS. OUTLINE METHODS OF TESTING USED BY THE SPECIFIED AGENCIES.

B. WHERE MATERIALS OR EQUIPMENT ARE SPECIFIED TO BE CONSTRUCTED OR TESTED, OR BOTH, IN ACCORDANCE WITH THE STANDARDS OF THE ASTM INTERNATIONAL (ASTM), THE ASME INTERNATIONAL (ASME), OR OTHER STANDARDS, A MANUFACTURER'S CERTIFICATE OF COMPLIANCE OF EACH ITEM IS ACCEPTABLE AS PROOF OF COMPLIANCE.

C. CONFORMANCE TO SUCH AGENCY REQUIREMENTS DOES NOT RELIEVE THE ITEM FROM COMPLIANCE WITH OTHER REQUIREMENTS OF THESE SPECIFICATIONS.

PART 2 PRODUCTS

2.1 DUCT SYSTEMS

2.1.1 METAL DUCTWORK: PROVIDE METAL DUCTWORK CONSTRUCTION, INCLUDING ALL FITTINGS AND COMPONENTS, THAT COMPLIES WITH SMACNA "HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE", AS SUPPLEMENTED AND MODIFIED BY THIS SPECIFICATION.

A. PROVIDE RADIUS TYPE ELBOWS WITH A CENTERLINE RADIUS OF 1.5 TIMES THE WIDTH OR DIAMETER OF THE DUCT WHERE SPACE PERMITS. OTHERWISE, ELBOWS HAVING A MINIMUM RADIUS EQUAL TO THE WIDTH OR DIAMETER OF THE DUCT OR SQUARE ELBOWS WITH FACTORY FABRICATED TURNING VANES ARE ALLOWED.

B. PROVIDE SEALANTS THAT ARE SUITABLE FOR THE RANGE OF AIR DISTRIBUTION AND AMBIENT TEMPERATURES TO WHICH IT IS EXPOSED. DO NOT USE PRESSURE SENSITIVE TAPE AS A SEALANT.

C. MAKE SPIRAL LOCK SEAM DUCT, AND FLAT OVAL WITH DUCT SEALANT AND LOCK WITH NOT LESS THAN 3 EQUALLY SPACED DRIVE SCREWS OR OTHER APPROVED METHODS INDICATED IN SMACNA "HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE". APPLY THE SEALANT TO THE EXPOSED MALE PART OF THE FITTING COLLAR SO THAT THE SEALER IS ON THE INSIDE OF THE JOINT AND FULLY PROTECTED BY THE METAL OF THE DUCT FITTING. APPLY ONE BRUSH COAT OF THE SEALANT OVER THE OUTSIDE OF THE JOINT TO AT LEAST 2 INCH BAND WIDTH COVERING ALL SCREW HEADS AND JOINT GAP. DENTS IN THE MALE PORTION OF THE SLIP FITTING COLLAR ARE NOT ACCEPTABLE. FABRICATE OUTDOOR AIR INTAKE DUCTS AND PLENUMS WITH WATERTIGHT SOLDERED OR BRAZED JOINTS AND SEAMS.

2.1.2 INSULATED NONMETALLIC FLEXIBLE DUCT RUNOUTS: USE FLEXIBLE DUCT RUNOUTS ONLY WHERE INDICATED. RUNOUT LENGTH IS INDICATED ON THE DRAWINGS, AND IS NOT TO EXCEED 5 FEET. PROVIDE RUNOUTS THAT ARE PREINSULATED, FACTORY FABRICATED, AND THAT COMPLY WITH NFPA 90A AND UL 181. PROVIDE EITHER FIELD OR FACTORY APPLIED VAPOR BARRIER. PROVIDE NOT LESS THAN 20 OUNCE GLASS FABRIC DUCT CONNECTORS COATED ON BOTH SIDES WITH NEOPRENE. WHERE COIL INDUCTION OR HIGH VELOCITY UNITS ARE SUPPLIED WITH VERTICAL AIR INLETS, USE A STREAMLINED, VANED AND MITERED ELBOW TRANSITION PIECE FOR CONNECTION TO THE FLEXIBLE DUCT OR HOSE. PROVIDE A DIE-STAMPED ELBOW AND NOT A FLEXIBLE CONNECTOR AS THE LAST ELBOW TO THESE UNITS OTHER THAN THE VERTICAL AIR INLET TYPE. INSULATED FLEXIBLE CONNECTORS ARE ALLOWED AS RUNOUTS. PROVIDE INSULATED MATERIAL AND VAPOR BARRIER THAT CONFORM TO THE REQUIREMENTS OF SECTION 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. DO NOT EXPOSE THE INSULATION MATERIAL SURFACE TO THE AIR STREAM.

2.1.3 GENERAL SERVICE DUCT CONNECTORS: PROVIDE A FLEXIBLE DUCT CONNECTOR APPROXIMATELY 6 INCHES IN WIDTH WHERE SHEET METAL CONNECTIONS ARE MADE TO FANS OR WHERE DUCTS OF DISSIMILAR METALS ARE CONNECTED. FOR ROUND/OVAL DUCTS, SECURE THE FLEXIBLE MATERIAL BY STAINLESS STEEL OR ZINC-COATED, IRON CLINCH-TYPE DRAW BANDS. FOR RECTANGULAR DUCTS, INSTALL THE FLEXIBLE MATERIAL LOCKED TO METAL COLLARS USING NORMAL DUCT CONSTRUCTION METHODS. PROVIDE A COMPOSITE CONNECTOR SYSTEM THAT COMPLIES WITH NFPA 701 AND IS CLASSIFIED AS "FLAME-RETARDED FABRICS" IN UL BLD MAT DIR.

PART 3 EXECUTION

3.1 GENERAL: SEE DUCTWORK SCHEDULE FOR SYSTEM MATERIALS, PRESSURE CLASSIFICATIONS AND SEALANT REQUIREMENTS.

3.2 INSTALLATION

A. INSTALL MATERIALS AND EQUIPMENT IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT DRAWINGS AND APPROVED MANUFACTURER'S INSTALLATION INSTRUCTIONS. ACCOMPLISH INSTALLATION BY WORKERS SKILLED IN THIS TYPE OF WORK. PERFORM INSTALLATION SO THAT THERE IS NO DEGRADATION OF THE DESIGNED FIRE RATINGS OF WALLS, PARTITIONS, CEILINGS, AND FLOORS.

B. NO INSTALLATION IS PERMITTED TO BLOCK OR OTHERWISE IMPEDE ACCESS TO ANY EXISTING MACHINE OR SYSTEM. INSTALL ALL HINGED DOORS TO SWING OPEN A MINIMUM OF 120 DEGREES. PROVIDE AN AREA IN FRONT OF ALL ACCESS DOORS THAT CLEARS A MINIMUM OF 3 FEET. IN FRONT OF ALL ACCESS DOORS TO ELECTRICAL CIRCUITS, CLEAR THE AREA THE MINIMUM DISTANCE TO ENERGIZED CIRCUITS AS SPECIFIED IN OSHA STANDARDS, PART 1910.333 (ELECTRICAL-SAFETY RELATED WORK PRACTICES)AND AN ADDITIONAL 3 FEET.

3.2.2 FLEXIBLE DUCT

INSTALL PRE-INSULATED FLEXIBLE DUCT IN ACCORDANCE WITH THE LATEST PRINTED INSTRUCTIONS OF THE MANUFACTURER TO ENSURE A VAPOR TIGHT JOINT. PROVIDE HANGERS, WHEN REQUIRED TO SUSPEND THE DUCT, OF THE TYPE RECOMMENDED BY THE DUCT MANUFACTURER AND SET AT THE INTERVALS RECOMMENDED.

3.2.3 METAL DUCTWORK: INSTALL ACCORDING TO SMACNA "HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE" UNLESS OTHERWISE INDICATED. INSTALL DUCT SUPPORTS FOR SHEET METAL DUCTWORK ACCORDING TO SMACNA "HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE", UNLESS OTHERWISE SPECIFIED. DO NOT USE FRICTION BEAM CLAMPS INDICATED IN SMACNA. ANCHOR RISERS ON HIGH VELOCITY DUCTS IN THE CENTER OF THE VERTICAL RUN TO ALLOW ENDS OF RISER TO MOVE DUE TO THERMAL EXPANSION. ERECT SUPPORTS ON THE RISERS THAT ALLOW FREE VERTICAL MOVEMENT OF THE DUCT. ATTACH SUPPORTS ONLY TO STRUCTURAL FRAMING MEMBERS AND CONCRETE SLABS. DO NOT ANCHOR SUPPORTS TO METAL DECKING UNLESS A MEANS IS PROVIDED AND APPROVED FOR PREVENTING THE ANCHOR FROM PUNCTURING THE METAL DECKING. WHERE SUPPORTS ARE REQUIRED BETWEEN STRUCTURAL FRAMING MEMBERS, PROVIDE SUITABLE INTERMEDIATE METAL FRAMING. WHERE C-CLAMPS ARE USED, PROVIDE RETAINER CLIPS.

3.6 TESTING, ADJUSTING, AND BALANCING: PERFORM TAB IN ACCORDANCE WITH THE REQUIREMENTS OF THE TAB PROCEDURAL STANDARD RECOMMENDED BY THE TAB TRADE ASSOCIATION THAT APPROVED THE TAB FIRMS QUALIFICATIONS. COMPLY WITH REQUIREMENTS OF AABC "NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE", NEBB "PROCEDURAL STANDARDS FOR TAB (TESTING, ADJUSTING AND BALANCING) ENVIRONMENTAL SYSTEMS", OR SMACNA "HVAC SYSTEMS - TESTING, ADJUSTING AND BALANCING". RECOMMENDATIONS AND SUGGESTED PRACTICES CONTAINED IN THE TAB PROCEDURAL STANDARDS ARE CONSIDERED MANDATORY. SUBMIT TAB REPORTS TO THE OWNER'S REPRESENTATIVE.

3.7 PERFORMANCE TESTS: AFTER TESTING, ADJUSTING, AND BALANCING IS COMPLETE AS SPECIFIED, TEST EACH SYSTEM AS A WHOLE TO SEE THAT ALL ITEMS PERFORM AS INTEGRAL PARTS OF THE SYSTEM AND TEMPERATURES AND CONDITIONS ARE EVENLY CONTROLLED THROUGHOUT THE BUILDING. RECORD THE TESTING DURING THE APPLICABLE SEASON. MAKE CORRECTIONS AND ADJUSTMENTS AS NECESSARY TO PRODUCE THE CONDITIONS INDICATED OR SPECIFIED. CONDUCT CAPACITY TESTS AND GENERAL OPERATING TESTS BY AN EXPERIENCED ENGINEER. PROVIDE TESTS THAT COVER A PERIOD OF NOT LESS THAN 3 DAYS FOR EACH SYSTEM AND DEMONSTRATE THAT THE ENTIRE SYSTEM IS FUNCTIONING ACCORDING TO THE SPECIFICATIONS.

3.9 INSULATION: SEE DUCT INSULATION SCHEDULES FOR INSULATION MATERIAL AND INSTALLATION REQUIREMENTS.

DUCTWORK SYMBOLS

- 12Ø — SINGLE LINE ROUND DUCT (DIMENSIONS IN INCHES)
- 24x12 — SINGLE LINE RECTANGULAR DUCT, FIRST NUMBER IS VIEW SIZE, SECOND NUMBER IS DEPTH SIZE (DIMENSIONS IN INCHES)
- 12Ø — DOUBLE LINE ROUND DUCT (DIMENSIONS IN INCHES)
- 24x12 — DOUBLE LINE RECTANGULAR DUCT, FIRST NUMBER IS VIEW SIZE, SECOND NUMBER IS DEPTH SIZE (DIMENSIONS IN INCHES)
- 24/12 — DOUBLE LINE OVAL DUCT, FIRST NUMBER IS VIEW SIZE, SECOND NUMBER IS DEPTH SIZE (DIMENSIONS IN INCHES)
- INTERNALLY LINED DUCTWORK
- 8Ø — FLEX DUCT WITH SIZE (DIMENSIONS IINCHES)
- 90 DEGREE ELBOW WITH TURNING VANES
- ELBOW WITH TURNING VANES
- SUPPLY UP OR DN
- RETURN DUCT UP OR DN
- EXHAUST DUCT UP OR DN
- MANUAL BALANCING DAMPER
- FD&AD — FIRE DAMPER AND ACCESS DOOR
- SFD&AD — COMBINATION FIRE / SMOKE DAMPER & ACCESS DOOR, SPRING CLOSED/POWER OPEN DAMPER ACTUATOR MOTOR
- SLF4P-6x6-200 — SUPPLY DIFFUSER WITH DESIGNATION, NECK SIZE & CFM
- RPF24T-6-200 — RETURN GRILLE WITH DESIGNATION, NECK SIZE & CFM
- SLF4P-6x6-200 OR RPF24T-6-200 — SUPPLY OR RETURN GRILLE WITH DESIGNATION, NECK SIZE & CFM
- EPF24T-6-75 — EXHAUST GRILLE WITH DESIGNATION, NECK SIZE & CFM
- SUPPLY AIR FLOW
- RETURN / EXHAUST AIR FLOW

CONTROL SYMBOLS

- T — THERMOSTAT

GENERAL SYMBOLS

PLAN TITLES

A / A8 — SCALE: 1/8" = 1'-0" (0, 4', 8', 16')

A / A8 — SECTION MARKERS

NORTH ARROW

ITEMS TO BE DEMOLISHED

CODE REQUIREMENTS

ALL CONSTRUCTION SHALL FOLLOW THE 10TH ADDITION OF THE MASSACHUSETTS STATE BUILDING CODE AS FOLLOWS:
MASSACHUSETTS STATE BUILDING CODE (780 CMR),
MASSACHUSETTS ELECTRICAL CODE (527 CMR 12.00),
UNIFORM STATE PLUMBING CODE (248 CMR 10.00),
MASSACHUSETTS FUEL GAS CODE (248 CMR 4.00)
MASSACHUSETTS COMPREHENSIVE FIRE SAFETY CODE (527 CMR 1.00),
MASSACHUSETTS SANITARY CODE (105 CMR 410),
ARCHITECTURAL ACCESS BOARD (521 CMR),
MASSACHUSETTS STRETCH ENERGY CODE.

THE MASSACHUSETTS CODE AMENDS AND REFERENCES THE FOLLOWING CODES:
2021 INTERNATIONAL BUILDING CODE
2021 INTERNATIONAL RESIDENTIAL CODE (IRC):
2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
2021INTERNATIONAL EXISTING BUILDING CODE (IEBC)
2021INTERNATIONAL MECHANICAL CODE (IMC):
2023 NFPA 70 (NATIONAL ELECTRICAL CODE)

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. SYLVIA — REGISTERED PROFESSIONAL ENGINEER — 6/4/26

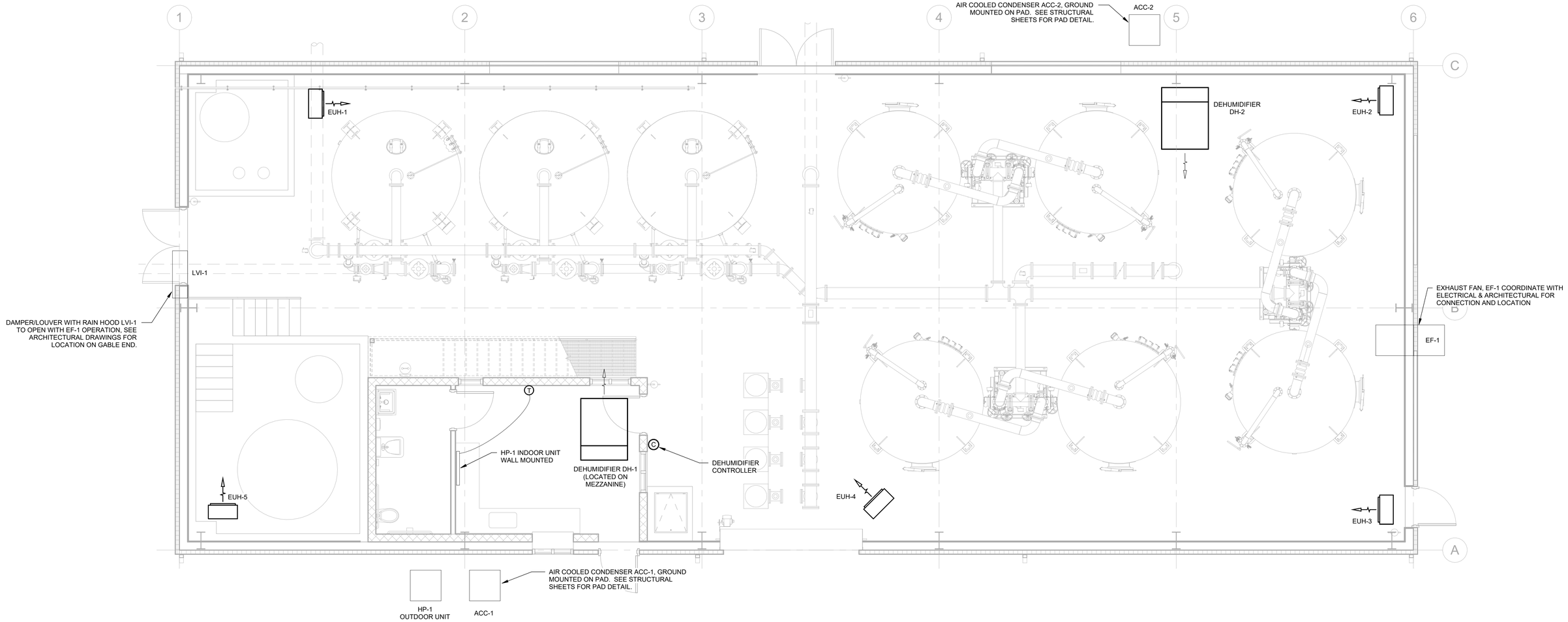
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	12" = 1'-0"
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	GJG
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
MECHANICAL NOTES & SYMBOLS

DRAWING NO.:
H-1

SHEET NO. 48 OF 57



1 / H-2

MECHANICAL PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
MECHANICAL PLANS

DRAWING NO.:
H-2

SHEET NO. 49 OF 57

MECHANICAL PIPING MATERIAL SCHEDULE						
PIPING SYSTEM	ABBREVIATION	OPERATING TEMPERATURE (°F) OR PRESSURE (PSI)	SERVICE PRESSURE (PSI)	PIPE DIAMETER, NPS (INCH)	PIPE MATERIAL \ SCHEDULE OR TYPE \ SPECIFICATION	JOINT MATERIAL \ TYPE \ SPECIFICATION
COOLING COIL CONDENSATE	C	55°F	N/A	0.5 - 4.0	CPR \ L \ ASTM B88 HARD DRAWN PVC \ 40 \ ASTM D 2665	WC \ SOLDER SOCKET \ ASME B16.22 CPR \ PRESS FITTING \ ASME 18.18 OR ASME B16.22 PVC \ SOCKET SOLVENT CEMENT \ ASTM F 891
REFRIGERANT	LL & VL	45°F - 150°F	150	0.5 - 2.0	CPR-ACR \ \ ASTM B280	WC \ SOCKET BRAZED \ ASME B16.22

NOTES
1. VALVE JOINT TYPE INCLUDES OTHER VALVES AND ITEMS NOT SHOWN IN SCHEDULE (I.E. STRAINERS, BALANCING VALVES)
2. DRAWINGS MAY INDICATE DIFFERENT VALVE TYPE. VALVE TYPE SHALL BE AS SHOWN ON DRAWINGS UNLESS OTHERWISE INDICATED.
3. MXIMUM WORKING PRESSURE OF 62 PSI AT 180°F.

PIPE MATERIAL ABBREVIATION SCHEDULE	
CPR	COPPER
CPR-ACR	COPPER AIR-CONDITIONING REFRIGERATION
PVC	POLYVINYLCHLORIDE

JOINT MATERIAL ABBREVIATION SCHEDULE	
CPR	COPPER
PVC	POLYVINYLCHLORIDE
WC	WROUGHT COPPER

MECHANICAL PIPE SUPPORT SCHEDULE, NOTE 1				
PIPE MATERIAL \ SCHEDULE OR TYPE \ SPECIFICATION	PIPE SIZE (IN)	MAX. HORIZONTAL SUPPORT SPACING (FT)	MIN. HORIZONTAL HANGER ROD SIZE DIAMETER (IN)	MAX. VERTICAL SUPPORT SPACING (FT)
CPR \ L \ ASTM B88 HARD DRAWN	0.50	4	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	0.75	5	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	1.00	6	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	1.25	6	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	1.50	9	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	2.00	10	3/8	10
CPR \ L \ ASTM B88 HARD DRAWN	2.50	10	1/2	10
CPR-ACR \ \ ASTM B280	<0.5	4	1/4	10
CPR-ACR \ \ ASTM B280	0.50	4	3/8	10
CPR-ACR \ \ ASTM B280	0.75	5	3/8	10
CPR-ACR \ \ ASTM B280	1.00	6	3/8	10
PVC\ 40 \ ASTM D 2665	0.50	3	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	0.75	3	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	1.00	3	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	1.25	4	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	1.50	4	3/8	10, NOTE 3
PVC\ 40 \ ASTM D 2665	2.00	4	3/8	10, NOTE 3

NOTES:
1. PIPE SUPPORTS BASED ON STRAIGHT RUNS WITH NO VALVES. PROVIDE ADDITIONAL SUPPORTS AS REQUIRED.
2. ROD MATERIAL BASED ON STEEL ROLLED THREADS, S=9.5 KSI.
3. MID STORY GUIDE REQUIRED.
4. AS RECOMMENDED BY PIPING MANUFACTURER.

MECHANICAL PIPING & EQUIPMENT INSULATION SCHEDULE														
PIPING SYSTEM, NOTE 1	LOCATION	PIPING TEMP. (°F)	INSULATION THICKNESS BASED ON PIPE DIAMETER (IN), NOTE 2						INSULATION MATERIAL, NOTE 3	K-FACTOR AT A 75°F MEAN TEMP.	JACKET TYPE, NOTE 3	FITTING COVER TYPE	PRODUCT, NOTE 4	MANUFACTURER, NOTE 4
			RUNOUTS <2	<=1	1.0 - 1.25	1.5 - 3.5	4 - 6	>=8						
COOLING COIL CONDENSATE	INTERIOR	55	0.5	0.5	0.5	0.5	0.5	0.5	GLASS MINERAL WOOL	0.23	ASJ+	PVC	EARTHWOOL 1000°	KNAUF
REFRIGERANT VAPOR	INTERIOR	45	0.5	0.5	1.0	1.0	1.0	1.0	CLOSED CELL ELASTOMERIC FOAM	0.25	N/A	N/A	AP ARMAFLEX	ARMACELL
REFRIGERANT VAPOR	EXTERIOR	45	1.0	1.0	1.5	1.5	1.5	1.5	CLOSED CELL ELASTOMERIC FOAM	0.25	N/A	N/A	AP ARMAFLEX	ARMACELL

NOTES:
1. SEE PIPING SCHEDULE FOR PIPING TYPES.
2. RUNOUTS ARE AREAS WERE PIPING IS RUN IN PARTITIONS WITHIN CONDITIONED SPACES.
3. INSULATION AND JACKET SHALL HAVE A MAXIMUM FLAME SPREAD OF 25 & SMOKE DEVELOPMENT OF 50 PER ASTM E 84.
4. OR EQUAL MANUFACTURERS ARE ACCEPTABLE.

ELECTRIC UNIT HEATER SCHEDULE					
DESIGNATION	EUH-1	EUH-2	EUH-3	EUH-4	EUH-4
DESCRIPTION	ELECTRIC UNIT HEATER	ELECTRIC UNIT HEATER	ELECTRIC UNIT HEATER	ELECTRIC UNIT HEATER	ELECTRIC UNIT HEATER
HEATER OUTPUT (KW)	20	20	20	20	20
AIR FLOW (CFM)	1000	1000	1000	1000	1000
FAN MOTOR HP	1/10	1/10	1/10	1/10	1/10
ACCESSORIES	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET	REMOTE LOW VOLTAGE THERMOSTAT, 24V CONTROL TRANSFORMER, WALL BRACKET
LOCAL ELECTRICAL DISCONNECT	PROVIDE	PROVIDE	PROVIDE	PROVIDE	PROVIDE
ELECTRICAL (V/PH/HZ)	480V/3/60	480V/3/60	480V/3/60	480V/3/60	480V/3/60
ELECTRICAL MCA (AMPS)	24.8	24.8	24.8	24.8	24.8
ELECTRICAL MOCP (AMPS)	35	35	35	35	35
WEIGHT (LBS)	78	78	78	78	78
MODEL	IUH-2048	IUH-2048	IUH-2048	IUH-2048	IUH-2048
MANUFACTURER	QMARK / MARLEY	QMARK / MARLEY	QMARK / MARLEY	QMARK / MARLEY	QMARK / MARLEY

DEHUMIDIFIER SCHEDULE		
DESIGNATION	DH-1	DH-2
DESCRIPTION	LOW TEMPERATURE DESIGN DEHUMIDIFIER UNIT OUTDOOR AIR COOLED CONDENSER	LOW TEMPERATURE DESIGN DEHUMIDIFIER UNIT OUTDOOR AIR COOLED CONDENSER
SUPPLY AIR FLOW (CFM)	2750.00	2750.00
COOLING COIL TYPE	DX	DX
COOLING COIL REFRIGERANT TYPE	R-407C	R-407C
COOLING LAT. CAPACITY (MBH)	10.00	10.00
COOLING SENS. CAPACITY (MBH)	50.00	50.00
COOLING TOTAL CAPACITY (MBH)	60.00	60.00
COOLING EAT DB/RH (F)	70 / 50%	70 / 50%
DEHUMIDIFICATION RATE (LBS/HR)	13.20	13.20
HOT GAS LINE SIZE (IN), NOTE 2	7/8	7/8
LIQUID LINE SIZE (IN), NOTE 2	1/2	1/2
FILTER TYPE	MERV 8	MERV 8
TEMPERATURE AND HUMIDITY CONTROLLER	PROVIDE CM3540-3-WALL WALL MOUNTED CONTROLLER WITH TEMP AND RH SENSORS	PROVIDE CM3540-3-WALL WALL MOUNTED CONTROLLER WITH TEMP AND RH SENSORS
TEMPERATURE AND HUMIDITY SENSOR	PROVIDE WALL MOUNT TYPE	PROVIDE WALL MOUNT TYPE
ACCESSORIES	SECONDARY DRAIN PAN UNDER UNIT, ELECTROFIN COATING ON COILS	SECONDARY DRAIN PAN UNDER UNIT, ELECTROFIN COATING ON COILS
LOCAL ELECTRICAL DISCONNECT	PROVIDE	PROVIDE
ELECTRICAL (V/PH/HZ)	480/3/60	480/3/60
ELECTRICAL MCA, ESTIMATED note 3	12	12
ELECTRICAL MOCP, ESTIMATED Note 3	15	15
AIR COOLED CONDENSER		
DESIGNATION	ACC-1	ACC-2
SERVICE	DH-1	DH-2
DESCRIPTION	AIR COOLED CONDENSER	AIR COOLED CONDENSER
AIR FLOW RATE (CFM)		
REFRIGERANT TYPE	R-407C	R-407C
CONDENSER EAT TEMP. (F)	95.00	95.00
HEAT OF REJECTION (MBH)	48.00	48.00
ACCESSORIES	ELECTROFIN COATING ON COILS	ELECTROFIN COATING ON COILS
LOCAL ELECTRICAL DISCONNECT	PROVIDE	PROVIDE
ELECTRICAL (V/PH/HZ)	480/3/60	480/3/60
ELECTRICAL MCA	2.50	2.50
ELECTRICAL MOCP	15.00	15.00
DH MODEL	LW05	LW05
ACC MODEL	NOTE 1	NOTE 1
MANUFACTURER	DESERT-AIRE	DESERT-AIRE

NOTES:
1. CONFIRM ACC UNIT MEETS THE REQUIREMENTS OF THE DH UNIT IT SERVES.
2. PROVIDE REFRIGERANT PIPING BETWEEN DH AND ACC UNIT. INSTALL PER DH MANUFACTURER'S REQUIREMENTS.
3. MECHANICAL CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR FOR SIZE OF CIRCUIT IF DIFFERENT FROM WHAT IS SHOWN.

EXHAUST FAN SCHEDULE	
DESIGNATION	EF-1
DESCRIPTION	SIDEWALL DIRECT DRIVE FAN
CONSTRUCTION	SEE STANDARD CONSTRUCTION FEATURES BELOW
AIR FLOW (CFM)	6,000
EXT. STATIC PRESS. (IWG)	0.250
FAN RPM	1,750
MOTOR RPM	1,750
MOTOR TYPE	VARIGREEN (ECM)
MOTOR OPERATING HP	1.19
MOTOR HP	2.0
AMCA SOUND RATING (SONES)	30.0
BACK DRAFT DAMPER	PROVIDE MOTORIZED TYPE
ACCESSORIES	SEE ACCESSORIES LIST BELOW
ELECTRICAL (V/PH/HZ)	480/3/60
ELECTRICAL FLA (AMPS)	3.2
ELECTRICAL MOCP (AMPS)	15
WEIGHT (LBS)	292
MODEL	AER-24-VG
MANUFACTURER	GREENHECK OR APPROVED EQUAL

STANDARD CONSTRUCTION FEATURES:
GALVANIZED STEEL FAN PANEL - DIE FORMED, GALVANIZED STEEL DRIVE FRAME ASSEMBLY.
CAST ALUMINUM AIRFOIL BLADE PROPELLER - BALL BEARING MOTORS - CORROSION RESISTANT FASTENERS.

ACCESSORIES:
SELECTED OPTIONS & ACCESSORIES:
MOTOR - VARI-GREEN EC MOTOR
CONTROL - DIAL FOR BALANCING
AIRFLOW DIRECTION: EXHAUST
LONG WALL HSG, FLUSH EXTERIOR, W/OSHA GRD., FACTORY INSTALLED, CTD WITH PERMATECTOR, CONCRETE GRAY-RAL 7023
MOTOR ACCESS: FROM INT. OF BLDG.
MOUNTING STYLE - FLUSH
WEATHERHOOD, GALVANIZED 45 DEG. WITH BIRD SCREEN, SHIPPED LOOSE FROM FACTORY
CTD PERMATECTOR, CONCRETE GRAY-RAL 7023
PROPELLER GUARD, COATED STEEL, FACTORY ATTACHED
COATED WITH PERMATECTOR, CONCRETE GRAY-RAL 7023, FAN AND ATTACHED ACC
DAMPER SHIPPED LOOSE, WD-320-PB-26X26, COATED
DAMPER ACTUATOR (MP-310), 460 VAC ACTUATED
END SWITCH

LOUVER SCHEDULE											
DESIGNATION	DESCRIPTION	LENGTH (IN)	HEIGHT (IN)	MAX AIR FLOW (CFM)	FREE AREA (SF)	STAIC PRESS. DROP (IWG), NOTE 1	FINISH	COLOR	ACCESSORIES	MODEL	MANUFACTURER
INTAKE											
LVI-1	INTAKE, WIND DRIVEN RAIN RESISTANT LOUVER	60	48	6,000	8.32	0.1	AAMA 2605 COMPLIANT COATING, 100% FLUOROPOLYMER (FEVE) OR 2-COAT 70% KYNAR (PVDF)	AS SELECTED BY ARCHITECT	BIRD SCREEN	EHH-401	GREENHECK OR APPROVED EQUAL

NOTES:
1. MAXIMUM ALLOWABLE PRESSURE DROP AT MAXIMUM CFM, IN OF H2O.

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
CIVIL
No. 38143
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	
DESIGNED BY:	KWK
CHECKED BY:	KWK
DRAWN BY:	GJG
APPROVED BY:	KWK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
MECHANICAL DIAGRAMS & SCHEDULES

DRAWING NO.:
H-3
SHEET NO. 50 OF 57

GENERAL NOTES

1. PROJECT SCOPE: PROVIDE COMPLETE AND OPERATIONAL SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS INCLUDING ALL NECESSARY MATERIAL, LABOR, AND EQUIPMENT.
2. CONSTRUCTION\CONTRACT DOCUMENTS: CONTRACT DOCUMENTS INCLUDING PLANS, DETAILS, AND ONE-LINE DIAGRAMS SHOW THE GENERAL LOCATION AND ARRANGEMENT OF THE WORK. THESE DOCUMENTS ARE DIAGRAMMATIC AND DO NOT SHOW ALL CONNECTORS, FITTINGS, HANGERS, AND ADDITIONAL ELEMENTS WHICH THE CONTRACTOR MUST PROVIDE TO COMPLETE THE SYSTEMS AS OUTLINED IN THE CONTRACT DOCUMENTS. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN, THAT MAY EXIST, THUS REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE PROJECT AREA BEFORE PERFORMING THE WORK. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BY FIELD MEASUREMENTS.
3. COORDINATION:
   A. THE CONTRACTOR SHALL COORDINATE THEIR WORK WITH ALL CONSTRUCTION DOCUMENTS AND OTHER TRADES ASSOCIATED WITH THE PROJECT.
   B. THE CONTRACTOR SHALL VISIT THE SITE OF WORK AND FAMILIARIZE HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE NATURE OF THE INSTALLATION AND CONDITIONS.
   C. BEFORE SELECTING MATERIAL, EQUIPMENT AND PROCEEDING WITH WORK, INSPECT AREAS WHERE MATERIAL AND EQUIPMENT ARE TO BE INSTALLED TO INSURE SUITABILITY, AND CHECK NEEDED SPACE FOR PLACEMENT, CLEARANCES AND INTERCONNECTIONS.
   D. PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN THAT MAY EXIST; THUS, REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE SPACE BEFORE PERFORMING THE WORK.
   E. BEFORE CUTTING OR DRILLING INTO BUILDING ELEMENTS INSPECT AND LAYOUT WORK TO AVOID DAMAGING STRUCTURAL ELEMENTS AND BUILDING UTILITIES.
   F. ARRANGE FOR CHASES, SLOTS, AND OPENINGS IN OTHER BUILDING COMPONENTS DURING PROGRESS OF CONSTRUCTION, TO ALLOW FOR PROPER SYSTEM INSTALLATIONS.
   G. COORDINATE THE INSTALLATION OF REQUIRED SUPPORTING DEVICES AND SLEEVES TO BE SET IN POURED IN PLACE CONCRETE AND OTHER STRUCTURAL COMPONENTS, AS THEY ARE CONSTRUCTED.
   H. H) SEQUENCE, COORDINATE, AND INTEGRATE INSTALLATIONS OF MATERIALS AND EQUIPMENT FOR EFFICIENT FLOW OF THE WORK. GIVE PARTICULAR ATTENTION TO LARGE EQUIPMENT REQUIRING POSITIONING PRIOR TO CLOSING IN THE BUILDING.
   I. FAILURE OF THE CONTRACTOR TO ACQUAINT HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE ABOVE CONDITIONS AND NOT PERFORMING PROPER COORDINATION WILL NOT RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY FOR ESTIMATING THE DIFFICULTIES AND COSTS FOR SUCCESSFULLY PERFORMING THE COMPLETE WORK UNDER THIS PROJECT.
4. SHUTDOWNS: WRITTEN REQUESTS FOR APPROVAL FOR PLANNED SHUTDOWNS OR INTERRUPTION OF OWNER'S UTILITIES, SYSTEMS AND EQUIPMENT SHALL BE MADE 72 HOURS PRIOR TO THE START OF THE REQUESTED SHUTDOWN PERIODS.
5. CODES AND STANDARDS: THE CONTRACTOR SHALL FOLLOW ALL FEDERAL, STATE AND LOCAL CODES THAT HAVE JURISDICTION WHERE THE WORK IS BEING PERFORMED. THROUGHOUT THE CONTRACT DOCUMENTS CERTAIN CODES AND STANDARDS ARE REFERENCED. THE CONTRACTOR SHALL USE THE LATEST VERSIONS OF CODES AND STANDARDS REFERENCED UNLESS OTHERWISE NOTED. IF THE CONTRACTOR IS NOT FAMILIAR WITH THE REFERENCED STANDARD THEY SHALL CONTACT THE OWNER'S REPRESENTATIVE FOR DIRECTION.
6. PERMITS: THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED PERMITS AND ARRANGE FOR ALL REQUIRED INSPECTIONS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES.
7. WORKMAN: ALL WORK SHALL BE DONE WITH LICENSED WORKMEN IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES CODES AND REGULATIONS.
8. SUBMITTALS: THE CONTRACTOR SHALL PROVIDE SUBMITTALS FOR ALL EQUIPMENT AND MATERIALS BEING PROVIDED BEFORE SUCH EQUIPMENT AND MATERIALS ARE PURCHASED AND INSTALLED. THE SUBMITTALS SHALL BE REVIEWED AND RETURNED BY THE OWNER'S REPRESENTATIVE WITH APPROPRIATE COMMENTS. SUBMITTALS SHALL BE SUBMITTED ELECTRONICALLY IN PDF FORMAT AND WILL BE RETURNED WITH COMMENTS TO THE CONTRACTOR IN PDF FORMAT.
9. AS-BUILT DOCUMENTATION: THE CONTRACTOR SHALL PROVIDE ONE MARK-UP SET OF CONSTRUCTION DOCUMENTS SHOWING FINAL AS-BUILT CONDITIONS. DOCUMENTS SHALL CLEARLY SHOW THE CHANGES MADE TO THE INSTALLED SYSTEMS.
10. EQUIPMENT WARRANTIES, MAINTENANCE MANUALS AND INSTALLATION MANUALS: TURN OVER TO THE OWNER ALL MANUFACTURERS' WARRANTIES, MAINTENANCE MANUALS, AND INSTALLATION MANUALS FOR EQUIPMENT AND MATERIALS PROVIDED.
11. PHOTOGRAPHS: PHOTOGRAPHS ARE PROVIDED TO SHOW CURRENT CONDITION OF BUILDING SYSTEMS TO ASSIST THE CONTRACTOR. PHOTOGRAPHS DO NOT SHOW ALL AREAS OF THE BUILDING OR ALL SYSTEM CONDITIONS, THUS REQUIRING THE CONTRACTOR TO VISIT THE SITE BEFORE PERFORMING WORK. PHOTOGRAPHS ARE NOT INTENDED TO SHOW SCOPE OF WORK. PLANS, NOTES, SPECIFICATIONS AND OTHER BID DOCUMENTS INDICATE SCOPE OF WORK.
12. TERMINOLOGY:
   A. THE TERM "INDICATED" SHALL MEAN, "AS SHOWN ON CONTRACT DOCUMENTS (SPECIFICATIONS, DRAWINGS, AND RELATED ATTACHMENTS)".
   B. THE TERM "PROVIDE" SHALL MEAN, "TO FURNISH, INSTALL, AND CONNECT COMPLETELY".
   C. THE TERM "COORDINATE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "TO MANAGE, INTERFACE, COMMUNICATE, MAKE ARRANGEMENT, BRING INTO ORDER, ADMINISTER AND HANDLE COMPLETELY".
   D. THE TERM "INTERIOR" IS AN INTERIOR LOCATION WHERE ITS ENVIRONMENT IS HEATED AND/OR AIR CONDITIONED AND NOT SUBJECT TO OUTSIDE WEATHER CONDITIONS.
   E. THE TERM "EXTERIOR" IS ALL LOCATIONS, WHICH ARE NOT INTERIOR, OR UNDERGROUND.
   F. THE TERM "INTERIOR FINISHED SPACE" IS INTERIOR SPACES, WHICH ARE USED FOR OFFICES, CORRIDORS, LOBBIES, TOILETS, STORAGE AND FILING ROOMS, LOUNGES, MECHANICAL ROOMS, ELECTRICAL ROOMS, ETC.
13. DEMOLITION: DEMOLITION OF INDICATED ITEMS INCLUDES THE REMOVAL AND PROPER DISPOSAL OF THOSE ITEMS AND ALL ASSOCIATED PIPING, DUCTWORK, WIRING AND HANGERS. ELECTRICAL BRANCH, CONTROL, TELEPHONE, AND ALARM WIRING SHALL BE REMOVED BACK TO PANELBOARDS OR RELATED SYSTEM PANELS OR BACKBOARDS.
14. EQUIPMENT AND MATERIAL INSTALLATIONS:
   A. ALL EQUIPMENT AND MATERIALS SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING AND MANUFACTURER'S REQUIREMENTS.
   B. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
   C. IF AN EQUIPMENT MANUFACTURER REQUIRES LARGER CAPACITY, CIRCUITRY AND/OR EQUIPMENT, THE CONTRACTOR SHALL PROVIDE SUCH CAPACITY AND/OR EQUIPMENT UNDER HIS CONTRACT AT NO ADDITIONAL COST TO THE OWNER.
   D. LOCATE ALL EQUIPMENT, WHICH REQUIRES SERVICING IN FULLY ACCESSIBLE POSITIONS. IF REQUIRED FOR BETTER ACCESSIBILITY, FURNISH ACCESS DOORS FOR THAT PURPOSE.
   E. MINOR DEVIATIONS FROM DRAWINGS MAY BE MADE TO ALLOW FOR BETTER ACCESSIBILITY.
   F. ALL WORK IN INTERIOR FINISHED SPACES SHALL BE CONCEALED BEHIND WALLS, ABOVE CEILINGS OR HUNG CEILINGS, OR UNDER THE FLOOR. PROVIDE ALL NECESSARY CUTTING, PATCHING, REPAINTING AND/OR REPLACEMENT OF CEILING TILES AS REQUIRED TO PERFORM WORK.
   G. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO CONFORM WITH APPROVED SUBMITTAL DATA, INCLUDING COORDINATION DRAWINGS (IF REQUIRED), TO GREATEST EXTENT POSSIBLE. CONFORM TO ARRANGEMENTS INDICATED BY THE CONTRACT DOCUMENTS, RECOGNIZING THAT PORTIONS OF THE WORK ARE SHOWN ONLY IN DIAGRAMMATIC FORM. WHERE COORDINATION REQUIREMENTS CONFLICT WITH INDIVIDUAL SYSTEM REQUIREMENTS, REFER CONFLICT TO THE ARCHITECT/ENGINEER.
   H. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT LEVEL AND PLUMB, PARALLEL AND PERPENDICULAR TO OTHER BUILDING SYSTEMS AND COMPONENTS, WHERE INSTALLED EXPOSED IN FINISHED SPACES
   I. INSTALL EQUIPMENT TO FACILITATE SERVICING, MAINTENANCE, AND REPAIR OR REPLACEMENT OF EQUIPMENT COMPONENTS. AS MUCH AS PRACTICAL, CONNECT EQUIPMENT FOR EASE OF DISCONNECTING, WITH MINIMUM OF INTERFERENCE WITH OTHER INSTALLATIONS.
   J. INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT GIVING RIGHT OF WAY PRIORITY TO SYSTEMS REQUIRED TO BE INSTALLED AT A SPECIFIED SLOPE.
   K. K) WHERE MOUNTING HEIGHTS ARE NOT DETAILED OR DIMENSIONED, INSTALL SYSTEMS, MATERIALS, AND EQUIPMENT TO PROVIDE THE MAXIMUM HEADROOM POSSIBLE.
   L. ASCERTAIN FROM EXAMINATION OF THE DRAWINGS, ANY SPECIAL TEMPORARY OPENINGS IN THE BUILDING REQUIRED FOR THE ADMISSION OF APPARATUS PROVIDED UNDER THIS DIVISION. NOTIFY THE CONTRACTOR WITH SUFFICIENT NOTICE TO PROVIDE THESE OPENINGS. IN THE EVENT OF FAILURE TO GIVE SUFFICIENT NOTICE, THE CONTRACTOR SHALL ASSUME ALL COSTS OF PROVIDING SUCH OPENINGS THEREAFTER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DISASSEMBLY AND ASSEMBLY OF EQUIPMENT AS REQUIRED TO PLACE EQUIPMENT IN THEIR FINAL LOCATIONS.
   M. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UNDERGROUND UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
15. FIRE RATINGS: THE CONTRACTOR SHALL REVIEW ALL CONTRACT DOCUMENTS FOR FIRE SEPARATION AND FIRE RATED ASSEMBLIES. ALL PIPING, DUCTWORK AND CONDUITS PASSING THROUGH FIRE RATED PENETRATING WALLS, CEILINGS AND FLOORS SHALL BE PROVIDED WITH A UL LISTED FIRE STOPPING ASSEMBLIES. UL LISTED FIRE STOPPING ASSEMBLIES SHALL BE SUITABLE FOR THE CONDITIONS ENCOUNTERED AND SHALL BE RATED EQUAL TO THE RATING OF THE WALL, CEILING OR FLOOR. REVIEW FIRE RATED ASSEMBLIES THAT ALLOW PENETRATIONS OF ITEMS SUCH AS OUTLET BOXES AND CONDUITS THAT DO NOT REQUIRE FIRE STOPPING. SPACE AND POSITION THESE DEVICES AS ALLOWED PER THE ASSEMBLY'S UL RATING.
16. SERVICE LABELING: LABEL EQUIPMENT, PIPING, CONDUITS, INCLUDING FANS, AIR HANDLERS, TERMINAL UNITS, PANELBOARDS, ETC. WITH LABELS MADE OF SELF-STICKING, PLASTIC FILM DESIGNED FOR PERMANENT INSTALLATION. LABELS SHALL MATCH DESIGNATIONS AS INDICATED ON CONTRACT DRAWINGS. IDENTIFY PIPING AND CONDUITS IN ACCORDANCE WITH OSHA 29 CFR 1910.144, EXCEPT THAT LABELS OR TAPES MAY BE USED IN LIEU OF PAINTING OR STENCILING. SPACING OF IDENTIFICATION MARKING ON RUNS SHALL NOT EXCEED 50 FEET. MATERIALS FOR LABELS AND TAPES SHALL CONFORM TO CID A-A-1689. LABELS SHALL BE GENERAL PURPOSE, TYPE AND COLOR OR CLASS.
   A. IN ADDITION IDENTIFY SERVICES AS INDICATED BELOW:
   B. EACH POINT OF ENTRY AND EXIT OF PIPE OR CONDUITS PASSING THROUGH WALLS.
   C. EACH CHANGE IN DIRECTION, I.E., ELBOWS, TEES.
   D. IN CONGESTED OR HIDDEN AREAS AND AT ALL ACCESS PANELS AT EACH POINT REQUIRED TO CLARIFY SERVICE OR INDICATED HAZARD.
   E. IN LONG STRAIGHT RUNS, LOCATE LABELS AT DISTANCES WITHIN EYESIGHT OF EACH OTHER NOT TO EXCEED 50 FEET. ALL LABELS SHALL BE VISIBLE AND LEGIBLE FROM THE PRIMARY SERVICE AND OPERATING AREA.
17. MANUFACTURER'S NAMEPLATE: EACH ITEM OF EQUIPMENT SHALL HAVE A NAMEPLATE BEARING THE MANUFACTURER'S NAME, ADDRESS, MODEL NUMBER, AND SERIAL NUMBER SECURELY AFFIXED IN A CONSPICUOUS PLACE; THE NAMEPLATE OF THE DISTRIBUTING AGENT WILL NOT BE ACCEPTABLE.
18. POSTED OPERATING INSTRUCTIONS: PROVIDE FOR EACH SYSTEM AND PRINCIPAL ITEM OF EQUIPMENT AS SPECIFIED FOR USE BY OPERATION AND MAINTENANCE PERSONNEL. PRINT OR ENGRAVE OPERATING INSTRUCTIONS AND FRAME UNDER GLASS OR IN APPROVED LAMINATED PLASTIC. POST INSTRUCTIONS WHERE DIRECTED. FOR OPERATING INSTRUCTIONS EXPOSED TO THE WEATHER, PROVIDE WEATHER-RESISTANT MATERIALS OR WEATHERPROOF ENCLOSURES. OPERATING INSTRUCTIONS SHALL NOT FADE WHEN EXPOSED TO SUNLIGHT AND SHALL BE SECURED TO PREVENT EASY REMOVAL OR PEELING. THE OPERATING INSTRUCTIONS SHALL INCLUDE THE FOLLOWING:
   A. WIRING DIAGRAMS, CONTROL DIAGRAMS, AND CONTROL SEQUENCE FOR EACH PRINCIPAL SYSTEM AND ITEM OF EQUIPMENT.
   B. START UP, PROPER ADJUSTMENT, OPERATING, LUBRICATION, AND SHUTDOWN PROCEDURES.
   C. SAFETY PRECAUTIONS.
   D. THE PROCEDURE IN THE EVENT OF EQUIPMENT FAILURE.
   E. OTHER ITEMS OF INSTRUCTION AS RECOMMENDED BY THE MANUFACTURER OF EACH SYSTEM OR ITEM OF EQUIPMENT.
19. WARNING SIGNS: PROVIDE WARNING SIGNS FOR THE ENCLOSURES OF ELECTRICAL EQUIPMENT INCLUDING SUBSTATIONS, PAD-MOUNTED TRANSFORMERS, PAD-MOUNTED SWITCHES, GENERATORS, AND SWITCHGEAR HAVING A NOMINAL RATING EXCEEDING 600 VOLTS.
20. EXTERIOR FERROUS MATERIALS: ALL EXTERIOR FERROUS MATERIALS SHALL BE PROTECTED FROM CORROSION BY ONE OF THE FOLLOWING METHODS:
   A. COVERED WITH A NON-FERROUS OR NON-CORRODING MATERIAL.
   B. MATERIALS THAT ARE INSULATED ON THE EXTERIOR.
   C. MATERIALS THAT ARE GALVANIZED.
   D. MATERIALS THAT ARE PAINTED. EXTERIOR PAINTING SHALL CONSIST OF A BASE COAT OF AN APPROPRIATE PRIMER AND TWO COATS OF FINAL PAINT. FINAL PAINT COLOR SHALL BE SELECTED BY THE OWNER'S REPRESENTATIVE.

ELECTRICAL SPECIFICATIONS

PART 1 GENERAL

1. SEE GENERAL NOTES AND REQUIREMENTS.
2. PROVIDE A COMPLETE AND OPERATIONAL ELECTRICAL SYSTEM INCLUDING ALL NECESSARY MATERIAL, LABOR, EQUIPMENT AND TESTING REQUIRED.
3. ELECTRICAL PLANS, DETAILS, AND ONE-LINE DIAGRAMS SHOW THE GENERAL LOCATION AND ARRANGEMENT OF THE ELECTRICAL SYSTEM. THEY ARE DIAGRAMMATIC AND DO NOT SHOW ALL CONDUIT BODIES, CONNECTORS, BENDS, FITTINGS, HANGERS, AND ADDITIONAL PULL AND JUNCTION BOXES WHICH THE CONTRACTOR MUST PROVIDE TO COMPLETE THE ELECTRICAL SYSTEM. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BY FIELD MEASUREMENTS.
4. ELECTRICAL PLANS AND DETAILS DO NOT SHOW ALL INTERFERENCE'S AND CONDITIONS, VISIBLE AND/OR HIDDEN, THAT MAY EXIST, THUS REQUIRING THE CONTRACTOR TO INSPECT AND SURVEY THE SPACE BEFORE PERFORMING THE WORK.
5. ALL EQUIPMENT AND MATERIAL SHALL BE LABELED AND LISTED, AND INSTALLED IN ACCORDANCE WITH THEIR LISTING.
6. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS AND ARRANGE FOR ALL REQUIRED INSPECTIONS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES.
7. ALL WORK SHALL BE DONE WITH LICENSED WORKMEN IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL GOVERNING AUTHORITIES AND CODES.
8. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE CONNECTICUT BUILDING CODE, FIRE CODE, AND THE NATIONAL ELECTRIC CODE (NEC) ANSI/NFPA 70 2014 EDITION.
9. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC) ANSI/NFPA 70 2014 EDITION.
10. INSTALLATION OF EMERGENCY LIGHTING AND EXIT SIGNS SHALL MEET ALL APPLICABLE CODES AND REGULATIONS INCLUDING BUILDING CODES, NEC AND ADA.
11. THE DEFINITION OF ELECTRICAL TERMS USED SHALL BE AS DEFINED IN THE 2017 EDITION OF THE NATIONAL ELECTRICAL CODE (NEC).
12. THE TERM "INDICATED" SHALL MEAN, "AS SHOWN ON CONTRACT DOCUMENTS (SPECIFICATIONS, DRAWINGS, AND RELATED ATTACHMENTS)".
13. THE TERM "PROVIDE" SHALL MEAN, "TO FURNISH, INSTALL, AND CONNECT COMPLETELY".
14. THE TERM "SIZE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "LENGTH, CURRENT AND VOLTAGE RATING, NUMBER OF POLES, NEMA SIZE, AND OTHER SIMILAR ELECTRICAL CHARACTERISTICS".
15. THE TERM "SPACE" ON PANELBOARD AND SWITCHBOARD SCHEDULES SHALL MEAN, "PROVIDE SPACE TO INSTALL THE NUMBER OF POLES AND SIZE OF THE PROTECTIVE DEVICE INDICATED WITH ALL THE NECESSARY SPACE ON THE BUSBAR AND FITTINGS TO INSTALL THE DEVICE AT SOME FUTURE DATE".
16. THE TERM "COORDINATE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "TO MANAGE, INTERFACE, COMMUNICATE, MAKE ARRANGEMENT, BRING INTO ORDER, ADMINISTER AND HANDLE COMPLETELY".
17. COORDINATE ELECTRICAL WORK WITH OWNER.
18. PROVIDE AS-BUILT, AND OPERATIONAL AND MAINTENANCE (O&M) DOCUMENTATION TO OWNER.

PART 2 PRODUCTS AND EXECUTION

1. BEFORE TRENCHING OR DIGGING, CONTACT THE UTILITY COMPANIES BY CALLING THE "CALL BEFORE YOU DIG" SERVICE AT 1-800-922-4455 FOR CONNECTICUT OR "DIG SAFE" AT 1-800-322-4844 FOR MASSACHUSETTS FOR INFORMATION REGARDING THE LOCATION OF UNDERGROUND UTILITIES. DO NOT RELY ON CONTRACT SITE AND BUILDING DRAWINGS FOR UTILITY INFORMATION AS THEY ARE SCHEMATIC IN NATURE AND DO NOT SHOW EXACT INFORMATION OR ALL UTILITY LINES THAT MAY BE PRESENT.
2. THE CONTRACTOR SHALL VISIT THE SITE OF WORK AND FAMILIARIZE HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE NATURE OF THE INSTALLATION AND CONDITIONS. FAILURE OF THE CONTRACTOR TO ACQUAINT HIMSELF WITH ALL AVAILABLE INFORMATION CONCERNING THE ABOVE CONDITIONS WILL NOT RELIEVE THE CONTRACTOR FROM THE RESPONSIBILITY FOR ESTIMATING THE DIFFICULTIES AND COSTS FOR SUCCESSFULLY PERFORMING THE COMPLETE WORK UNDER THIS PROJECT.
3. WHERE ELECTRICAL OUTLET BOXES AND DEVICES ARE INSTALLED IN FIRE RATED WALLS, SEE ARCHITECTURAL DRAWING FOR RATED WALLS. LOCATE BOX OPENINGS AND SIZE OF OPENINGS IN WALL IN ACCORDANCE WITH U.L. RATING REQUIREMENTS TO MAINTAIN FIRE RATING OF WALL. PROVIDE FIRE STOPPING PRODUCTS AND ASSEMBLIES AS REQUIRED BY THE CODES, BY U.L. LISTED ASSEMBLIES AND BY LOCAL FIRE AND BUILDING INSPECTION DEPARTMENTS TO MEET THEIR FINAL APPROVALS.
4. WHERE ELECTRICAL CABLES AND RACEWAYS PASS THROUGH FIRE RATED WALLS AND FLOORS, PENETRATIONS IN WALLS AND FLOORS SHALL BE FIRE SEALED WITH U.L. RATED PRODUCTS SUITABLE FOR CONDITIONS ENCOUNTERED AND RATING REQUIRED TO MAINTAIN THE RATING OF THE U.L. FIRE RATED ASSEMBLY INVOLVED.
5. THE RIGHT IS RESERVED BY THE ENGINEER OR OWNER TO MAKE REASONABLE CHANGES IN LOCATIONS OF EQUIPMENT, OUTLETS, OR WIRING PRIOR TO THE INSTALLATION WITHOUT INVOLVING ADDITIONAL COST OR EXPENSE TO THE OWNER.
6. TURN OVER TO THE OWNER ALL MANUFACTURER'S WARRANTIES FOR EQUIPMENT AND MATERIALS PROVIDED.
7. UNLESS OTHERWISE INDICATED, ALL ELECTRICAL EQUIPMENT HAS BEEN BASED ON GENERAL ELECTRIC PRODUCTS. THE CONTRACTOR MAY SUBSTITUTE PRODUCTS OF ANOTHER MANUFACTURER IF IT IS OF EQUAL QUALITY AND RATING, SUBJECT TO ENGINEER'S REVIEW AND OWNER'S ACCEPTANCE.
8. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.
14. **ELECTRIC SERVICE**
15. COORDINATE ELECTRIC SERVICE INSTALLATION WITH POWER COMPANY.
16. PROVIDE A TEMPORARY ELECTRIC SERVICE FOR ELECTRICAL POWER DURING CONSTRUCTION.
17. **PANELBOARDS**
18. ALL PANELBOARDS SHALL BE PROVIDED WITH AN EQUIPMENT GROUNDING BUS CONNECTED TO PANELBOARD ENCLOSURE. WHEN SCHEDULES ON THE PANELBOARDS REQUIRE AN ADDITIONAL ISOLATED GROUND BUS, WHICH IS TO BE INSULATED FROM THE ENCLOSURE AND GROUNDED BACK TO THE ELECTRICAL SERVICE, EQUIPMENT GROUND THIS BUS USING INSULATED EQUIPMENT GROUNDING CONDUCTOR IN PANELBOARD FEEDER.
19. PROVIDE PANEL NAME PLATE WITH 3 LINES OF TEXT. PANEL NAME ON TOP, FEEDER INFORMATION ON SECOND LINE AND FEED SOURCE LOCATION ON THIRD LINE. EXAMPLE "PANEL A / FED FROM MAIN SWITCH BOARD 1 / MAIN ELECTRIC RM 123". COORDINATE FINIAL PANEL AND ROOM NAMES FOR EACH PANEL WITH OWNER. LABEL SOURCE FEED DISTRIBUTION PANEL AND OR SWITCH BOARD WITH ANY REVISIONS.
20. PROVIDE A TYPED PANEL SCHEDULE FOR ALL PANELS INSTALLED OR MODIFIED IN THE PROJECT. SCHEDULE SHALL BE PROVIDED IN A CLEAR PLASTIC PROTECTIVE COVERING INSIDE THE DOOR TO THE PANEL.
21. UNLESS OTHERWISE INDICATED, ALL ENCLOSURES FOR EQUIPMENT SHALL BE NEMA TYPE 1.
22. EXTERIOR EQUIPMENT ENCLOSURES SHALL BE WEATHERPROOF FOR CONDITION ENCOUNTERED AND SHALL MEET THE MINIMUM REQUIREMENTS OF NEMA TYPE 3R.
23. UNLESS OTHERWISE INDICATED, EXTERNALLY OPERATED SAFETY SWITCHES (DISCONNECT SWITCHES) SHALL BE UN-FUSED, SOLID NEUTRAL HEAVY DUTY AND SIZED TO MEET THE LOAD REQUIREMENTS.
24. **WIRING METHODS**
25. PROVIDE POWER WIRING FOR HEATING, VENTILATION AND AIR CONDITIONING SYSTEM. CONTROL WIRING WILL BE PROVIDED UNDER DIVISION 15, "MECHANICAL".
26. CONDUIT SIZE FOR INDICATED CONDUCTORS SHALL BE BASED ON ARTICLE [illegible] AND APPENDIX C OF NEC.
27. THE CONTRACTOR [illegible] GROUP BRANCH CIRCUIT HOMERUN CONDUIT", [illegible] RACEWAY IN ACCORDANCE WITH ARTICL[illegible] OF THE NEC, UTILIZING CORR[illegible]CTORS FOR CON[illegible]GER CONDUCTORS AS MA[illegible]
28. UNLESS [illegible]CH WIRING AND FEEDERS [illegible]RTITIONS, WALLS, BELO[illegible]
29. METALLIC CON[illegible]NG MAY BE EXPOSED ABOVE [illegible], MECHANICAL, AND A[illegible]
30. MINIMUM SIZE CONDU[illegible]MT OR 3/4" RSC AND PVC
31. UNLESS OTHERWISE INDIC[illegible]ERS TO BE RUN IN EMT CONDUIT.
32. UNLESS OTHERWISE INDICATED, BRANCH AND CONTROL WIRING SHALL BE INSTALLED IN EMT.
33. NONMETALLIC CABLE SHALL NOT BE INSTALLED EXPOSED OR WALLS HAVING FIRE RATED CONSTRUCTION.
34. UNLESS OTHERWISE INDICATED, WIRING TO EQUIPMENT AND MOTORS MAY BE INSTALLED IN LIQUID TIGHT FLEXIBLE METALLIC CONDUIT. FOR INTERIOR DRY LOCATIONS FLEXIBLE METAL CONDUIT MAY BE USED. MAXIMUM LENGTH OF FLEXIBLE CONDUIT SHALL BE 5 FEET. PROVIDE INSULATED GROUND CONDUCTOR IN ALL FLEXIBLE CONDUIT.
35. UNLESS OTHERWISE INDICATED, FLEXIBLE METAL CONDUIT MAY BE USED FOR LIGHTING FIXTURE DROPS, CONNECTION OF VIBRATING EQUIPMENT, UNDER COUNTER AND DISPLAY CASE WIRING.
36. BEFORE SELECTING MATERIAL, EQUIPMENT AND PROCEEDING WITH WORK, INSPECT AREAS WHERE MATERIAL AND EQUIPMENT ARE TO BE INSTALLED TO INSURE SUITABILITY, AND CHECK NEEDED SPACE FOR PLACEMENT, CLEARANCES AND INTERCONNECTIONS.
37. BEFORE CUTTING OR DRILLING INTO BUILDING ELEMENTS, INSPECT AND LAYOUT WORK TO AVOID DAMAGING STRUCTURAL ELEMENTS AND BUILDING UTILITIES.
38. THE MEASUREMENT FROM ABOVE FINISHED FLOOR (AFF) OF BOXES, DEVICES OR LIGHTING FIXTURES SHALL BE TAKEN FROM THE FINISHED FLOOR SURFACE TO THE ELEVATION INDICATED. IN NO CASE THE MOUNTING HEIGHT SHALL VIOLATE THE REQUIREMENTS OF THE CONNECTICUT BUILDING CODE, THE CONNECTICUT FIRE SAFETY CODE, AND THE NATIONAL ELECTRIC CODE (NEC) ANSI/NFPA 70.

MOTOR AND PHASE ROTATION

1. CONTRACTOR TO COORDINATE ROTATION OF ALL MOTORS WITH MECHANICAL OR DIVISION SPECIFYING MOTORS.
2. ALL MOTOR SHALL HAVE SAFETY DISCONNECTS WITHIN IN SITE OF MOTOR. PROVIDE DISCONNECT SIZED TO MOTOR HP.
3. TURN OVER TO THE OWNER ALL MANUFACTURER'S WARRANTIES FOR EQUIPMENT AND MATERIALS PROVIDED.
4. UNLESS OTHERWISE INDICATED, ALL ELECTRICAL EQUIPMENT HAS BEEN BASED ON GENERAL ELECTRIC PRODUCTS. THE CONTRACTOR MAY SUBSTITUTE PRODUCTS OF ANOTHER MANUFACTURER IF IT IS OF EQUAL QUALITY AND RATING, SUBJECT TO ENGINEER'S REVIEW AND OWNER'S ACCEPTANCE.
5. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.

14. **MOTOR AND PHASE ROTATION**

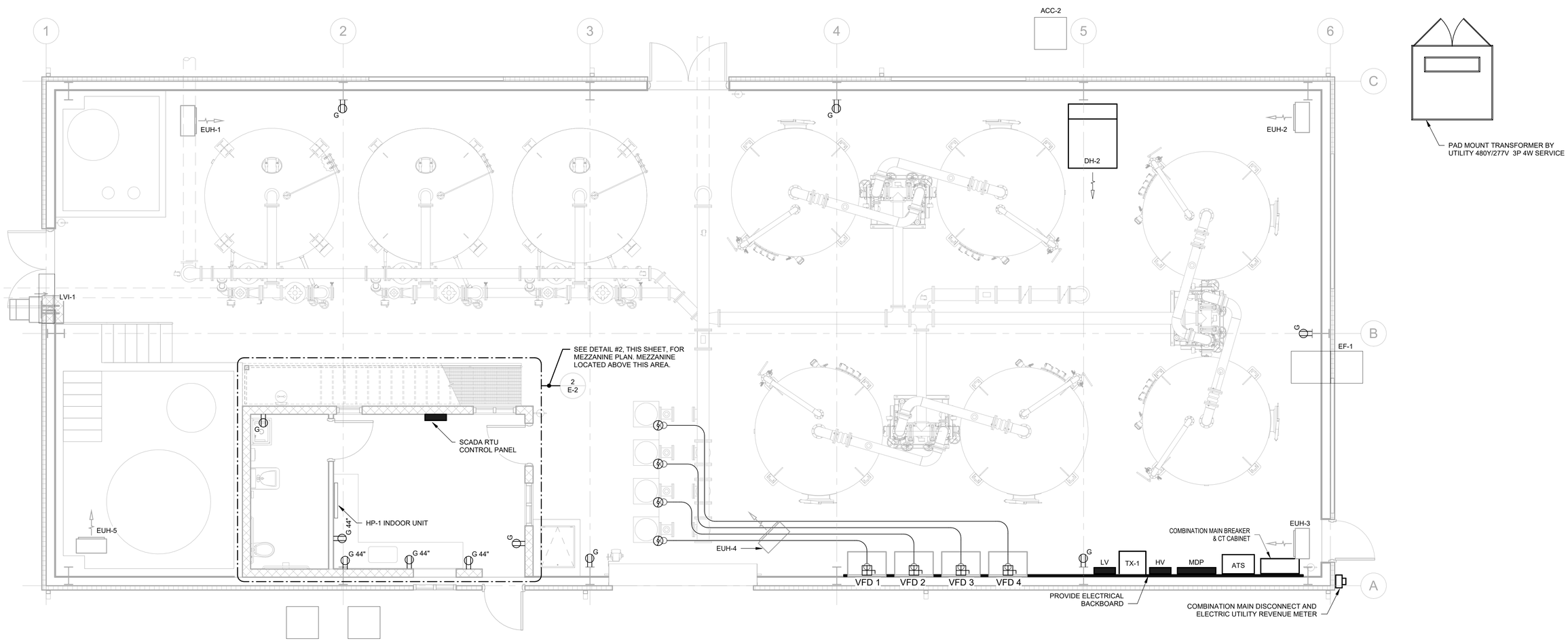
1. CONTRACTOR TO COORDINATE ROTATION OF ALL MOTORS WITH MECHANICAL OR DIVISION SPECIFYING MOTORS.
2. ALL MOTOR SHALL HAVE SAFETY DISCONNECTS WITHIN IN SITE OF MOTOR. PROVIDE DISCONNECT SIZED TO MOTOR HP.

1. TURN OVER TO THE OWNER ALL MANUFACTURER'S WARRANTIES FOR EQUIPMENT AND MATERIALS PROVIDED.
2. UNLESS OTHERWISE INDICATED, ALL ELECTRICAL EQUIPMENT HAS BEEN BASED ON GENERAL ELECTRIC PRODUCTS. THE CONTRACTOR MAY SUBSTITUTE PRODUCTS OF ANOTHER MANUFACTURER IF IT IS OF EQUAL QUALITY AND RATING, SUBJECT TO ENGINEER'S REVIEW AND OWNER'S ACCEPTANCE.
3. WHEN A MANUFACTURER RECOMMENDS AN OPTION OR ACCESSORY ITEM FOR THE INSTALLED CONDITION, OPERATION, OR ENVIRONMENT THAT IS TO BE EXPERIENCED, SUCH ITEM SHALL BE SUPPLIED AT NO ADDITIONAL COST TO THE OWNER.

1. FOR INTERIOR CONCEALED BRANCH AND CONTROL WIRING LOCATED IN WALLS AND CEILINGS THAT HAVE NUMBER 6 AWG AND SMALLER CONDUCTORS MAY BE METAL CLAD CABLE (MC CABLE, TYPE MC) WITH ONE INSULATED EQUIPMENT GROUNDING CONDUCTOR.
2. ALL CONDUCTORS TO BE 12 AWG, UNLESS OTHERWISE INDICATED.
3. ALL CONDUCTORS TO BE COPPER DUAL RATED THWN / THHN, UNLESS OTHERWISE INDICATED.
4. ALUMINUM CONDUCTORS SHALL NOT BE USED.
5. THE TEMPERATURE RATING OF CONNECTIONS SHALL BE A MINIMUM OF 75 DEGREES CENTIGRADE, UNLESS OTHERWISE INDICATED.
6. PROVIDE A DEDICATED NEUTRAL CONDUCTOR FOR ALL FEEDERS AND BRANCH WIRING, UNLESS OTHERWISE INDICATED. NEUTRAL SHALL NOT BE SHARED WITH OTHER BRANCH CIRCUITS OR OTHER PHASES.
7. UNLESS OTHERWISE INDICATED, NEUTRAL CONDUCTORS FOR 3 PHASE 208Y/120 AND 480Y/277V SYSTEMS SHALL BE RATED FOR 1.0 TIMES THE AMPACITY OF THE PHASE CONDUCTORS.

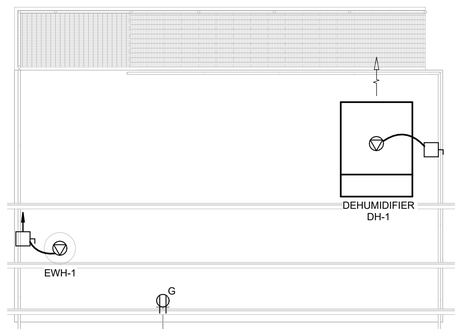
HVAC POWER AND CONTROL

1. ALL ROOFTOP EQUIPMENT



1 / E-2 POWER PLAN

Scale: 1/4" = 1'-0"



2 / E-2 MEZZANINE POWER PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON
ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

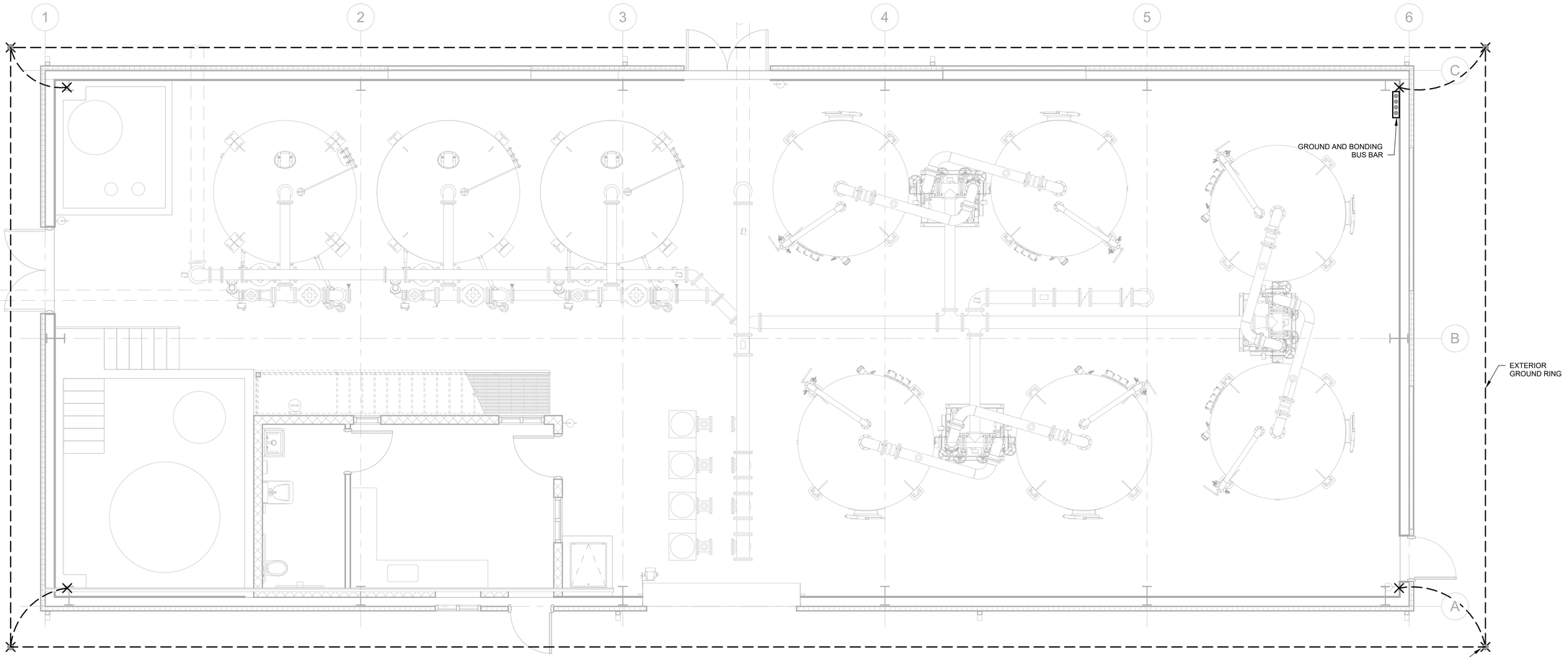
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
ELECTRICAL PLANS
POWER

DRAWING NO.:
E-2

SHEET NO. 52 OF 57



1
E-3

GROUNDING & BONDING PLAN

Scale: 1/4" = 1'-0"

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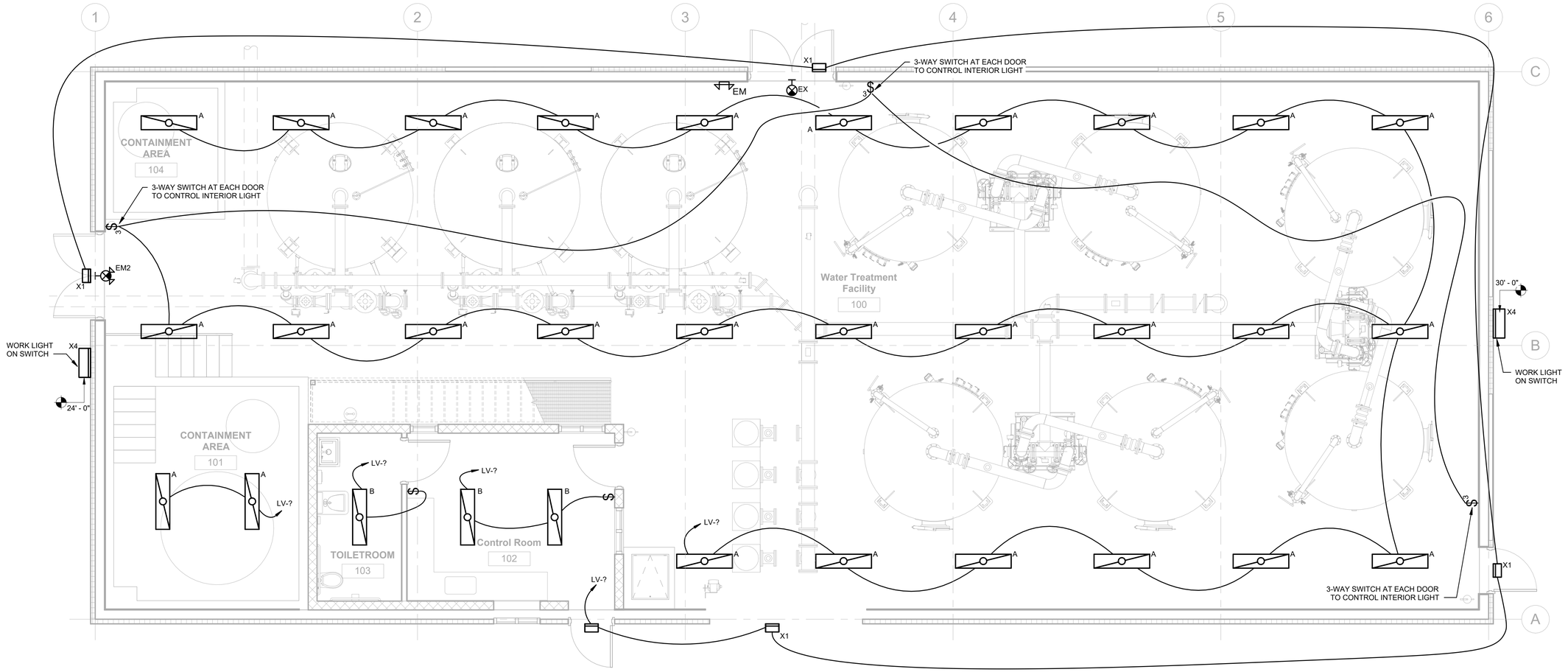
WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
ELECTRICAL PLANS
GROUNDING &
BONDING

DRAWING NO.:
E-3

SHEET NO. 53 OF 57



1
E-4

LIGHTING PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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REVISIONS		
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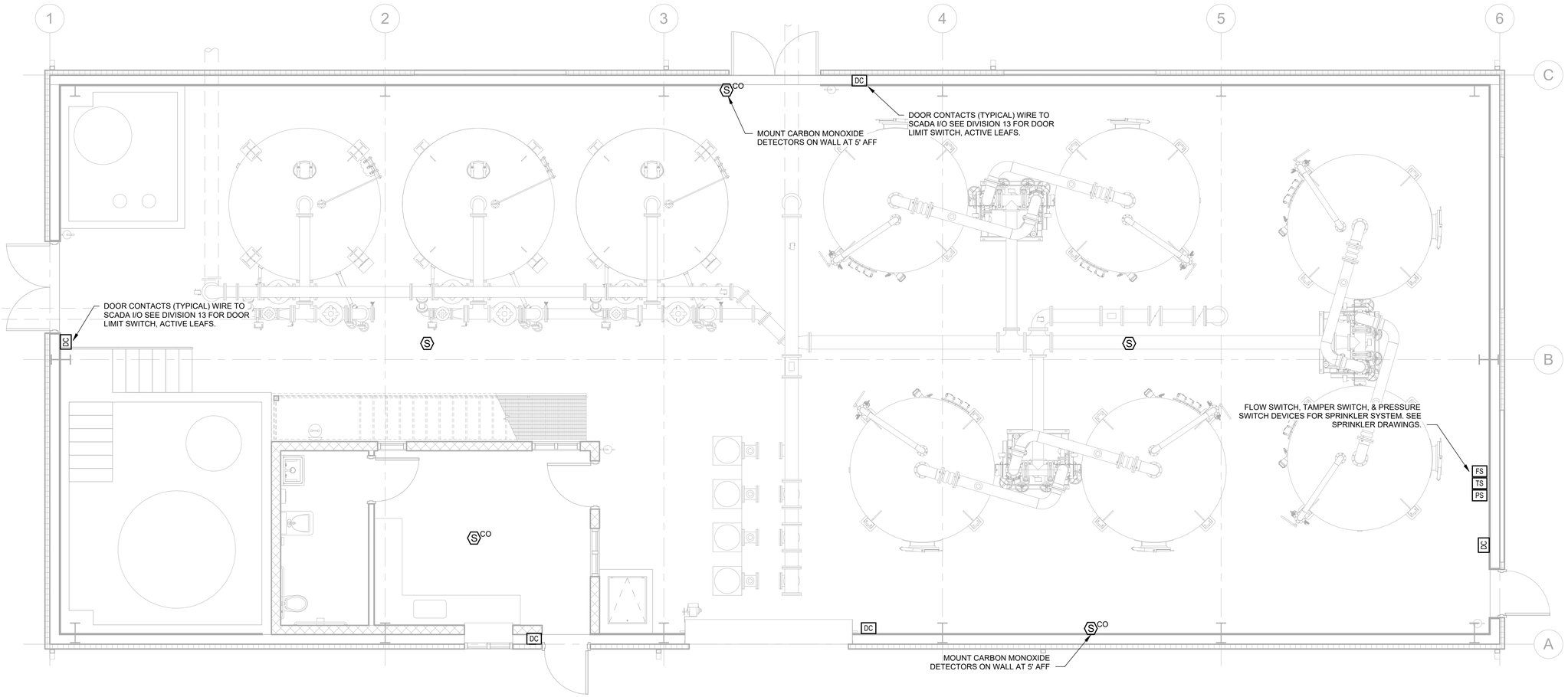
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
TREATMENT PLANT
ELECTRICAL
LIGHTING PLANS

DRAWING NO.:
E-4

SHEET NO. 54 OF 57



1
E-5

INSTRUMENTATION & CONTROL WIRING PLAN

Scale: 1/4" = 1'-0"

FOR PERMITTING

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REVISIONS		
NO.	DATE	DESCRIPTION

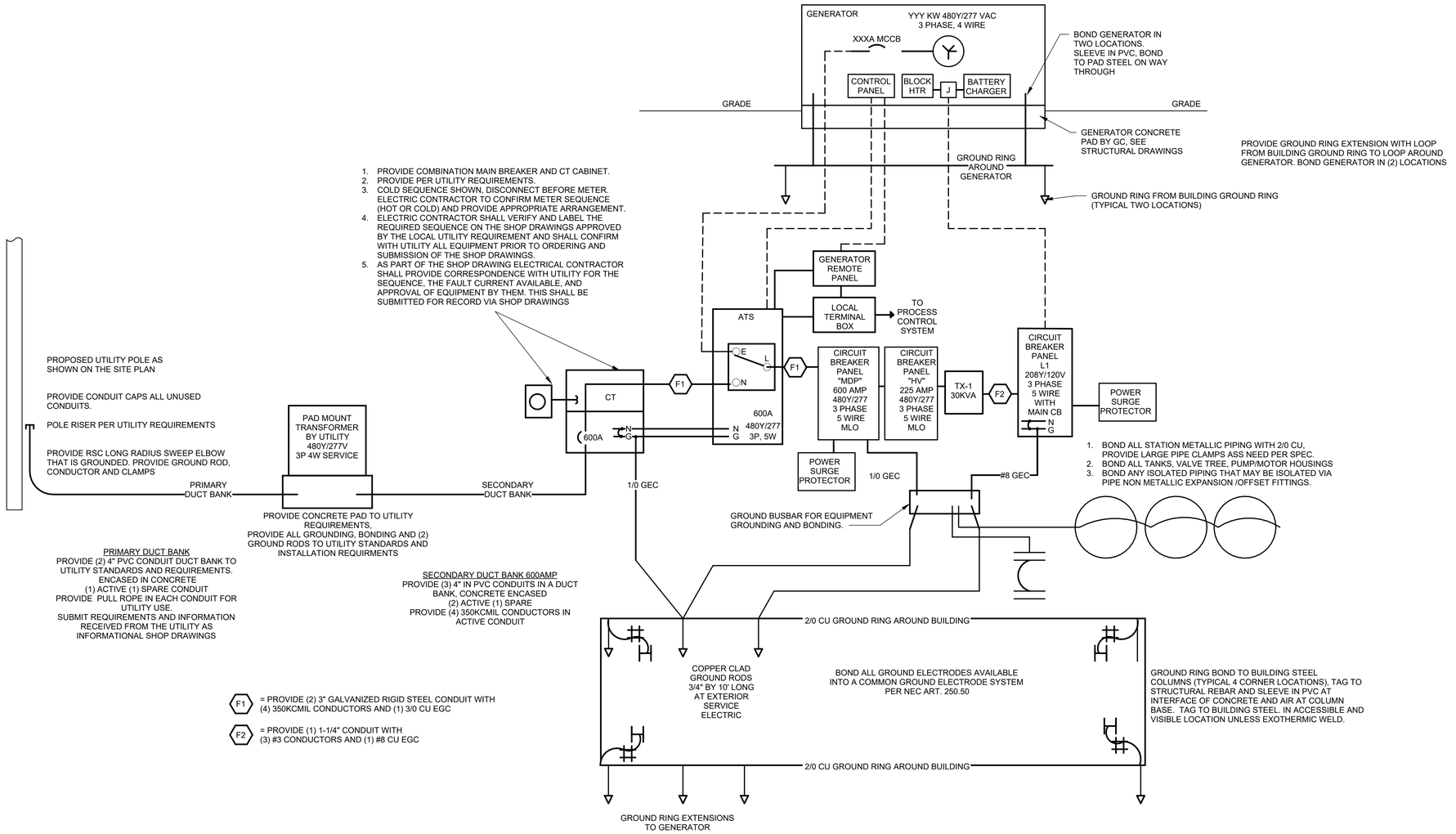
PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1/4" = 1'-0"
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
INSTRUMENTATION PLANS & CONTROL PLAN

DRAWING NO.:
E-5

SHEET NO. 55 OF 57



1
E-6

ONE LINE DIAGRAM - POWER PS/PFAS 600AMP SERVICE

Scale: 12" = 1'-0"

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	12" = 1'-0"
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
ELECTRICAL ONE LINE DIAGRAM

DRAWING NO.:
E-6

SHEET NO. 56 OF 57

FIXTURE TYPE "A"

CS CONTRACTOR SELECT™

LITHONIA LIGHTING.

Catalog Number	
Notes	
Type	

Contractor Select™

CSVT

Vapor Tight LED Strip Light



These fully-gasketed, wet-location, and code-compliant vapor tights are and IP65 and IP66 rated. They can be surface mounted on the ceiling or wall and are designed for continuous row mounting. The CSVT vapor tights are ideal for outdoor venues, canopies and locker rooms.

FEATURES:

- The fully gasketed, polycarbonate housing with polycarbonate captive latches provides a water-tight seal and stands up to dust and dirt with its IP65 and IP66 ratings
- Provides the performance you need with the UV-stabilized, high-impact, frosted polycarbonate lens for uniform light output and high impact-resistance
- Quick and simple to install with the snap-lock tool-less access
- Available with Switchable technology

Catalog Number	UPC	Description	Lumens	Wattage	Voltage	Color Temperature	Color Rendering Index
CSVT L48 5000LM MVOLT 40K 80CRI	00194995069408	4' MVOLT Vapor Tight LED Strip Light	4946	42	MVOLT (120-277)	4000K	80CRI
CSVT L48 ALO3 MVOLT SWW3 80CRI	00194995069507	4' MVOLT Switchable LED Vapor Tight Strip Light	3106 - 4946	27 - 42	MVOLT (120-277)	35K/40K/50K	80CRI
CSVT L96 10000LM MVOLT 40K 80CRI	00194995280858	8' MVOLT LED Vapor Tight Strip Light	10300	87.9	MVOLT(120-277)	4000K	80CRI
CSVT L96 ALO4 MVOLT SWW3 80CRI	00194995069446	8' MVOLT LED Vapor Tight Strip Light	6495-10300	55.3-87.9	MVOLT(120-277)	35K/40K/50K	80CRI

More configurations are available. Click here or visit www.acuitybrands.com and search for CSVT LED.

Accessories: *Order as separate catalog number.*

CSVT STSL LATCH	Stainless steel latch kit (Set of 10) ‡
CSVTRMBA	Angle mount bracket (QTY of 2) (316 stainless steel)
CSVTRMBU	Rigid mount U-bolt bracket (QTY of 2) (316 stainless steel)
CSVTRMBK	Rigid mount bracket (QTY of 2) (316 stainless steel)
CSVTSMB	Replacement standard mounting brackets (QTY of 2) (301 stainless steel)
MHCH36SS	36" stainless steel chain (QTY of 2)

‡ Option Value Ordering Restrictions	
Option value	Restriction
CSVT STSL LATCH	Requires two for L96



CONTRACTOR SELECT-CSVT Page 1 of 2

FIXTURE TYPE "EM2"

LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	

Indura®

LED Wet Location Emergency Light / Exit Combo

WLTC



FEATURES & SPECIFICATIONS

INTENDED USE — Ideal for wet location areas requiring combination exit sign and emergency lighting that are subject to saturation with non-mechanically delivered water. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate.** Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.

CONSTRUCTION — White, compact, contemporary design. Housing also available in black. Engineering-grade thermoplastic housing is impact-resistant, scratch-resistant and corrosion-proof. Universal directional Chevron inserts are easily removed and reinserted. UL94V-0 flame rating. UV-stable resin resists discoloration from natural and man-made light sources. Rugged, heavy-duty, polycarbonate clear housing lens.

OPTICS — Low energy consumption — fewer than 5 watts. The typical life of the exit LED lamp is >5 years, based on 24/7 operation.

ELECTRICAL — Dual voltage input capacity (120/277V).

Battery: — Sealed, maintenance free nickel-cadmium battery delivers 90 minutes rated capacity. Magnetic test switch (magnet included) provides manual activation of 30-second diagnostic testing for on-demand visual inspection.

Self-diagnostic testing (SD Option Only) for 30 seconds every 30 days, 30 minutes every 180 days and a 90-minute annual test. Diagnostic evaluation of LED light source, charging and battery condition.

INSTALLATION — Universal (top, end or back mount), canopy included. Back mount standard for single face only. Double face does not include back plate. Junction box hole pattern for 4" octagon mounting. Flexible conduit entry.

LISTINGS — UL listed. Wet location listed. Standard temperature rating 32-122°F (0-50°C), CW (cold weather) temperature rating -4°F to 122°F (-20°C to 50°C). Meets UL 924, NFPA 101 (current Life Safety Code) and NFPA 70-NEC, FCC Title 47, Part 15, Subpart B.

WARRANTY — 5-year limited warranty. (Battery is prorated). This is the only warranty provided and no other statements in this specification sheet create any warranty of any kind. All other express and implied warranties are disclaimed. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

† Exit Signs Certified in the CA Title 20 Appliance Efficiency Database

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative. **Example:** WLTC 1 R SD M4

Series	Housing Color	Number of Faces	Letter color	Options
WLTC LED Wet Location Combo	(Blank) White B Black	1 Single Face 2 Double Face	R Red G Green	SD Self-Diagnostics TPS Tamperproof Screw Hardware CW Cold Weather

EMERGENCY WLTC

FIXTURE TYPE" X1"



WDGE1 LED

Architectural Wall Sconce

Catalog Number	
Notes	
Type	

Hit the Tab key or mouse over the page to see all interactive elements.

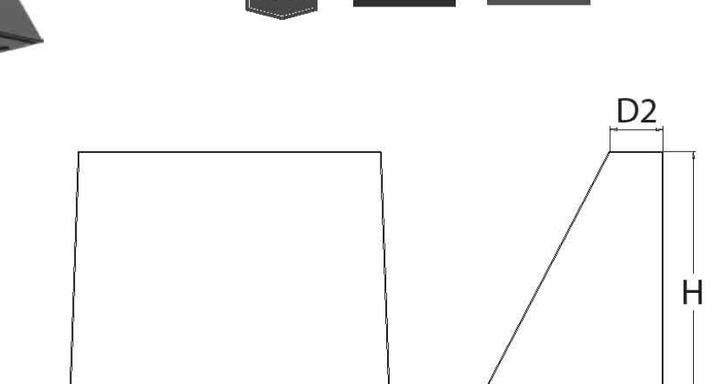
Introduction

The WDGE LED family is designed to meet specifier's every wall-mounted lighting need in a widely accepted shape that blends with any architecture. The clean rectilinear design comes in four sizes with lumen packages ranging from 1,200 to 25,000 lumens, providing true site-wide solution.

WDGE1 delivers up to 2,000 lumens with a soft, non-pixelated light source, creating a visually comfortable environment. The compact size of WDGE1, with its integrated emergency battery backup option, makes it an ideal over-the-door wall-mounted lighting solution.

Specifications

Depth (D1):	5.5"
Depth (D2):	1.5"
Height:	8"
Width:	9"
Weight: (without options)	9 lbs



design select Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect. *See ordering tree for details

WDGE LED Family Overview

Luminaire	Optics	Standard EM, 0°C	Cold EM, -20°C	Sensor	P0	P1	P2	P3	P4	P5	P6
WDGE1 LED	Visual Comfort	4W		--	750	1,200	2,000	--	--	--	--
WDGE2 LED	Visual Comfort	10W	18W	Standalone / nLight	--	1,200	2,000	3,000	4,500	6,000	--
WDGE2 LED	Precision Refractive	10W	18W	Standalone / nLight	700	1,200	2,000	3,200	4,200	--	--
WDGE3 LED	Precision Refractive	15W	18W	Standalone / nLight	6,000	7,500	8,500	10,000	12,000	--	--
WDGE4 LED	Precision Refractive			Standalone / nLight	--	12,000	16,000	18,000	20,000	22,000	25,000

(Approximate Lumens (4000K, 80CRI) for P0–P6)

Ordering Information **EXAMPLE:** WDGE1 LED P2 40K 80CRI VF MVOLT SRM PE DDBXD

Series	Package	Color Temperature	CRI	Distribution	Voltage	Mounting
WDGE1 LED	P0 P1 P2	27K 2700K 30K 3000K 35K 3500K 40K 4000K 50K[1] 5000K	80CRI 90CRI	VF Visual comfort forward throw VW Visual comfort wide	MVOLT 347[2]	Shipped included SRM Surface mounting bracket ICW Indirect Canopy/Ceiling Washer bracket (dry/damp locations only)[3] Shipped separately AWS 3/8inch Architectural wall spacer[4] PBBW Surface-mounted back box (top, left, right conduit entry) Use when there is no junction box available.[4]

Options	
E4WH	Emergency battery backup, Certified in CA Title 20 MAEDBS (4W, 0°C min)[5]
PE	Photocell, Button Type[6]
DS	Dual switching (comes with 2 drivers and 2 light engines; see page 3 for details)[7]
DMG	0-10V dimming wires pulled outside fixture (for use with an external control, ordered separately)
BCE	Bottom conduit entry for back box (PBBW). Total of 4 entry points.
DSLE	Dual Switching (1 Driver, 2 Light Engines)
CCE	Coastal Construction[8]

Finish			
DDBXD	Dark bronze	DDBTXD	Textured dark bronze
DBLXD	Black	DBLBXD	Textured black
DNAXD	Natural aluminum	DNATXD	Textured natural aluminum
DWHXD	White	DWHGXD	Textured white
DSSXD	Sandstone	DSSTXD	Textured sandstone

LITHONIA LIGHTING. COMMERCIAL OUTDOOR One Lithonia Way • Conyers, Georgia 30012 • Phone: 1-800-705-SERV (7378) • www.lithonia.com © 2019-2025 Acuity Brands Lighting, Inc. All rights reserved. WDGE1 LED Rev. 04/02/25

FIXTURE TYPE" X4"



WDGE4 LED

Architectural Wall Sconce

Catalog Number	
Notes	
Type	

Hit the Tab key or mouse over the page to see all interactive elements.

Introduction

The WDGE LED family is designed to meet specifier's every wall-mounted lighting need in a widely accepted shape that blends with any architecture. The clean rectilinear design comes in four sizes with lumen packages ranging from 1,200 to 25,000 lumens, providing a true site-wide solution. Embedded with nLight® AIR wireless controls, the WDGE family provides additional energy savings and code compliance.

WDGE4 has been designed to deliver up to 25,000 lumens through a precision refractive lens with wide distribution, perfect for augmenting the lighting from pole mounted luminaires.

Specifications

Depth (D1):	10"
Depth (D2):	2"
Height:	9"
Width:	25"
Weight: (without options)	30.5 lbs



design select Items marked by a shaded background qualify for the Design Select program and ship in 15 days or less. To learn more about Design Select, visit www.acuitybrands.com/designselect. *See ordering tree for details

WDGE LED Family Overview

Luminaire	Optics	Standard EM, 0°C	Cold EM, -20°C	Sensor	P0	P1	P2	P3	P4	P5	P6
WDGE1 LED	Visual Comfort	4W		--	750	1,200	2,000	--	--	--	--
WDGE2 LED	Visual Comfort	10W	18W	Standalone / nLight	--	1,200	2,000	3,000	4,500	6,000	--
WDGE2 LED	Precision Refractive	10W	18W	Standalone / nLight	700	1,200	2,000	3,200	4,200	--	--
WDGE3 LED	Precision Refractive	15W	18W	Standalone / nLight	6,000	7,500	8,500	10,000	12,000	--	--
WDGE4 LED	Precision Refractive			Standalone / nLight	--	12,000	16,000	18,000	20,000	22,000	25,000

(Approximate Lumens (4000K, 80CRI) for P0–P6)

Ordering Information **EXAMPLE:** WDGE4 LED P3 40K 70CRI R3 MVOLT SRM DDBXD

Series	Package	Color Temperature	CRI	Distribution	Voltage	Mounting
WDGE4 LED	P1 P4 P2 P5 P3 P6	30K 3000K 40K 4000K 50K 5000K	70CRI 80CRI	R2 Type 2 R3 Type 3 R4 Type 4 RFT Forward Throw	MVOLT 347[1] 480[1]	Shipped included SRM Surface mounting bracket ICW Indirect Canopy/Ceiling Washer bracket (dry/damp locations only)[2] Shipped separately AWS 3/8 inch Architectural wall spacer[3] PBBW Surface-mounted back box (top, left, right conduit entry). Use when there is no junction box available.[3]

Options	
PE	Photocell, Button Type[4]
DS	Dual switching (comes with 2 drivers and 2 light engines)[5]
DMG	0-10V dimming wires pulled outside fixture (for use with an external control, ordered separately)[5]
BCE	Bottom conduit entry for back box (PBBW). Total of 4 entry points.
SPD10KV	10kV Surge pack
CCE	Coastal Construction[3]

Standalone Sensors/Controls	
PIR	Bi-level (100/35%) motion sensor for 8-15' mounting heights. Intended for use on switched circuits with external dusk to dawn switching.
PIRH	Bi-level (100/35%) motion sensor for 15-30' mounting heights. Intended for use on switched circuits with external dusk to dawn switching
PIR1FC3V	Bi-level (100/35%) motion sensor for 8-15' mounting heights with photocell pre-programmed for dusk to dawn operation.
PIRH1FC3V	Bi-level (100/35%) motion sensor for 15-30' mounting heights with photocell pre-programmed for dusk to dawn operation.
Networked Sensors/Controls	
NLTAIR2 PIR	Embedded wireless controls by nLight with Passive Infrared Occ sensor and on/off photocell for 8-15' mounting heights.
NLTAIR2 PIRH	Embedded wireless controls by nLight with Passive Infrared Occ sensor and on/off photocell for 15'-30' mounting heights.
NLTAIREM2 PIR	Embedded wireless controls by nLight with UL924 listed emegency operation, Passive Infrared Occ sensor and on/off photocell for 8-15' mounting heights
NLTAIREM2 PIRH	Embedded wireless controls by nLight with UL924 listed emegency operation, Passive Infrared Occ sensor and on/off photocell for 15'-30' mounting heights

See page 3 for out of box functionality

Finish	
DDBXD	Dark bronze
DBLXD	Black
DNAXD	Natural aluminum
DWHXD	White
DSSXD	Sandstone
DDBTXD	Textured dark bronze
DBLBXD	Textured black
DNATXD	Textured natural aluminum
DWHGXD	Textured white
DSSTXD	Textured sandstone

Accessories *Ordered and shipped separately.*

WDGEAWS DDBXD	WDGE 3/8inch Architectural Wall Spacer (specify finish)
WDGE4PBBW DDBXD U	WDGE4 surface-mounted back box (specify finish)

NOTES
1 347V and 480V not available with DS.
2 Not qualified for DLC.
3 For PBBW and AWS with CCE option, require an RFA.
4 PE not available in 480V and with sensors/controls.
5 DS and DMG not available with sensors/controls.

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LIGHT FIXTURE SCHEDULE

DESIGNATION	DESCRIPTION	MANUFACTURER [1]	MODEL [1]	WATTS	LUMENS	LAMP TYPE [2] [3]	COLOR DEGREES K	OPERATING VOLTS [6]	NSTALLATION & MOUNTING [7] [8]	COUNT
A	4' MVOLT VAPOR TIGHT STRIP LIGHT	LITHONIA	CSVT	42.00 W	4946	LED	4000	120 V	THIS LUMINAIRE MAY BE SURFACE MOUNTED OR SUSPENDED BY CABLE OR CHAIN. FOR ALL MOUNTING METHODS MAKE SURE THE FACILITY MOUNTING POINTS AND MOUNTING HARDWARE ARE RATED FOR 4X THE FIXTURE LOAD.	28
B		LITHONIA				LED	4000	120 V	CEILING, SEE ARCHITECTURAL DRAWINGS FOR CEILING TYPE	3
EM	2-HEAD EMERGENCY LIGHT UNIT, WHITE THERMOPLASTIC HOUSING, PROVIDES A MINIMUM 90 MINUTESOF EMERGENCY ILLUMINATION, SEALED MAINTENANCE-FREE BATTERY WITH TEST SWITCH AND STATUS INDICATOR, UL 924 LISTED AND NFPA 101 COMPLIANT	LITHONIA	EU2C	9.40 W		LED	4000	120 V	WALL SURFACE, 3 FT EGRESS WITDTH MH OF 7.5' WITH 15' SPACING, AIM FIXTURES AT 45 DEGRESS OUT AND CENTERED ON EGRESS PATH	1
EM2	HIGH-OUTPUT COMBO EXIT / EMERGENCY LIGHT WITH DUAL HEAD. IMPACT RESISTANT THERMOPLASTIC HOUSING. RED LETTERING 6" HIGH WITH 3/4" STROKE, PROVIDES 90 MINUTES OF EMERGENCY ILLUMINATION, SEALED MAINTENANCE-FREE BATTERY WITH TEST SWITCH AND STATUS INDICATOR. PROVIDE WITH DUAL INDOOR REMOTE HEADS.	LITHONIA	LHQM-HO	4.30 W		LED	4000	120 V	WALL SURFACE	1
EX	THERMOPLASTIC EXIT SIGN, RED LETTERING 6" HIGH WITH 3/4" STROKE, IMPACT RESISTANT, PROVIDES 90 MINUTES OF EMERGENCY ILLUMINATION, SEALED MAINTENANCE-FREE BATTERY WITH TEST SWITCH AND STATUS INDICATOR	LITHONIA	LQM			LED	4000	120 V	SINGLE OR DUAL FACE, WALL OR CEILING MOUNT, CONNECT TO UNSWITCHED LIGHT CIRCUIT OF AREA / EGREES SERVED.	1
X1	WDGE1 LED WITH P2 - PERFORMANCE PACKAGE 4000K 80CRI VISUAL COMFORT FORWARD OPTIC	LITHONIA	WDGE2	15.00 W	10360	LED	4000	120 V	WALL SURFACE	5
X4	WDGE4 LED WITH P6 - PERFORMANCE PACKAGE 4000K 70CRI TYPE 3 OPTIC	LITHONIA	WDGE4	185.00 W	25233	LED	4000	120 V	WALL SURFACE	2

LIGHT FIXTURE SCHEDULE NOTES

#	DESCRIPTION
1	GENERAL NOTE - CATALOG NUMBER MAY NOT SPECIFY ALL OPTIONS, ACCESSORIES, ADAPTERS THAT MUST BE PROVIDED FOR A COMPLETE INSTALLATION, OR SPARE ITEMS, SEE OTHER COLUMNS IN THIS SCHEDULE, CONTRACT DOCUMENTS AND ACTUAL CONDITIONS ENCOUNTERED.
2	GENERAL NOTE - MOUNTING INDICATED SHOWS BASIC FIXTURE MOUNTING ARRANGEMENT. SEE ARCHITECTURAL AND OTHER DOCUMENTS FOR ADDITIONAL INFORMATION WHICH AMY EFFECT FIXTURE PLACEMENT AND MOUNTING STRUCTURES (CEILING AND WALL CONSTRUCTION, ETC). PROVIDE MOUNTING ADAPTERS AS
3	GENERAL NOTE - CONTRACTOR MUST PROVIDE ADJUSTMENTS (ALIGNMENTS AND FOCUSING) FOR FIXTURES WHICH ARE ADJUSTABLE. ADJUSTMENTS SHALL PROVIDE OPTIMAL ILLUMINATION OF AREA TO BE ILLUMINATED. ADJUSTMENTS SHALL BE MADE TO PROVIDE EVEN ILLUMINATION.

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

KUEGLER ASSOCIATES
A Division of Loureiro
100 NORTHWEST DRIVE PLAINVILLE, CT 06062
Phone: (860) 747-6181
www.kueglerassociates.com

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS

NO.	DATE	DESCRIPTION



PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	
DESIGNED BY:	ERK
CHECKED BY:	ERK
DRAWN BY:	JPD
APPROVED BY:	ERK

WELL 3 & 4
GAC TREATMENT ADDITION
BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

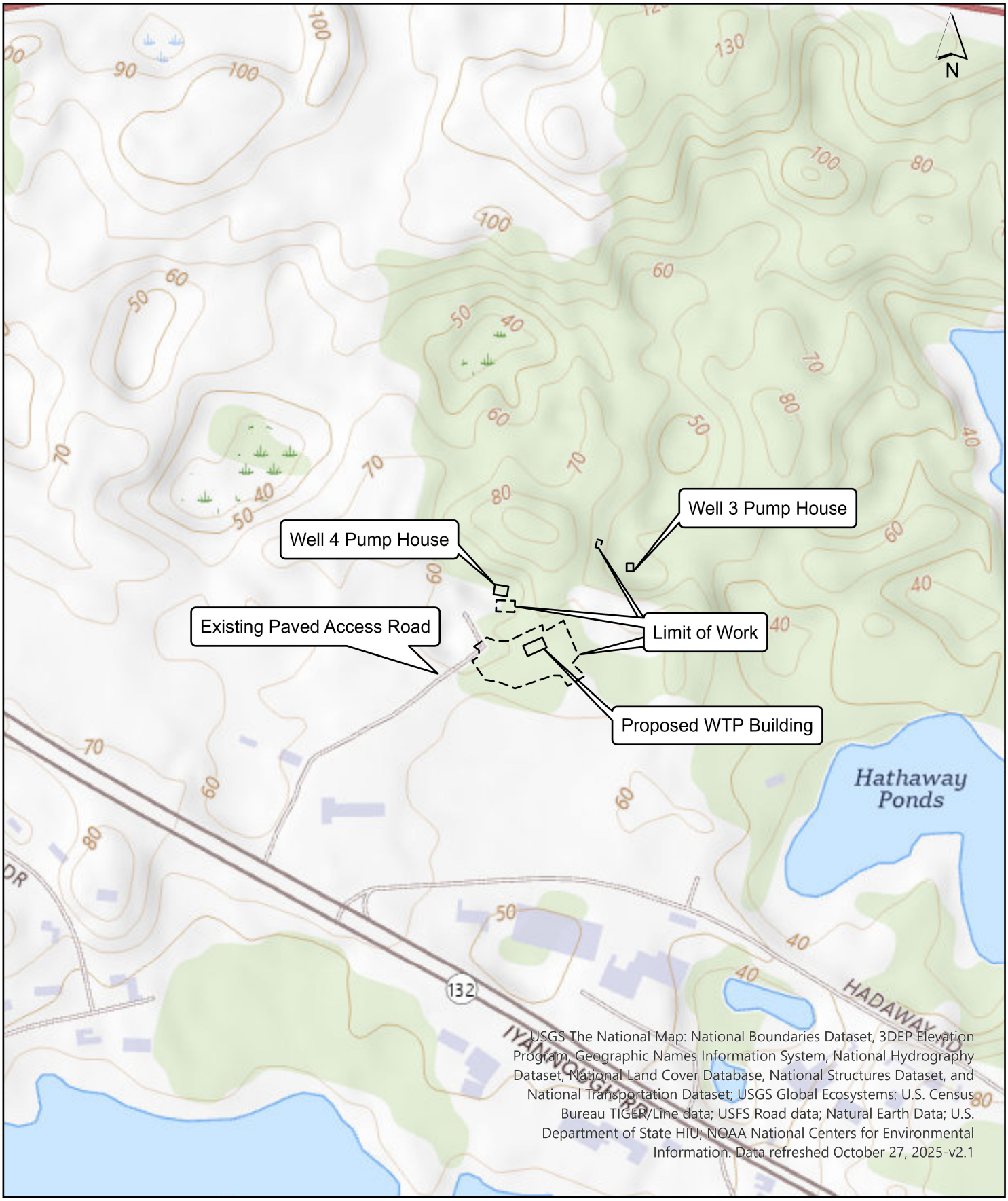
DRAWING TITLE:
TREATMENT PLANT ELECTRICAL SCHEDULES & DIAGRAMS

DRAWING NO.: E-7

SHEET NO. 57 OF 57

APPENDIX B

Site Figures



0 320 640 1,280 Feet

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

Site Locus Map
Barnstable Fire District Wells 3&4 WTP
Barnstable, Massachusetts
June 2026

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

HYANNIS QUADRANGLE
MASSACHUSETTS - BARNSTABLE COUNTY
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid:Universal Transverse Mercator, Zone 19T

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, August 2018 - August 2018
Roads.....U.S. Census Bureau, 2018
Names.....GNIS, 1974 - 2023
Hydrography.....National Hydrography Dataset, 2005 - 2022
Contours.....National Elevation Dataset, 2023
Boundaries.....Multiple sources; see metadata file 2021 - 2022

Wetlands.....FWS National Wetlands Inventory 2008 - 2011

MN
GN
14°20'
255 MILS
0°52'
15 MILS
UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
CG
Grid Zone Designation
19T

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

MASSACHUSETTS
QUADRANGLE LOCATION

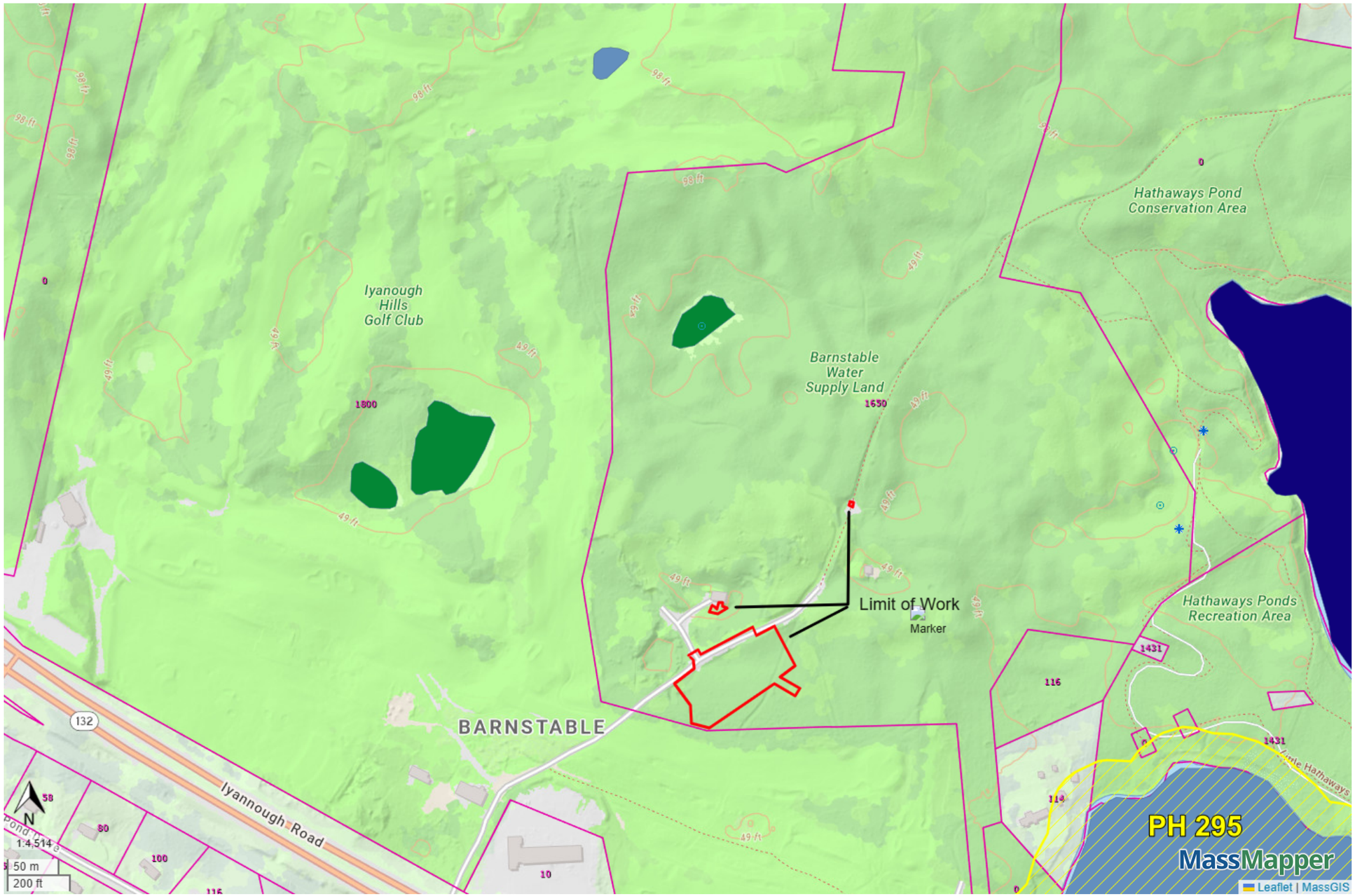
1 Sandwich OE N
2 Dennis OE N
3 Sandwich
4 Dennis
5 Cotuit
6 Hyannis OE S
ADJOINING QUADRANGLES

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

HYANNIS, MA
2024

NSN 7643016369553
NGA REF NO. USGSX24K74869

MassGIS Environmental Constraints Map



NHESP Priority Habitats of Rare Species

Potential Vernal Pools

NHESP Certified Vernal Pools

Areas of Critical Environmental Concern
ACECs Transparent Green

NWI Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Other

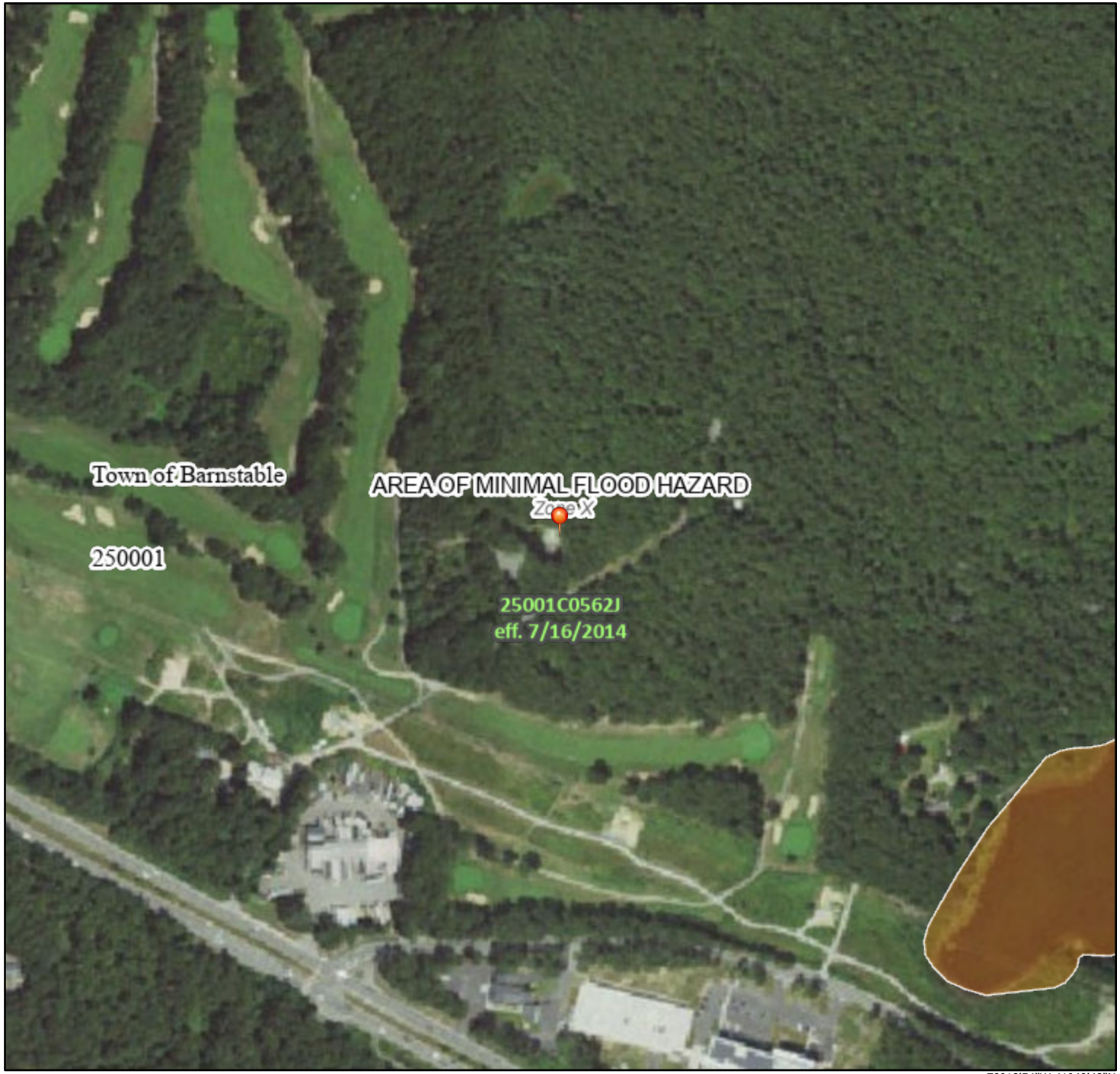
Property Tax Parcels

Printed May 4, 2026

National Flood Hazard Layer FIRMette

FEMA

70°19'32"W 41°41'15"N



70°18'54"W 41°40'48"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/6/2026 at 3:26 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

ZONING MAP

of the

TOWN OF BARNSTABLE MASSACHUSETTS

INDEX MAP

SEPTEMBER 1, 1998

APPROVED SEPTEMBER 17, 1998
AMENDED NOVEMBER 12, 1998
AMENDED JULY 15, 1999
AMENDED OCTOBER 26, 2000
AMENDED FEBRUARY 1, 2001
AMENDED JUNE 28, 2001
AMENDED JULY 19, 2001
AMENDED AUGUST 16, 2001
AMENDED NOVEMBER 15, 2001
AMENDED SEPTEMBER 19, 2002
AMENDED APRIL 15, 2004
AMENDED SEPT. 2, 2004
AMENDED NOV. 18, 2004
AMENDED JULY 14, 2005
AMENDED JUNE 1, 2006
AMENDED MAY 3, 2007
AMENDED FEBRUARY 28, 2008
AMENDED APRIL 3, 2008
AMENDED JULY 16, 2009
AMENDED MARCH 4, 2010
AMENDED JUNE 17, 2010
AMENDED OCTOBER 7, 2010
AMENDED JANUARY 19, 2011
AMENDED SEPTEMBER 8, 2011
AMENDED FEBRUARY 16, 2012
AMENDED FEBRUARY 6, 2014
AMENDED MARCH 19, 2015
AMENDED MAY 7, 2015
AMENDED MAY 19, 2016
AMENDED JULY 21, 2016
AMENDED APRIL 27, 2017
AMENDED JUNE 1, 2017
AMENDED FEBRUARY 28, 2019
AMENDED FEBRUARY 4, 2021
AMENDED OCTOBER 21, 2021
AMENDED SEPTEMBER 1, 2023
AMENDED FEBRUARY 2, 2023

SEAL OF THE TOWN OF BARNSTABLE, MASS. 1639. ADOPTED MAY 4, 1889

TOWN OF SANDWICH

TOWN OF MASHPEE

TOWN OF YARMOUTH

Cape Cod Bay

Barnstable Harbor

Centerville Harbor

Hyannis Harbor

Lewis Bay

Nantucket Sound

Great Marshes

Mystic Lake

Middle Pond

Hamblin Pond

Wequaquet Lake

North Bay

East Bay

West Bay

Cotuit Bay

Popponesset Bay

RF

RF-1

RF-2

RG

RD-1

RC

RC-1

RC-2

RB

RB-1

RB-2

CBD

B

IND

IND Ltd

HB

HC

TC

MB-A

MB-B

R-2C

AP

WP

GP

S&D

WBWBD

BA

Map Legend

- HB — Zoning District
- WP — Wellhead Protection Overlay District
- GP — Groundwater Protection Overlay District
- AP — Aquifer Protection Overlay District
  All other areas not identified as Wellhead or Groundwater Protection Overlay Districts
- Adult Use Overlay District
- Dock and Pier Overlay District
- Former Grade 5 School Planned Unit Development Overlay District
- Medical Services Overlay District
- Mixed-Use Sub Zone of the Medical Services Overlay District
- Resource Protection Overlay District
- Shopping Center Redevelopment Overlay District
- Drive Through Restaurant Sub Zone of the Shopping Center Redevelopment Overlay Dist.
- Senior Continuing Care Retirement Community - SCCRCOD 2008-1
- Recreational Shellfish Area and Shellfish Relay Area Dock & Pier Overlay District
- Ground Mounted Solar Photovoltaic Overlay District
- Medical Marijuana Overlay District
- Registered Recreational Marijuana Cultivators, Research Facilities, and Testing Laboratories Overlay
- Craigville Village Neighborhood Overlay
- Long / Short Beach Neighborhood Overlay
- Craigville Beach Neighborhood Overlay
- Centerville River North Bank Neighborhood Overlay
- ★ C-O #12 — Existing Public Well Site
- ★ C-O #18 — Proven Future Public Well Site
- ★ C-O #20 — Proposed Future Public Well Site
- Paved Road
- Unimproved Road
- Railroad Track
- Town Boundary Line
- Marsh Area
- Stream / Edge of Water

SEE TEXT OF ZONING ORDINANCE FOR COMPLETE INFORMATION ON BULK REGULATIONS.

Where a zoning district boundary is located at the edge of a water body, that zone that applies to the land shall apply to structures and uses such as piers and commercial boating operations to the extent of the territorial jurisdiction of the town.

Where zoning district boundaries are located along the edge of a roadway and a distance is shown from such point to another zoning boundary, such distance and points shall be from the edge of the road layout. The ultimate location of such point shall be determined by survey as the line shown on this map is considered an approximation.

Sheet Index Grid



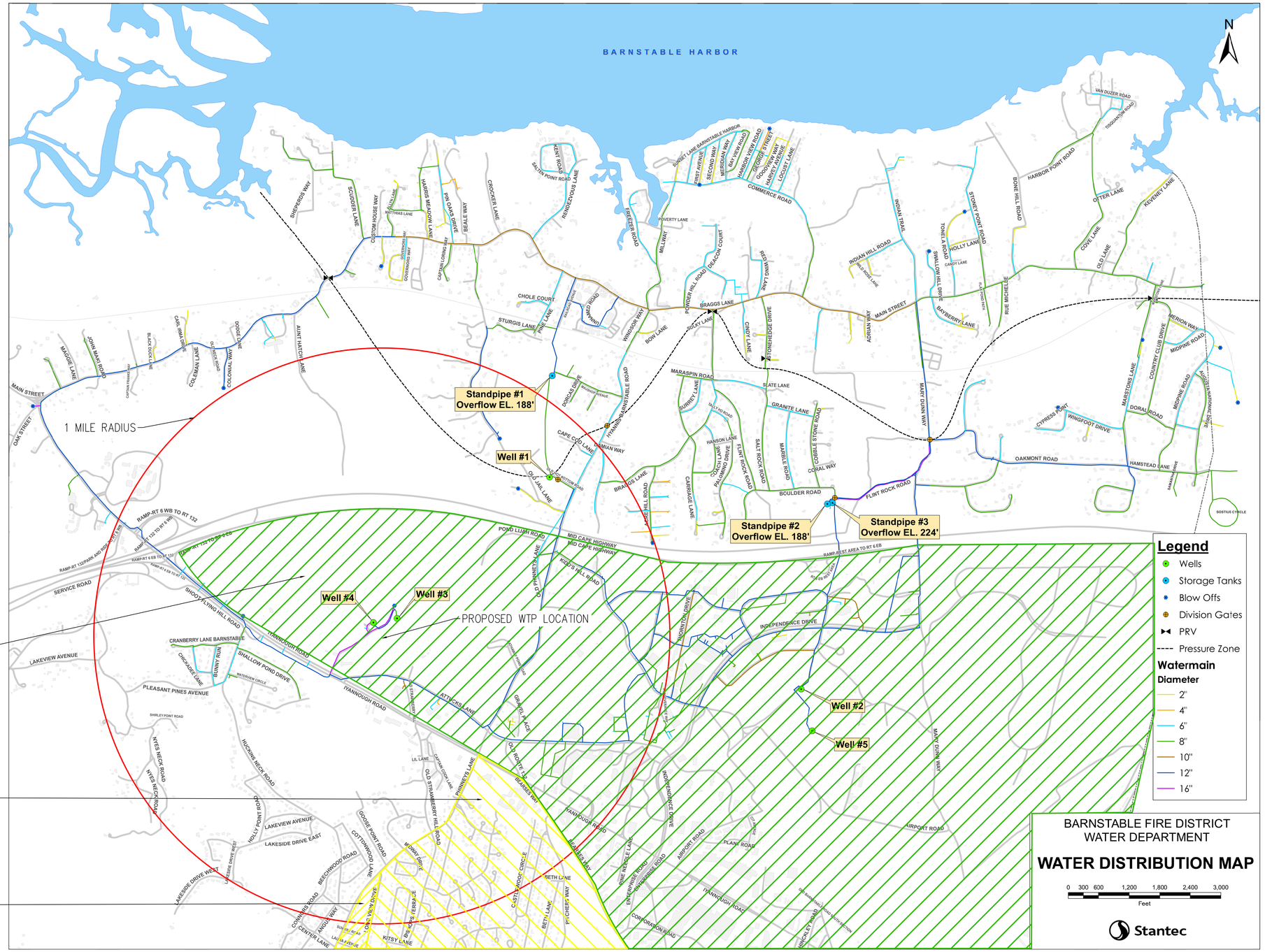
N W E S

SCALE 1"=1800'

feet 3000 2000 1000 0 1/4 1/2 1 mile

1" = 0.34 miles 1:21,600

TOWN OF BARNSTABLE G.I.S. UNIT FILE: townzone.dgn A.N.M. 3-21-2023



FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
WATER DISTRICT EJ POPULATION MAP

DRAWING NO.:

SHEET NO. 1 OF 1

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C Sheets.dwg

APPENDIX C

Agency Correspondence

MASSWILDLIFE

DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

January 14, 2026

Sean Anderson
Barnstable Fire District Water Department
255 Breeds Hill Road
PO Box 546
Barnstable, Massachusetts 02630

RE: Project Location: 1650 Iyannough Road
Project Description: Construction of a new water treatment plant for the treatment of water from Well 3 and Well 4
Heritage Hub Form ID: RC-97409

Dear Applicant:

Thank you for submitting the MESA Project Review Checklist, site plans (dated December 2025 (3 sheets, C-1, C-2, C-3; H2Olson Engineering, Inc.) prepared by) and other required materials to the Natural Heritage and Endangered Species Program of the MA Division of Fisheries & Wildlife (the "Division") for review pursuant to the Massachusetts Endangered Species Act (MESA) (MGL c.131A) and its implementing regulations (321 CMR 10.00).

PROJECT DESCRIPTION

The existing site includes a paved access road, Well 3 Pump House, and Well 4 Pump House. Water from Well 3 and Well 4 is treated at the Well 4 Pump House, which consists of potassium hydroxide (KOH) and sodium hypochlorite (NAOCl) storage, feed, and handling facilities. Water is then pumped to distribution. The proposed project involves the construction of a new water treatment plant for the treatment of water from Well 3 and Well 4. The proposed facility will be equipped with three (3) 10.5-foot GreensandPlusTM media filters and associated process mechanical valves and piping, six (6) 10-foot GAC pressure vessels and associated process mechanical valves and piping, and NaOCl storage, feed, and handling facilities. This project also involves the construction of two (2) sand filters and two (2) infiltration basins for the treatment of water treatment residuals, a septic system for the facility bathroom, the installation of new yard piping to deliver water to the treatment building, new finished water piping to deliver water to the distribution system, a new generator next to the existing Well 4 Pump House, and a new water hydrant located at the end of the paved access roadway.

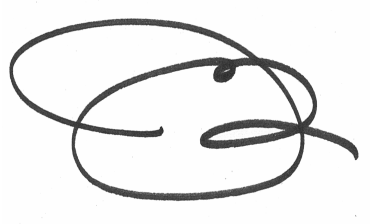
MA ENDANGERED SPECIES ACT

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries & Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if

there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Emily Holt, Endangered Species Review Assistant, at Emily.Holt@mass.gov, (508) 389-6385.

Sincerely,



Jesse Leddick
Assistant Director

cc: Stephen C Olson, H2Olson Engineering, Inc.

RECEIVED

DEC 19 2025

MASS. HIST. COMM

APPENDIX A

MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD
BOSTON, MASS. 02125
617-727-8470, FAX: 617-727-5128

PROJECT NOTIFICATION FORM

Project Name: Barnstable Fire District Wells 3&4 WTP

Location / Address: 1650 Lyannough Road/RTE 132

City / Town: Barnstable

After review of MHC files and the materials you submitted, it has been determined that this project is unlikely to affect significant historic or archaeological resources.

Caitriona Parker RC. 77760 1/12/26
Caitriona Parker Date
Preservation Planner
Massachusetts Historical Commission
xc: Robin McNamara, DEP-SRF

Project Proponent

Name: H2Olson Engineering Inc.

Address: 10 Riverside Drive, Suite 103

City/Town/Zip/Telephone: Lakeville, 02347, (508) 375-7007

Agency license or funding for the project (list all licenses, permits, approvals, grants or other entitlements being sought from state and federal agencies).

Agency Name	Type of License or funding (specify)
DEP	SRF Funding

Project Description (narrative):

See Appendix B attached.

Does the project include demolition? If so, specify nature of demolition and describe the building(s) which are proposed for demolition.

No building demolition.

Does the project include rehabilitation of any existing buildings? If so, specify nature of rehabilitation and describe the building(s) which are proposed for rehabilitation.

No building rehabilitation.

Does the project include new construction? If so, describe (attach plans and elevations if necessary).

Construction of a new water treatment building and related facilities. See Appendix C attached.

APPENDIX A (continued)

To the best of your knowledge, are any historic or archaeological properties known to exist within the project's area of potential impact? If so, specify.

None to our knowledge.

What is the total acreage of the project area?

Woodland	1.45 acres	Productive Resources:	
Wetland	0 acres	Agriculture	0 acres
Floodplain	acres	Forestry	1.45 acres
Open space	acres	Mining/Extraction	0 acres
Developed	0.10 acres	Total Project Acreage	1.55 acres

What is the acreage of the proposed new construction? 1.45 acres

What is the present land use of the project area?

Public drinking water supply with water treatment facilities.

Please attach a copy of the section of the USGS quadrangle map which clearly marks the project location.

See Appendix D attached.

Additional maps attached. See Appendix E for the Locus Map and Appendix F for the Assessor's Map. .

This Project Notification Form has been submitted to the MHC in compliance with 950 CMR 71.00.

Signature of Person submitting this form: _____ Date: 12/15/25

Name: Stephen C. Olson P.E.

Address: 10 Riverside Drive, Suite 103

City/Town/Zip: Lakeville, 02347

Telephone: (508) 375-7007

REGULATORY AUTHORITY

950 CMR 71.00: M.G.L. c. 9, §§ 26-27C as amended by St. 1988, c. 254.

APPENDIX D

RMAT Report

Climate Resilience Design Standards Tool Project Report

Barnstable Fire District Wells 3&4 WTP
Date Created: 3/4/2026 3:17:12 PM
Created By: GCordeiro
Date Report Generated: 5/7/2026 7:02:11 PM
Tool Version: Version 1.4
Project Contact Information: Steve Olson (sco@h2olsonengineering.com)

Project Summary

Link to Project

Estimated Capital Cost: $17800000.00
End of Useful Life Year: 2060
Project within mapped Environmental Justice neighborhood: Yes

Ecosystem Service Benefits	Scores
Project Score	Moderate
Exposure	**Scores**
Sea Level Rise/Storm Surge	Not Exposed
Extreme Precipitation - Stormwater Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	Not Exposed
Extreme Heat	High Exposure



Asset Preliminary Climate Risk Rating Summary

Number of Assets: 1

Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Stormwater Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
Facility Building	Low Risk	High Risk	Low Risk	High Risk

Climate Resilience Design Standards Summary

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
Sea Level Rise/Storm Surge					
Facility Building					
Extreme Precipitation					
Facility Building	2070			50-yr (2%)	Tier 3
Extreme Heat					
Facility Building	2070		90th		Tier 3

Scoring Rationale - Project Exposure Score

The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. The rationale behind the exposure rating is provided below.

Sea Level Rise/Storm Surge

This project received a "Not Exposed" because of the following:

- Not located within the predicted mean high water shoreline by 2030
- No historic coastal flooding at project site
- Not located within the Massachusetts Coast Flood Risk Model (MC-FRM)

Extreme Precipitation - Stormwater Flooding

This project received a "High Exposure" because of the following:

- Increased impervious area
- Maximum annual daily rainfall exceeds 10 inches within the overall project's useful life
- No historic flooding at project site
- Existing impervious area of the project site is less than 10%

Extreme Precipitation - Riverine Flooding

This project received a "Not Exposed" because of the following:

- No historic riverine flooding at project site
- The project is not within a mapped FEMA floodplain [outside of the Massachusetts Coast Flood Risk Model (MC-FRM)]
- Project is more than 500ft from a waterbody
- Project is not likely susceptible to riverine erosion

Extreme Heat

This project received a "High Exposure" because of the following:

- Not located within 100 ft of existing water body
- Increased impervious area
- Existing trees are being removed as part of the proposed project
- Existing impervious area of the project site is less than 10%
- 10 to 30 day increase in days over 90 deg. F within project's useful life

Scoring Rationale - Asset Preliminary Climate Risk Rating

A Preliminary Climate Risk Rating is determined for each infrastructure and building asset by considering the overall project Exposure Score and responses to Step 4 questions provided by the user in the Tool. Natural Resource assets do not receive a risk rating. The following factors are what influenced the risk ratings for each asset.

Asset - Facility Building
Primary asset criticality factors influencing risk ratings for this asset:

- Asset must be operable at all times, even during natural hazard event
- Less than 10,000 people would be directly affected by the loss/inoperability of the asset
- The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
- Inoperability of the asset would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses
- Inoperability is likely to significantly impact other facilities, assets, or buildings and will likely affect their ability to operate
- Spills and/or releases of hazardous materials would be relatively easy to clean up

Project Climate Resilience Design Standards Output

Climate Resilience Design Standards and Guidance are recommended for each asset and climate parameter. The Design Standards for each climate parameter include the following: recommended planning horizon (target and/or intermediate), recommended return period (Sea Level Rise/Storm Surge and Precipitation) or percentile (Heat), and a list of applicable design criteria that are likely to be affected by climate change. Some design criteria have numerical values associated with the recommended return period and planning horizon, while others have tiered methodologies with step-by-step instructions on how to estimate design values given the other recommended design standards.

Asset: Facility Building — Building/Facility

Sea Level Rise/Storm Surge — Low Risk

Applicable Design Criteria

Projected Tidal Datums: NOT APPLICABLE

Projected Water Surface Elevation: NOT APPLICABLE

Projected Wave Action Water Elevation: NOT APPLICABLE

Projected Wave Heights: NOT APPLICABLE

Projected Duration of Flooding: NOT APPLICABLE

Projected Design Flood Velocity: NOT APPLICABLE

Projected Scour & Erosion: NOT APPLICABLE

Extreme Precipitation — High Risk

Target Planning Horizon: 2070
Return Period: 50-yr (2%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

The projected values, standards, and guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence.

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Facility Building	2070	50-Year (2%)	8.7	Downloadable Methodology PDF

Projected Riverine Peak Discharge & Peak Flood Elevation: NOT APPLICABLE

Extreme Heat — High Risk

Target Planning Horizon: 2070
Percentile: 90th Percentile

LIMITATIONS: The recommended standards are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Applicable Design Criteria

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Annual Average Temperature [°F]	Projected Summer Average Temperature [°F]	Projected Winter Average Temperature [°F]
Facility Building	2070	90th	60.65	78.47	42.71

LIMITATIONS: The recommended Standards for Projected Average Annual/Summer/Winter Temperature are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Growing Degree Days: NOT APPLICABLE

Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Days with Max Temp >95°F (days)	Projected Days with Max Temp >90°F (days)	Projected Days with Max Temp <32°F (days)
Facility Building	2070	90th	9	35	42

LIMITATIONS: The recommended Standards for ProjectedÂ Days per Year with Max Temp >95Â°F, >90Â°F, <32Â°F are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Number of Heat Waves Per Year (events)	Projected Average Heat Wave Duration (days)
Facility Building	2070	90th	0	4

LIMITATIONS: The recommended Standards for ProjectedÂ Number of Heat Waves Per Year and Average Heat Wave DurationÂ are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Cooling Degree Days (base = 65°) (degree days)	Projected Heating Degree Days (base = 65°) (degree days)
Facility Building	2070	90th	1749	3338

LIMITATIONS: The recommended Standards for ProjectedÂ Cooling Degree Days and Heating Degree DaysÂ are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Heat Index: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Project Inputs

Core Project Information

Name:	Barnstable Fire District Wells 3&4 WTP
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2060
Location of Project:	Barnstable
Estimated Capital Cost:	$17,800,000
Who is the Submitting Entity?	Private Other H2Olson Engineering Inc. Steve Olson (sco@h2olsonengineering.com)
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Permitting
Is climate resiliency a core objective of this project?	No
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	Yes
Brief Project Description:	The main goals of the project are to increase the drinking water capacity of the Barnstable Fire District and improve the water quality at Well 3 and Well 4. The project includes the construction of a new water treatment plant, a paved access driveway, two sand filters and two infiltration basins for the treatment of water treatment residuals, a septic system, stormwater best management practices (BMPs), new yard piping, new underground electrical lines, new underground fiberoptic lines, two new generators, three new propane tanks, yard fencing, and three new water hydrants. The project will require Massachusetts Historical Commission Review (completed), MESA Project Review with NHESP (completed), a MEPA Secretary's Certificate, coverage under the NPDES Construction General Permit, MassDEP drinking water permit (WS 24), a Title 5 Permit, a local stormwater management permit, and a local building permit.

Project Ecosystem Service Benefits

Factors Influencing Output

- ✓ Project reduces storm damage
- ✓ Project protects public water supply
- ✓ Project recharges groundwater
- ✓ Project filters stormwater using green infrastructure
- ✓ Project improves water quality
- ✓ Project prevents pollution

Factors to Improve Output

- ✓ Incorporate nature-based solutions that may provide flood protection
- ✓ Incorporate strategies that reduce carbon emissions
- ✓ Incorporate nature-based solutions that sequester carbon carbon
- ✓ Increase biodiversity, protect critical habitat for species, manage invasive populations, and/or provide connectivity to other habitats
- ✓ Preserve, enhance, and/or restore coastal shellfish habitats
- ✓ Incorporate vegetation that provides pollinator habitat
- ✓ Identify opportunities to remediate existing sources of pollution
- ✓ Provide opportunities for passive and/or active recreation through open space
- ✓ Increase plants, trees, and/or other vegetation to provide oxygen production
- ✓ Mitigate atmospheric greenhouse gas concentrations and other toxic air pollutants through nature-based solutions
- ✓ Incorporate education and/or protect cultural resources as part of your project

Is the primary purpose of this project ecological restoration?

No

Project Benefits

Provides flood protection through nature-based solutions	No
Reduces storm damage	Yes
Recharges groundwater	Yes
Protects public water supply	Yes
Filters stormwater using green infrastructure	Yes
Improves water quality	Yes
Promotes decarbonization	No

Enables carbon sequestration	No
Provides oxygen production	No
Improves air quality	No
Prevents pollution	Yes
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	No
Protects land containing shellfish	No
Provides pollinator habitat	No
Provides recreation	No
Provides cultural resources/education	No

Project Climate Hazard Exposure

Is the primary purpose of this project ecological restoration?	No
Does the project site have a history of coastal flooding?	No
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	No
Does the project site have a history of riverine flooding?	No
Does the project result in a net increase in impervious area of the site?	Yes
Are existing trees being removed as part of the proposed project?	Yes

Project Assets

Asset: Facility Building
Asset Type: Typically Unoccupied
Asset Sub-Type: Water treatment plant (potable water)
Construction Type: New Construction
Construction Year: 2030
Useful Life: 30

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Building must be accessible/operable at all times, even during natural hazard event

Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.
Impacts would be limited to local area and/or municipality

Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.
Less than 10,000 people

Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the building/facility would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses

If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?
Spills and/or releases of hazardous materials would be relatively easy to clean up

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Significant – Inoperability is likely to impact other facilities, assets, or buildings and will likely affect their ability to operate

If this building/facility was damaged beyond repair, how much would it approximately cost to replace?
Between $10 million and $30 million

Is this a recreational facility which can be vacated during a natural hazard event?
No

If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?
Some alternative programs and/or services are available to support the community

If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
Impact on natural resources can be mitigated naturally

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?
Loss of building may reduce the ability to maintain some government services, while a majority of services will still exist.

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?
Loss of confidence in government agency

Report Comments

N/A

APPENDIX E

Stormwater Report

STOROMWATER MANAGEMENT REPORT

FOR

WELLS 3&4 WATER TREATMENT BUILDING

JUNE 2026

Prepared For:

BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

255 BREEDS HILL ROAD PO BOX 546

BARNSTABLE, MA 02601

Contact: Sean Anderson

Phone: 508-362-6498

Email: bfdwatersupt@barnstablefiredistrict.com

Prepared By:

Contact: Stephen C. Olson, P.E.

Phone: 508-375-7007

Email: sco@h2olsonengineering.com

Address : 10 Riverside Drive. Suite #103

Lakeville, MA 02347

H2Olson Engineering, Inc.

DRINKING WATER PROFESSIONALS

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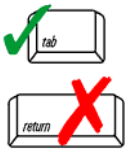
1.0 Stormwater Management Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



6/8/12

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☒ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☒ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☒ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☒ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

2.0 Introduction

H2Olson Engineering Inc. (H2Olson) has completed a drainage analysis for the Barnstable Fire District Wells 3&4 Water Treatment Plant Project (Project), the results of which are contained herein. The purpose of this analysis is to quantitatively understand the impacts of the proposed Project on the existing hydrologic conditions, and to mitigate any impacts through the implementation of a stormwater management system utilizing best management practices (BMPs) supported by both a Construction Period Pollution Prevention and Erosion and Sedimentation Plan and a Long-Term Operations and Maintenance Plan, found in Appendix A and Appendix B, respectively. The Stormwater Management Report herein has been prepared to demonstrate compliance with the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Handbook in accordance with the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and applicable local regulations and bylaws.

3.0 Existing Conditions

3.1 Site Conditions

The Project area is a portion of District-owned land currently in use for public water supply located at 1650 Iyannough Road/Route 132 Barnstable, Massachusetts. This land consists of a paved access road, Well 3 Pump House, and Well 4 Pump House. The property is located in the Residential RG and RF-1 zoning districts, as well as the Wellhead Protection Overlay District, as seen in the Town of Barnstable Zoning Map shown in Appendix C. Existing utilities include water mains to transport water from Well 3 and Well 4 into distribution, overhead electrical lines to transmit power to the two Pump Houses, and underground fiberoptic lines to transmit SCADA information between Pump Houses, as seen in the Design Drawings shown in Appendix D.

The Project site includes a portion of the existing paved access road, a wooded area to the south of the existing paved access road, and a small wooded area to the south of the Well 4 Pump House. Refer to the Site Locus Map shown in Appendix C for the location and extent of the Project.

The existing property is predominantly woodlands. Land use in the area surrounding the Project includes undeveloped forest to the North, Hathaway's Pond Recreation Area to the East, and the Hyannis Golf Club to the South and West. The existing paved access road runs East to West, connecting the site to Iyannough Road/Route 132. Topography at the Project site varies, as the site contains various depressions, or kettles.

3.1.1 Critical Areas

Critical Areas as defined by Standard 6 of the MassDEP Stormwater Management Handbook are areas where high levels of stormwater treatment are required; typically, the first inch of runoff is treated using distinct BMPs and pre-treatment methods. Specific source control and pollution prevention measures are also required.

The Project site is located within designated groundwater recharge areas for public water supply (310 CMR 22.02), including both Zone I's and Zone II's.

3.2 Soil Description

The Natural Resources Conservation Service (NRCS) lists the on-site soils as Easchop loamy fine sand. Eastchop loamy fine sand is an excessively drained soil consisting of 75% Eastchop and similar soils and of 25% other components. The NRCS also lists the area as 'hilly, rolling, bouldery' and 'pits, sand and gravel'. Refer to the NRCS Soil Map in Appendix E for more information.

Competent Soils Professionals (Pete Newton, P.G., and Genevieve Cordeiro, E.I.T.) separately conducted site visits on 11/7/2025 and 12/24/2025, and together on 5/15/2026 to verify the NRCS classification. Inspection of the site determined that the on-site soils in the area of interest have not been disturbed, filled, or otherwise altered.

Boring logs were prepared by John Turner Consulting on 12/24/2025. These logs indicated that the on-site soil generally consists of a layer of silty sand, underlain by a layer of sand. Groundwater was found at elevations between 30 feet and 34 feet. Refer to the geotechnical engineering report Appendix E for more information.

Test pits were performed by H2Olson on 5/15/2026. These tests confirmed the presence of Class A soils in the locations and soil layer where stormwater infiltration is proposed. Refer to the Soil Evaluation Forms in Appendix E for more information.

No evidence of high groundwater elevation was encountered during the logs or test pits. As such, the Estimation of High Groundwater Levels for Construction and Land Use Planning (revised in 2006) method presented in Cape Cod Commission's Technical Bulletin 92-001 was utilized. Using this method, the depth to the high groundwater level for the site was estimated to be 21 feet, or at an elevation of 39 feet.

Based on the data present in these logs and tests, the soils were modeled as Class A soils for the hydrologic analysis and recharge volume calculation. The proposed stormwater infiltration BMPs have been sited in the identified Class A soil locations.

3.3 Hydrologic Analysis

The existing hydrologic conditions were modeled using HydroCAD™ version 10.20-9a. The analysis utilized precipitation data from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the 2-, 10-, 25- and 100-year 24-hour storms, along with the projected 2070 50-year 24-hour storm consistent with the output report from the MA Climate Resilience Design Standards Tool prepared by the Resilient Massachusetts Action Team (RMAT), as seen in Appendix J.

Sub-catchments areas were delineated based on existing runoff patterns and topographic information. This information is shown on the Existing Watershed Plan included in Appendix F. Summaries of each area with respect to Curve Number and Time of Concentration calculations, as well as the site routing diagram, can be found in the Existing Conditions HydroCAD Model Results included in Appendix G.

Six Design Points were used for stormwater runoff analysis. These Design Points, along with the Sub-catchments that fall within each category, are listed in Table 1 below.

Table 1: Existing Conditions Analysis

Design Point	Sub-catchments	Description
1	1.1 through 1.4	Onsite Runoff
2	2.1	Offsite Runoff to the West
3	3.1	Offsite Runoff to the East
4	4.1	Offsite Runoff to the South
5	5.1 and 5.2	Offsite Runoff to the North
6	6.1	Offsite Runoff at the East End of the Access Road

4.0 Proposed Conditions

4.1 Site Conditions

The proposed Project involves the construction of a new water treatment plant for the treatment of water from Well 3 and Well 4. Along with the 4,040 square foot building, the Project consists of a paved driveway to the new building, two (2) sand filters and two (2) infiltration basins for the treatment of water treatment residuals, also known as backwash waste, a septic system for the facility bathroom, best management practices (BMPs) for the treatment and infiltration of stormwater, new yard piping to deliver water to and from the building, new underground electrical lines to deliver power to the building, new underground fiberoptic lines to transmit SCADA information, two (2) new generators, two (2) new propane tanks, yard fencing, and three (3) new water hydrants, one located at the end of the paved access road. Refer to the Design Drawings included in Appendix D for exact locations.

There will be no changes to the existing easements, zoning, or land use at the site.

4.2 Stormwater Management System Overview

The proposed stormwater management system consists of a closed drainage system including deep sump hooded catch basins, a drain manhole, an oil/grit separator, a filtering rain garden, a sediment forebay, an infiltration basin, infiltration trenches, roof leaders, underground piping, and dry wells, which will work in combination to collect, control, and treat runoff discharging from the site. The closed drainage system has been designed to accommodate the 25-year 24-hour storm. Offsite impervious areas draining to the proposed drainage system have been identified, as seen in the Proposed Offsite Contribution Plan included in Appendix F.

Stormwater runoff from portions of the new paved driveway and two (2) down spouts from the proposed building's roof will be directed to one of four (4) catch basins. Catch basins will include fifty-four-inch-deep sumps and oil/gas separator hoods. The deep sumps are intended to remove sediment, and the hoods are intended to remove oil and gas from the stormwater prior to release. Stormwater will then travel through pipes and the drain manhole to the oil/grit separator, which acts as a second line of defense in separating oil and sediment from the runoff. From this BMP, stormwater travels through pipes to the sediment forebay, which then spills into the infiltration basin. The deep sump hooded catch basins, oil/grit separator, sediment forebay, and infiltration basin make up Treatment Train 1.

Stormwater runoff from the remainder of the new paved driveway and portions of the existing paved access road will be directed to the filtering rain garden. This device is composed of shrubs and herbaceous perennials planted in mulch and soil media underlaid by an underdrain as described in the Design Drawings located in Appendix D. From this BMP, stormwater travels through pipes to the sediment forebay, which then spills into the infiltration basin. The filtering rain garden, sediment forebay, and infiltration basin make up Treatment Train 2.

Stormwater runoff from the remaining six (6) down spouts from the proposed building's roof will be directed to one of six (6) dry wells for treatment and infiltration. These dry wells make up Treatment Train 3.

The catch basins, oil/grit separator, rain garden, and sediment forebay have been designed to facilitate Total Suspended Solids (TSS) removal. All have been sized to provide adequate water quality treatment. The oil/grit separator has been designed to accommodate the 2-year 24-hour storm without interference. For larger storms, the drain manhole acts as a flow separator, diverting some of the flow away from the oil/grit separator and directly to the sediment forebay, as per Volume 2, Chapter 2 of the Stormwater Management Handbook.

The infiltration basin and dry wells have been designed to provide water quality treatment, groundwater recharge, and attenuation of the proposed peak flow rates and volumes to that of the existing conditions or less for both the 2- and 10-year 24-hour storms. These recharge BMPs have been equipped with overflow spillways to facilitate the discharge of stormwater during a high magnitude storm event.

The site will be vegetated with grass and shrubbery, as shown on the Design Drawings provided in Appendix D. The site will also be equipped with two infiltration trenches to assist in providing attenuation of the proposed peak flow rates and volumes for the 2-, 10-, 25-, 100-, and projected 2070 50-year 24-hour storms. As the two infiltration trenches are not components of treatment trains, and only provide assistance in attenuating peak runoff, the two devices are not considered infiltration nor treatment BMPs and thus are not included in the proposed volumes to meet the requirements of Standard 3 and Standard 4.

The areas that drain to the infiltration trenches include portions of the existing access road and proposed lawn. The Project is constrained by the need to meet existing grades at the existing paved access road, and the goal to minimize the disturbance to existing trees and shrubs, thus this portion of the site's impervious area does not drain to the proposed infiltration BMPs. Due to this constraint, the infiltration BMPs are sized based on the procedure set forth in Standard 3 of the MassDEP Stormwater Management Handbook. Refer to Standard 3 in Section 5.0 below and the Supplemental Calculations in Appendix J for more information.

4.3 Hydrologic Analysis

The proposed hydrologic conditions were modeled in the same manner as the existing conditions: using HydroCAD™ version 10.20-9a and precipitation data from NOAA and the RMAT output.

Sub-catchment areas and flow paths were modified to reflect proposed conditions. This information is shown on the Proposed Watershed Plan included in Appendix F. Summaries of each area with respect to

Curve Number and Time of Concentration calculations, as well as the site routing diagram, can be found in the Proposed Conditions HydroCAD Model Results included in Appendix H.

The established design points used in the existing conditions analysis were used in the proposed conditions analysis for direct comparison. The proposed conditions analysis considers both runoff from sub-catchments not captured by BMPs, as well as overflow from BMPs during high magnitude storm events. See Table 2 below for a summary of the sub-catchments and BMPs accounted for within each Design Point.

Table 2: Proposed Conditions Analysis

Design Point	Sub-catchments	BMP	Description
1	-	-	Onsite Runoff
2	-	14P	Offsite Runoff to the West
3	3.1	12P and 13P	Offsite Runoff to the East
4	4.1 and 4.2	7P and 15P	Offsite Runoff to the South
5	5.1 and 5.2	-	Offsite Runoff to the North
6	6.1	-	Offsite Runoff at the end of the Access Road

5.0 Compliance with the Stormwater Management Standards

As part of this drainage analysis, H2Olson has performed an in-depth review of the Project site for conformance with the ten standards outlined in the MassDEP Stormwater Management Handbook. This Project is not considered a redevelopment project (as defined in Standard 7) and is therefore required to meet all the Stormwater Management Standards. The following narrative discusses the Project as it relates to the Ten Stormwater Management Standards.

LID Measures:

Low Impact Development (LID) techniques utilized along portions of the Project include:

- No disturbance to any wetland resource area.
- Minimizing disturbance to existing trees and shrubs.
- Use of country drainage.
- Rain Gardens.

Standard 1: No New Untreated Discharges

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

There will be no direct discharge of untreated stormwater to nearby wetlands or waters of the Commonwealth. Runoff from a majority of the impervious areas on the site will be conveyed to BMPs for water quality treatment, infiltration, and runoff rate attenuation prior to discharge. Untreated runoff from impervious areas onsite will not be directed to adjacent wetlands. There are no wetlands located within a

500-foot radius of the Project site, as seen on the MassGIS Environmental Constraints Map shown in Appendix C.

Standard 2: Peak Rate Attenuation

Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.

As stated above in Section 3.3 and Section 4.3, the hydrologic conditions of the existing and proposed site were modeled using HydroCAD™ for the 2-, 10-, 25-, 100-, and projected 2070 50-year 24-hour storms to demonstrate that post-development stormwater runoff rates will be less than or equal to the pre-development runoff rates. The results of this analysis can be seen below in Table 3 and Table 4.

Table 3: Stormwater Runoff Peak Discharge Summary

Peak Discharge	Flow (cfs)									
	2-Year Storm		10-Year Storm		25-Year Storm		100-Year Storm		RMAT Projected 50-Year Storm	
Analysis Area	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.
Design Point 1	0.00	0.00	0.01	0.00	0.07	0.00	0.35	0.00	0.93	0.00
Design Point 2	0.26	0.00	0.41	0.00	0.51	0.00	0.65	0.45	0.77	1.47
Design Point 3	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.34	0.05	0.25
Design Point 4	0.00	0.00	0.01	0.01	0.07	0.05	0.44	0.43	0.97	1.47
Design Point 5	0.08	0.08	0.17	0.15	0.24	0.21	0.33	0.30	0.43	0.39
Design Point 6	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07
Total	**0.37**	**0.11**	**0.64**	**0.20**	**0.94**	**0.32**	**1.84**	**1.58**	**3.22**	**3.65**

Table 4: Stormwater Runoff Volume Summary

Runoff Volume	Volume (af)									
	2-Year Storm		10-Year Storm		25-Year Storm		100-Year Storm		RMAT Projected 50-Year Storm	
Analysis Area	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.
Design Point 1	0.000	0.000	0.006	0.000	0.017	0.000	0.048	0.000	0.086	0.000
Design Point 2	0.014	0.000	0.022	0.000	0.027	0.000	0.034	0.002	0.041	0.009
Design Point 3	0.000	0.000	0.000	0.001	0.001	0.003	0.002	0.007	0.005	0.012
Design Point 4	0.000	0.000	0.008	0.005	0.020	0.013	0.046	0.036	0.076	0.073
Design Point 5	0.004	0.004	0.010	0.008	0.012	0.011	0.017	0.016	0.022	0.021
Design Point 6	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.004
Total	**0.019**	**0.005**	**0.048**	**0.016**	**0.079**	**0.029**	**0.150**	**0.064**	**0.233**	**0.119**

As shown in Table 3 above, the post-development peak discharge rates are equal to or less than the pre-development peak discharge rates for both the 2- and 10-year 24-hour storms, as required by Standard 2 of the MassDEP Stormwater Management Handbook. Similarly, in Table 4 above, the post-development

runoff volumes are equal to or less than the pre-development runoff volumes for both the 2- and 10-year 24-hour storms. Both statements hold true for all six Design Points.

During the 100-year 24-hour storm, only Design Point 3 shows a greater post-development peak discharge rate and volume, even though the total runoff rate and volume of the Project site as a whole are lower in the post-development conditions. The runoff in Design Point 3 drains to a low point east of the site, which was modeled as a two-foot-deep basin in HydroCAD according to the existing contours of the area. The peak elevation in this low point 'basin' rose 0.26 feet in the post-development conditions compared to the pre-development conditions. As this off-site sub-catchment consists of woodlands in a mapped area of Class A soils by NRCS, the off-site sub-catchment is thought to have rapid infiltration similar to the Project site. Because of these favorable estimated soil conditions, and the minimal increase in depth of the modeled 'basin', it was determined that the rise in peak elevation is not subject to flooding areas downstream in the watershed and that this drainage analysis indicates this area is not subject to increased off-site flooding. Refer to Appendix I for the Existing and Proposed Offsite Sub-Catchment Plans, along with the 100-year 24-hour storm offsite HydroCAD Model results.

During the RMAT projected 2070 50-year 24-hour storm, Design Point 2, 3, and 4 all show greater post-development peak discharge rates, even though the post-development runoff volumes for Design Points 2 and 4 are lower. Although the current design does not attenuate peak discharge rates from this high magnitude storm, the proposed design allows for various future upgrades to adapt to this projected scenario due to climate change. Opportunities for future upgrades are as follows:

- Design Point 2: There is space to the west of the existing access road to upgrade the existing infiltration trench and/or install an additional stormwater BMP for treatment and recharge. The topography is supportive of this future design, as there is an existing depression in the area that could be utilized.
- Design Point 3: There is space to the east of the site to increase the capacity of the building's roof infiltration devices and/or add an additional stormwater BMP. The existing contours shown in the Existing Watershed Plan in Appendix F are supportive of this future design.
- Design Point 4: There is space to the South of the site to increase the capacity of the current infiltration basin and/or add additional stormwater BMPs. The existing contours shown in the Existing Watershed Plan in Appendix F are supportive of this future design.

The Project site is not located within any flood zones, as seen in the FEMA FIRMette Flood Zone Map located in Appendix C.

Standard 3: Recharge

Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The stormwater management system includes multiple infiltration BMPs that will effectively recharge groundwater on-site. These infiltration BMPs include an infiltration basin and six (6) dry wells. The total

provided recharge volume through these BMPs is 1,214 cubic feet, in excess of what is required, see Table 5 below. Refer to Appendix J for required and provided sizes of individual infiltration BMPs.

Table 5: Recharge Volume Summary

Total Proposed Impervious Area On-Site (sf)	13,630
Impervious Area Draining to Proposed Recharge BMPs (sf)	9,651
Adjusted Total Recharge Volume Required (cf)	962
Total Recharge Volume Provided (cf)	1,214
Percentage of Site's Impervious Area Directed to Infiltration BMPs	71%

As stated above in Section 4.2, not all impervious areas within the site limits are to drain to the proposed infiltration BMPs. As such, the total recharge volume was adjusted to reflect this, as per the procedure set forth in Standard 3 of the MassDEP Stormwater Management Handbook. Although the proposed design does not account for all impervious areas on site, the percentage of impervious areas treated is above the required 65%, as defined in Standard 3 of the MassDEP Stormwater Management Handbook.

Additionally, all infiltration BMPs have been designed to drawdown within 72 hours. Refer to Appendix J for drawdown calculations.

Standard 4: Water Quality

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids.

The stormwater management system includes multiple treatment BMPs that will effectively treat stormwater on-site. These treatment BMPs include four (4) deep sump hooded catch basins, an oil/grit separator, a sediment forebay, an infiltration basin, and six (6) dry wells. The total provided water quality volume through these BMPs is 2,282 cubic feet, in excess of what is required, see Table 6 below.

Table 6: Water Quality Volume Summary

Total Water Quality Volume Required (cf)	1,136
Total Water Quality Volume Provided (cf)	2,282

The proposed stormwater management system contains three treatment trains that will meet the 80% TSS removal requirement. Please see the TSS Removal Calculation Worksheets in Appendix J for more information. These treatment trains are as follows:

1. Deep sump hooded catch basins, oil/grit separator, sediment forebay, infiltration basin
2. Filtering rain garden, sediment forebay, infiltration basin
3. Dry wells

Treatment Train 1 contains runoff from the new pavement and roof runoff from two building down spouts. This train achieves 89% TSS removal in total and 44% TSS removal in pre-treatment, as required due to the site's location in an area of rapid infiltration rate and a Zone I Wellhead Protection Zone.

Treatment Train 2 contains runoff from the remainder of the new paved driveway and portions of the existing paved access road. Rain gardens achieve 90% TSS removal with adequate pre-treatment, and are approved as a pre-treatment device for areas with the potential to generate high concentration of oil and grease, as per Volume 2, Chapter 2 of the Stormwater Management Handbook. Since runoff from pavement has the potential to generate high concentration of oil and grease, and filtering rain gardens have been used as a pre-treatment to sediment forebays and infiltration basins in previous applications within a Zone 1 Critical Zone, it is of the understanding that this train achieves the required 44% TSS removal in pre-treatment. This train achieves at least 80% TSS removal in total.

Treatment Train 3 contains roof runoff from the remaining 6 building down spouts. This train achieves 80% TSS removal. Since the proposed roof will not be made of metal, as defined in Standard 3 of the MassDEP Stormwater Management Handbook, pre-treatment of roof runoff is not required. As such, no pre-treatment device is proposed for this treatment train.

The proposed Project is located within the Barnstable Harbor embayment within the Wequaquet Lake Watershed, which has a final Total Maximum Daily Load (TMDL) issued for fecal coliform, as seen in the MassDEP TMDL Map shown in Appendix C. The most likely runoff to contribute to this TMDL is from the pavement. As such, the treatment BMP for this infiltration area, the infiltration basin, was chosen as it has a 90% removal efficiency for pathogens. The roof runoff is considered clean and will not contribute to the TMDL for pathogens. As such, the treatment BMP for this infiltration area, the dry well, was chosen as this BMP does not need to meet removal efficiencies for pathogens.

There are additional TMDLs identified for the Wequaquet Lake Watershed. However, since this Project is not subject to wetlands regulation, as there are no wetlands located within a 500-foot radius of the site, these additional TMDLs were not considered, as set forth in Volume 1, Chapter 2 of the MassDEP Stormwater Management Standards.

All proposed stormwater management BMPs will be operated and maintained according to the Long-Term Operation and Maintenance Plan, located in Appendix B.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

Land use with high potential pollutant loads must have source control and pollution prevention measures implemented in accordance with the Massachusetts Stormwater Handbook.

The Project site is not a land use with higher potential pollutant loads, per the MassDEP Stormwater Management Handbook.

Standard 6: Critical Areas

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

The Project site discharges to a Zone I and a Zone II Wellhead Protection Area. Although Standard 6 generally prohibits stormwater discharges to a Zone I, an exception is made when essential to the operation of the public water supply. The proposed stormwater management system will treat stormwater runoff from a water treatment plant site and therefore is considered essential.

The treatment BMPs has been designed to treat the first 1-inch of runoff from all post-construction impervious areas. Treatment trains have been designed to provide 44% pretreatment prior to discharge to an infiltration BMP. The proposed stormwater BMPs listed above in Standard 3 and Standard 4 are considered suitable for Zone Is.

A source control and pollution prevention plan is provided in Appendix B.

Standard 7: Redevelopment

A redevelopment project is required to meet certain Stormwater Management Standards only to the maximum extent practicable. However, if it is not practicable to meet all the Standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.

Although a portion of the site was previously developed, this Project is considered new development as the proposed Project includes a net increase in impervious area. As such, the Project is required to fully meet all the Massachusetts Stormwater Management Standards.

Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control

A plan to control construction related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The Project will disturb more than one acre of land and will therefore be required to obtain coverage under the NPDES Construction General Permit. A Stormwater Pollution Prevention Plan (SWPPP) will be provided before the start of construction; however, erosion and sediment controls are identified in the Design Drawings, provided in Appendix D, and a Construction Period Pollution Prevention and Erosion and Sediment Control Plan is provided in Appendix A.

Standard 9: Long Term Operation and Maintenance Plan

A Long-Term Operation and Maintenance Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

Please refer to Appendix B for the Long-Term Operation and Maintenance Plan for the proposed Stormwater Management System.

Standard 10: Prohibition of Illicit Discharges

All illicit discharges to the stormwater management system are prohibited.

There will be no illicit discharges to the proposed stormwater management system associated with the proposed Project. An Illicit Discharge Compliance Statement is included below in Section 8.0.

6.0 Compliance with Town Bylaws

This Project is subject to the Town of Barnstable Stormwater Management Rules and Regulations (Chapter 903) and Stormwater Management Illicit Discharge Ordinance (Chapter 185). All information and calculations required by this regulation have been provided in this report.

The Project is required to meet the 90% TSS and 60% total phosphorus treatment requirements outlined in §903-7 B.(4). The Project proposes to meet this requirement by retaining the volume of runoff equivalent to 1.0 inch multiplied by the total post-construction impervious area on the new development site, as outlined in §903-7 B.(4)(a) ii. Refer to Appendix J for calculations related to water quality volume. Refer to Appendix F for the Proposed Offsite Contribution Plan, which identifies off-site areas contributing to the proposed drainage system, as required per §903-7 A.(14).

7.0 Conclusion

Based on the stormwater report herein, stormwater runoff will be captured, peak flows will be controlled, and TSS will be reduced. The proposed stormwater management system has been designed to meet MassDEP's Stormwater Management Handbook Policy and that of the local bylaws.

8.0 Illicit Discharge Compliance Statement

Standard 10 of the Massachusetts Stormwater Regulations prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, surface water, or municipal storm sewer system (MS4).

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater, discharges from fire-fighting activities, and certain non-stormwater discharges as specified in §185-12 of the Town Of Barnstable Bylaws.

I, Sean Anderson (print name), certify that, to the best of my knowledge, there are no illicit discharges located within the Project limits.

Signature

6/9/26
Date

Appendix A – Construction Period Pollution Prevention and Erosion and Sediment Control Plan

1.0 General Information

Project Name:	Barnstable Fire District Wells 3&4 Water Treatment Plant
Project Type:	Public Health
Address:	1650 Iyannough Road/Route 132 Barnstable, MA
Stormwater Management System Owner & Responsible Party:	Barnstable Fire District Water Department 255 Breeds Hill Road PO Box 546 Barnstable, MA 02630
Owner:	Sean Anderson O: 508-362-6498 bfdwatersupt@barnstablefiredistrict.com
Preparer:	Stephen C. Olson, P.E. O: 508-375-7007 sco@h2olsonengineering.com 10 Riverside Drive. Suite #103 Lakeville, MA 02347

2.0 Narrative

2.1 Introduction

This Project is anticipated to disturb greater than one acre of land; therefore, filing a Notice of Intent with EPA and preparing a Stormwater Pollution Prevention Plan (SWPPP) is required. The SWPPP will be provided as part of the construction documents and will be submitted to the Town of Barnstable Conversation Commission prior to the commencement of construction. The following plan provides general guidance for the prevention of pollution, erosion, and sedimentation during construction.

This Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan has been prepared in accordance with the Department of Environmental Protection's Massachusetts Erosion and Sedimentation Guidelines for Urban and Suburban Areas, the standards set forth in Standard 8 of MassDEP's Stormwater Management Handbook, and the Town of Barnstable Stormwater Management Rules and Regulations (Chapter 903).

It shall be the responsibility of the awarded contractor at the time of construction to ensure compliance with all erosion control measures.

2.2 Potential Erosion and Sedimentation

Portions of the Project involve soil disturbance in areas upgradient of stormwater collection systems. Site preparation, scheduling, and construction practices need to be carefully planned to prevent construction debris and erosion caused by stormwater runoff over exposed soils from causing degradation of downstream stormwater collection systems. Although it is not always possible to avoid impacts from storm events, the following guidelines shall be followed:

- Minimize land disturbance area and soil exposure to stormwater and wind erosion.
- Minimize time that area is disturbed.
- Avoid routing uncontaminated water (stormwater runoff or dewatering flows) through disturbed areas.
- Inspect and maintain erosion controls until all soils are stabilized.
- Maintain good housekeeping practices.
- Stabilize disturbed soils as soon as practical to limit exposure.

2.3 Extent of Disturbance

The total area of disturbance is approximately 2.10 acres. The existing site will be impacted by tree clearing, re-grading, building construction, paving, construction of a water treatment residuals handling system, septic system construction, and implementation of stormwater control measures. Refer to the Design Plans located in Appendix D for locations of the proposed structures, post-construction stormwater management best management practices (BMPs), and construction period erosion and sedimentation controls.

Off-site areas are not proposed to be directly altered but may be impacted by erosion and sedimentation if the controls described in this plan are not followed. No off-site land disturbance is proposed. Refer to the Locus Map located in Appendix C for the proposed area of disturbance.

The proposed Project is not located on a floodplain, nor will it disturb any wetlands, Areas of Critical Environmental Concern, or the Massachusetts Natural Heritage & Endangered Species Program (NHESP) certified vernal pools, as seen in the FEMA Flood Zone Map and the MassGIS Environmental Constraints Map, both located in Appendix C. Additionally, the Project will not disturb any Priority Habitats of Rare Species, as seen in the negative determination by NHESP included in Attachment A. Included in Attachment B is a list of abutters within 300 feet of the subject parcel in which the proposed site is located. Refer to the Watershed Plans located in Appendix F for existing vegetation and ground covers.

2.4 Pre-Construction and Site Preparation

- Install erosion control barriers in accordance with the Design Plans prior to commencing any land disturbance activity.
- Inspect and maintain erosion controls until soils are stabilized.
- Monitor weather reports daily and stabilize/prepare site if storm event in excess of the 2-year storm is expected.
- Maintain an inspection logbook on-site at all times. The specific location of the logbook shall be conveyed to the Town.

3.0 Erosion and Sedimentation Control Practices

Inspect erosion controls weekly and after every storm event until such time as soils are stabilized.

3.1 Catch Basin Inlet Protection

Inlet protection is proposed at proposed drain inlets within the Project area. Inlet protection shall also be provided at off-site drain inlets located immediately downgradient of the area of disturbance.

The purpose of inlet protection is to intercept and capture sediment that would otherwise enter the proposed drainage system for post-construction stormwater management. Inlet protection shall consist of manufactured filter fabric consistent with the construction details.

Inspection and maintenance shall consist of checking for sediment accumulation and removing accumulated sediment when the protection device is at least one-half full.

3.2 Erosion Control Barriers

Erosion control barriers are proposed along the downgradient limit of work, as depicted in the Design Plans. Additional erosion control barriers may be required at other locations as needed.

The purpose of erosion control barriers is to intercept and capture sediment that would otherwise migrate off-site. Erosion control barriers shall consist of compost filter tubes, straw wattles, and silt fences, or such other barriers as may be needed.

Inspection and maintenance:

- Check for sedimentation accumulation and remove sediments when they reach excessive volumes (approximately 1/3 the height of the barrier).
- Remove sediments when runoff ponds for 24 or more hours to prevent potential mosquito breeding habitat. Restake/replace controls as necessary to maintain their effectiveness.

3.3 Stabilized Construction Entrance

A stabilized construction entrance is proposed at the construction-period site entrance. Additional stabilized construction entrances shall be constructed if different means of access/egress are required.

The purpose of the stabilized construction entrance is to prevent sediment track out via construction vehicles. Stabilized construction entrance shall consist of coarse aggregate consistent with the construction plans and details.

Inspection and maintenance:

- Check the entrance to observe overall integrity and effectiveness of crushed stone entrance.
- Reshape the pad as needed for drainage and runoff control, and top dress with clean stone if needed.
- Remove tracked-out sediment by the end of each workday.

3.4 Tree Protection

Tree protection is proposed at trees that are to remain near to the area of disturbance, as noted on the Design Plans.

The purpose of tree protection is to minimize risk of damage to trees designated to remain. Tree protection shall consist of armoring, pruning, and/or fencing.

3.5 Construction Period Sedimentation Basin

Construction period sediment basins may be proposed if warranted during construction. A riprap spillway shall be provided at each basin to control outflow. The purpose of sediment basins is to detain sediment-laden stormwater runoff and collect construction-period sediment.

Inspection and maintenance:

- Remove sediment from the basins when the accumulated height exceeds one-half the height of the basin or swale.
- Check basin berm for signs of failure.
- Maintain integrity of overflow spillway.
- Check for signs of erosion in the vicinity of the basin and restore as needed.

3.6 Temporary Seeding

Temporary seeding is proposed for disturbed areas which have remained or are anticipated to remain exposed for more than 7 days. The purpose of temporary seeding is to provide vegetative stabilization of loose soil to mitigate risk of erosion. Temporary seeding shall consist of perennial rye grass.

Inspection and maintenance:

- Confirm that vegetation has been established
- Provide additional seeding as needed

3.7 Street Sweeping

Street sweeping is proposed at the existing paved access road periodically during construction. The purpose of street sweeping is to collect and dispose of any tracked-out sediment originating from the Project. All street sweepings shall be disposed of in a legal manner.

4.0 Additional Control Measures

4.1 Good Housekeeping

Minimize hazardous materials stored on site. All materials stored on site shall be stored in weatherproof enclosures in original containers and sealed. Refuel construction equipment off-site at a designated location. Any spills of hazardous materials shall be reported, contained, and removed in accordance with local, State, and Federal regulations.

Project shall also comply with all applicable local, State, and Federal regulations regarding air quality requirements and construction of the septic system onsite.

4.2 Material Stockpiling

Construction materials shall be stored in designated stockpile areas. Soil stockpiles shall be surrounded with silt fence, straw wattles, and/or compost filter tubes to mitigate erosion potential. All waste materials shall be removed from the site or placed in approved receptacles at the conclusion of each workday. Disposal of waste materials shall be in accordance with relevant local, state, and federal regulations. No excavated soil material shall be stockpiled within one hundred (100) feet of rivers, streams, ponds, or reservoirs.

4.3 Protection of Infiltration Areas

To maximize post-construction groundwater recharge and protect the infiltrative capacity of proposed basin areas, basins shall be excavated as late as practicable in the construction sequence; this includes the sediment forebay, two (2) infiltration trenches, and infiltration basin. During site restoration, all construction-period sediment shall be removed from basins, and the basins shall be re-seeded as necessary.

4.4 Uncontaminated Water

Appropriate erosion controls, construction-period grass swales, and construction-period infiltration basins will be implemented as necessary to divert uncontaminated water around disturbed areas, to the maximum extent practicable.

4.5 Potential Construction Site Pollutants

Pollutant-Generating Activity	Pollutant(s) Constituents	Location on Site
Equipment Re-fueling	Diesel Fuel, Gasoline	Laydown Area Off Site
Leaking or Broken Hydraulic Lines	Hydraulic Oil	Building Work Areas and Laydown Area
Minor Equipment Maintenance	Diesel Fuel, Gasoline, Hydraulic Oil, Motor Oil, Anti-Freeze	Laydown Area
Portable Sanitary Toilets	Bacteria, Parasites, Viruses	Laydown Area
Vehicle Accidental Spill	Diesel Fuel, Gasoline	Entire Site
Trash Containers/Dumpters	Paper, Plastic, Food Waste	Laydown Area

Refer to the Long-Term Pollution Prevention Plan, included as part of Appendix B, for measures to be implemented to minimize pollutant discharges.

4.6 General Construction Sequence

The proposed Project is not anticipated to be executed in a phased manor. The following represents a general construction sequence to be followed by the awarding contractor.

1. Obtain plan approval and other applicable permits.
2. Flag the work limits and applicable resource areas. Mark the tree area for protection.
3. Hold a pre-construction conference at least one week prior to starting construction.
4. Install stabilized construction entrance, perimeter erosion controls, and inlet protection.
5. Establish the location of stockpile and staging areas.
6. Install sediment basin if needed.
7. Conduct site clearing.
8. Rough grade site and stockpile topsoil.
9. Install drainage pipes and other utilities.
10. Install site features including building, treatment facilities, pavement, etc.
11. Install infiltration basin, sediment forebay, oil/grit separator, deep sump hooded catch basins, dry wells, and infiltration trenches.
12. Complete final grading.
13. Restore drainage BMPs impacted by construction-period sediment.
14. Complete final stabilization and site restoration.
15. Remove temporary erosion control measures pending approval by the responsible party.

Construction Period BMP Inspection and Maintenance Documentation Form

Inspection No.:_____ Date:_____ Weather:_____

Date & Amount of Last Precipitation Event:_____

Inspector Name:_____ Inspector Signature:_____

BMP	Condition	Recommendations	Date Corrected
Catch Basin Inlet Protection			
Erosion Control Barrier			
Stabilized Construction Entrance			
Street Sweepings			
Other			
Additional Comments			

Attachment A: NHESP Determination

MASSWILDLIFE

DIVISION OF
FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

January 14, 2026

Sean Anderson
Barnstable Fire District Water Department
255 Breeds Hill Road
PO Box 546
Barnstable, Massachusetts 02630

RE: Project Location: 1650 Iyannough Road
Project Description: Construction of a new water treatment plant for the treatment of water from Well 3 and Well 4
Heritage Hub Form ID: RC-97409

Dear Applicant:

Thank you for submitting the MESA Project Review Checklist, site plans (dated December 2025 (3 sheets, C-1, C-2, C-3; H2Olson Engineering, Inc.) prepared by) and other required materials to the Natural Heritage and Endangered Species Program of the MA Division of Fisheries & Wildlife (the "Division") for review pursuant to the Massachusetts Endangered Species Act (MESA) (MGL c.131A) and its implementing regulations (321 CMR 10.00).

PROJECT DESCRIPTION

The existing site includes a paved access road, Well 3 Pump House, and Well 4 Pump House. Water from Well 3 and Well 4 is treated at the Well 4 Pump House, which consists of potassium hydroxide (KOH) and sodium hypochlorite (NAOCl) storage, feed, and handling facilities. Water is then pumped to distribution. The proposed project involves the construction of a new water treatment plant for the treatment of water from Well 3 and Well 4. The proposed facility will be equipped with three (3) 10.5-foot GreensandPlusTM media filters and associated process mechanical valves and piping, six (6) 10-foot GAC pressure vessels and associated process mechanical valves and piping, and NaOCl storage, feed, and handling facilities. This project also involves the construction of two (2) sand filters and two (2) infiltration basins for the treatment of water treatment residuals, a septic system for the facility bathroom, the installation of new yard piping to deliver water to the treatment building, new finished water piping to deliver water to the distribution system, a new generator next to the existing Well 4 Pump House, and a new water hydrant located at the end of the paved access roadway.

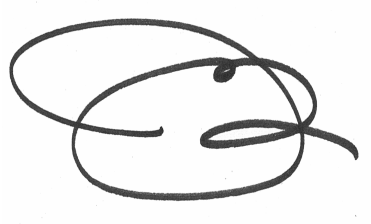
MA ENDANGERED SPECIES ACT

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries & Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if

there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Emily Holt, Endangered Species Review Assistant, at Emily.Holt@mass.gov, (508) 389-6385.

Sincerely,



Jesse Leddick
Assistant Director

cc: Stephen C Olson, H2Olson Engineering, Inc.

Attachment B: Abutters Within 300 feet of Project Parcel

Formal Site Plan Review GIZ Abutter List for Subject Parcel 254018

Abutters within 300 feet of subject parcel

Parcel ID	Owner 1	Owner 2	Address Line 1	Address Line 2	City	State	Zip
253020B00	CAPE COD 5 CENTS SAVINGS BANK		1500 IYANNOUGH RD		HYANNIS	MA	02601
254016	BARNSTABLE, TOWN OF (LB)		367 MAIN STREET		HYANNIS	MA	02601
254018	BARNSTABLE FIRE DISTRICT		PO BOX 546		BARNSTABLE	MA	02630
275001	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
275002	BARNSTABLE, TOWN OF (REC)		367 MAIN STREET		HYANNIS	MA	02601
275005	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
275008	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
275009	BARNSTABLE, TOWN OF (CON)	CONSERVATION COMMISSION	230 SOUTH STREET		HYANNIS	MA	02601
275013	ALWARDT, MARY ELLEN ET ALS		25 ALWARDT WAY		EAST FALMOUTH	MA	02536
275058	LEBEL, CAROL		114 ATTUCKS LANE		HYANNIS	MA	02601
275058001	BARNSTABLE LAND TRUST INC		1540 MAIN STREET		WEST BARNSTABLE	MA	02668
276002	BARNSTABLE, TOWN OF (CON)	CONSERVATION COMMISSION	230 SOUTH STREET		HYANNIS	MA	02601

Total Number of Abutters: 12

Report Generated On: 11/14/2025 12:20 PM

This list by itself does NOT constitute a "Certified List of Abutters" and is provided only as an aid to the determination of abutters. If a Certified Abutter List is required, you must contact the Assessing Division to have this list certified.

Appendix B – Long-Term Operation and Maintenance Plan

1.0 General Information

Project Name:	Barnstable Fire District Wells 3&4 Water Treatment Plant
Project Type:	Municipal
Address:	1650 Iyannough Road/Route 132 Barnstable, MA
Stormwater Management System Owner & Responsible Party:	Barnstable Fire District Water Department 255 Breeds Hill Road PO Box 546 Barnstable, MA 02630
Owner:	Sean Anderson O: 508-362-6498 bfdwatersupt@barnstablefiredistrict.com

It shall be the responsibility of the Owner to provide a revised plan to the Conservation Commission indicating any change of ownership or assignment of financial responsibility of the site and shall comply with §903-9 B.(3)(b) regarding amendments to the maintenance schedule provided herein.. The responsible party shall also be responsible for financing maintenance and emergency repairs at the site.

This stormwater management system (SWMS) operations and maintenance plan has been prepared in accordance with the Massachusetts Department of Environmental Protection's Stormwater Management Standards.

Applicant Certification

I, Sean Anderson (print name), being the applicant, certify that the Operation and Maintenance Manual provided herein abides by the applicable local, state, and federal regulations to the best of my knowledge.

SC 6/9/20

Signature Date

Owner Certification

I, Sean Anderson ✓ (print name), being the owner and person responsible for operation and maintenance, financing, and emergency repairs at the site, certify that I am familiar with the requirements of this Operation and Maintenance Plan and shall maintain the proposed Stormwater Management System in accordance with this Maintenance Agreement.

SC 6/9/20

Signature Date

2.0 Operation and Maintenance Introduction

In compliance with Standard 9 of the 2008 MassDEP Stormwater Management handbook and Town of Barnstable Stormwater Management Rules and Regulations (Chapter 903), this section outlines the stormwater best management practices (BMPs) associated with the proposed stormwater management system and identifies the long-term inspection and maintenance requirements for each BMP.

Inspection and maintenance personnel shall be provided with a copy of this Operation and Maintenance (O&M) Plan and required to review the specific inspection and maintenance procedures outlined below. A copy of the O&M Plan must be kept on-site at all times.

Inspection and Maintenance logs including inspections, repair, replacement, type of material removed, and disposal locations must be kept in this on-site plan and must be submitted to the Town of Barnstable Department of Public Works (Department), Reviewing Agent, or the Commonwealth of Massachusetts (Commonwealth) for review upon request. The owner shall provide Inspection and Maintenance logs to the Department on a yearly basis by June 30th, and an annual report prepared and stamped by Professional Engineer as per §903-9 D to the Department or Reviewing Agent. Owner shall keep the past seven (7) years of records on-site and allow the Department, Reviewing Agent, or Commonwealth access to inspect each BMP to ensure compliance with this O&M Plan.

2.1 Stormwater Management System Components

The following table outlines the type and quantity of the BMPs and their general location. Please refer to the site plans provided in Figure AB-1 for exact locations.

BMP Type	Quantity	General Location
Deep Sump Hooded Catch Basin	4	Within the new paved driveway.
Oil/Grit Separator	1	North of the infiltration basins for the WTP residuals
Filtering Rain Garden	1	South of the existing paved access road and west of the new paved driveway.
Sediment Forebay	1	West of the infiltration basins for the WTP residuals
Infiltration Basin	1	South of the sediment forebay.
Dry Well	6	North and south of the water treatment building.
Infiltration Trench	2	South of the water treatment building. West of the existing paved access road.

2.2 Inspection and Maintenance Measures

Effectiveness of BMPs is maximized when properly maintained. The inspections schedule and maintenance procedures for each BMP included in this Project are defined below, along with general guidance procedures.

For the purposes of the requirements below, a "rainfall event" is defined as the occurrence of greater than 0.25 inches of precipitation within 24 hours. A "major storm" is defined as a rainfall event resulting in greater than 2.87 inches of precipitation within 24 hours, reflecting the 1-year storm.

2.2.1 Deep Sump Hooded Catch Basin

Catch basins shall be inspected four times per year, including after the foliage and snow removal season. Other inspection and maintenance requirements include:

- Cleaning the units (organic material, sediment and hydrocarbons removed) four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.
    - Cleanout shall always occur after street sweeping.
- Removing hydrocarbons using absorbent pads or other suitable measures and disposing of it legally if any evidence of the material is found during inspection.
- Removing other accumulated debris as necessary.
- Transporting and disposing accumulated sediment off-site in accordance with applicable local, state and federal guidelines and regulations.

2.2.2 Oil/Grit Separator

Inspect after the first several rainfall events, after all major storms, and at least once every month. Inspection shall include:

- Cleaning the units twice a year to remove accumulated oil, grease, and sediment.
- Inspecting the inlets to ensure proper function.
- Transporting and disposing accumulated sediment off-site in accordance with applicable local, state and federal guidelines and regulations.

Refer to Manufacturer's Operation and Maintenance procedures for additional information.

2.2.3 Filtering Rain Garden

Inspect after the first several rainfall events, after all major storms, and at least once every month. Inspection shall include:

- Inspecting the soil and repairing eroded areas.
- Removing trash, litter, and debris monthly.
- Monitoring for ponding within the basin.
- Mulching annually in the spring season.
- Pruning annually in the spring or fall.
- Removing and replacing dead vegetation annually in the spring season.
- Removing invasive species within or near the basin.

- Replacing the entire media and all vegetation in the late spring or early summer as needed.

2.2.4 Sediment Forebay

Inspect after the first several rainfall events, after all major storms, and at least once every month. Inspection shall include:

- Cleaning at least four times per year and when sediment depth is between 3-6 inches.
- Removing accumulated sediment, trash, debris, leaves, and grass clippings.
- Replacing any vegetation damaged during the clean-out by re-seeding or re-sodding.
- Mowing the buffer area. The grass height shall be between 3-6 inches.
- Raking the stone side slopes, and basin bottom.
- Checking for ponding within forebay.
- Checking for erosion or sedimentation along the trapezoidal weir.
- Inspecting to ensure proper functioning.

2.2.5 Infiltration Basin

Inspect after the first several rainfall events, after all major storms, every time discharge drains through the emergency spillway, and at least once every six months. Inspection shall include:

- Removing the accumulated sediment, trash, debris, leaves, grass clippings, and organic matter.
- Removing tree or other plant seedlings before they become established.
- Replacing any vegetation damaged during the clean-out by re-seeding or re-sodding.
- Mowing the buffer area twice a year.
- Raking the stone side slopes and basin bottom twice a year.
- Checking for erosion along basin slopes.
- Checking for ponding within the basin.
- Inspecting to ensure proper functioning.
- Checking for erosion or sedimentation along downgradient slopes of the emergency spillway.

2.2.6 Dry Well

Inspect after the first several rainfall events, after all major storms, and at least once every year. Inspection shall include:

- Measuring the water depth in the observation well at 24- and 48-hour intervals after a storm. Clearance rates shall be calculated by dividing the drop in water level (inches) by the time elapsed (hour).
- Repairing damage to dry well. Replace gravel as needed.
- Removing accumulated sediment, trash, debris, leaves, and grass clippings.
- Checking for erosion or sedimentation along downgradient slopes.

2.2.7 Infiltration Trench

Inspect after the first several rainfall events, after all major storms, and at least once every 6 months. Inspection shall include:

- Repairing damage to trench, replacing gravel as needed.
- Removing accumulated sediment, trach, debris, leaves, and grass clippings.
- Removing tree or other plant seedlings before they become established.
- Checking for erosion along downgradient slopes.
- Checking for ponding within the trench.

2.2.8 Vegetation

Monitor establishment and health of all vegetation on site at least once a month for the first year, then at least once a month. Inspection shall include:

- Checking vegetation growth rate, health, and stability.
- Noting presence of any failing vegetation.
- Reseeding low-growth areas as necessary.

2.2.9 Street Sweeping

Paved areas shall be swept annually to remove excess sediments and trash, and always prior to catch basin cleanout. Once removed from paved surfaces, the sweepings shall be handled and disposed of properly in compliance with applicable local, state and federal regulations. Use of salt for de-icing purposes will not be used.

2.2.10 Public Safety Features

All excavations and entry into closed structures will be completed in accordance with OSHA requirements.

2.3 Erosion and Sediment Control Measures During Maintenance Activities

For maintenance activities that could result in discharges of sediments or other contaminants into wetlands, waterways, or other resource areas regulated under 310 CMR 10.00, the responsible maintenance personnel will employ measures to prevent migration of these sediments/contaminants. Such temporary measures may include, but are not necessarily limited to, the use of siltation barriers, catch basin silt sacks/filter bags, pipe plugs, cofferdams deployed within the stormwater structure, turbidity curtains, or other practices designed to prevent such discharges.

Where maintenance occurs in areas that are confined, with no risk of discharge to adjacent water bodies, no special measures may be needed. Examples include, but are not limited to: (1) cleaning of a forebay under dry conditions when the work can be completed and exposed surfaces stabilized prior to placing it back into service; and (2) catch basin cleaning where the activity is limited to removing material from a sump below the elevation of the outlet pipe.

2.4 Estimated Operation and Maintenance Budget

An operations and maintenance budget was prepared to approximate the annual cost of the inspections required in compliance with the MassDEP Stormwater Management Regulations. The table below estimates the annual cost to inspect and maintain each proposed BMP, based on the requirements in Section 2.2 above.

BMP Type	Quantity	Average Annual O&M Cost per BMP	Average Annual Cost
Catch Basin	4	$1,000	$4,000
Oil/Grit Separator	1	$1,000	$1,000
Rain Garden	1	$500	$500
Sediment Forebay	1	$250	$250
Infiltration Basin	1	$500	$500
Dry Well	6	$1,000	$6,000
Infiltration Trench	2	$1,000	$2,000
Street Sweeping	1 hour (14,000 sf)	$350/hour	$350
Total Average Annual Maintenance Cost			**$14,600**

BMP Inspection and Maintenance Documentation Form

Inspection No.:_____ Date:_____ Weather:_____

Date & Amount of Last Precipitation Event:_____

Inspector Name:_____ Inspector Signature:_____

BMP	Condition	Recommendations	Date Corrected
Catch Basin			
Oil/Grit Separator			
Rain Garden			
Sediment Forebay			
Infiltration Basin			
Dry Well			
Infiltration Trench			
Additional Comments			

3.0 Pollution Prevention Introduction

This Project is anticipated to disturb greater than one acre of land; therefore, filing a Notice of Intent with EPA and preparing a Stormwater Pollution Prevention Plan (SWPPP) is required. The SWPPP will be provided as part of the construction documents and will be provided to the Town of Barnstable Conversation Commission prior to the commencement of construction. The following section provides general guidance for source control and pollution prevention after construction concludes.

This section has been prepared in accordance with Standard 4, 5, 6, and 10 of the 2008 MassDEP Stormwater Management handbook and the Town of Barnstable Stormwater Management Rules and Regulations (Chapter 903).

3.1 Good Housekeeping

- Periodically inspect the stormwater management system to ensure all portions of the system are in good working order in conformance with Section 2.2.
- Conduct litter pick-up from the stormwater management facilities in conjunction with routine maintenance activities.
- Inspect Project area for signs of inadequate drainage.

3.2 Storage of Materials and Waste

- Avoid stockpiling of soil or materials within Wellhead protection areas. Avoid Zone I Wellhead Protection areas to extent practicable. If necessary, provide sufficient erosion controls to prevent migration of sediments.
- All materials shall be stored or disposed in accordance with all local, state, and federal regulations.
- All sand piles shall be removed from the site to prevent the discharge of sand to wetlands or water bodies.
- Minimize hazardous materials stored on site. All materials stored on site shall be stored in original containers and sealed.
- Solid waste, if encountered, shall be handled and disposed of in accordance with all local, state, and federal regulations.
- Store all materials and/or waste products inside or under cover whenever feasible.
- No snow shall be stored within waterbodies, resource areas, Zone I wellhead protection areas, or associated buffer zones.

3.3 Vehicle Washing

- No vehicle washing shall be performed on site.

3.4 Routine Inspections and Maintenance of Stormwater BMPs

- See Section 2.2 above for routine inspection and maintenance requirements for all proposed stormwater BMPs.

3.5 Spill Prevention and Response

The purpose of this spill prevention and response plan is to outline the source control and pollution prevention measures to minimize the risk of pollution to stormwater runoff. The following measures shall be implemented at the site:

- Maintain spill response supplies on site, include sorbent pads booms, granular material, shovel, and similar.
- Refuel construction equipment off-site.
- Any spills of hazardous materials shall be contained, removed, and reported in accordance with local, State, and Federal regulations.
- Review on-site equipment and activities to ensure no illicit discharges are created.
- Inspect and maintain the emergency generator and its spill containment system.
- Activities prone to spills include damage to construction equipment and materials. Construction vehicles and materials shall be inspected for leaks prior to their arrival at the site.
- Contractor shall keep a record of any waste or spill at the site as well as the associated response procedures implemented.
- In the event of a significant spill, contact the MassDEP 24-Hour emergency response notification line: (888) 304-1133 and immediately contact the 24-hour emergency contact.

3.6 Maintenance of Lawns, Gardens, and other Landscaped Areas

- Lawns, gardens, and other landscaped areas shall be maintained regularly by the site owner.
- See Section 2.2 above for instruction on how to maintain vegetated and landscaped BMPs.

3.7 Storage and Use of Fertilizers, Herbicides, and Pesticides

- No fertilizers, pesticides, and/or herbicides shall be used at the site.

3.8 Pet Waste Management

- No pets are anticipated to regularly be present at the site.
- Dispose of any pet waste encountered during routine inspection and maintenance activities.

3.9 Operation and Management of Septic Systems

- Inspect and pump out septic system once a year.
- Routinely mow the grass around the site to maintain clear access to the system.
- Remove tree or other plant seedlings in the area before they become established.

3.10 Snow and Deicing Chemical Management

- No road salt or sand for ice management or deicing chemicals shall be used or stored at the site.
- Plowed snow shall not be placed within the stormwater management system nor block flow paths to the system.

3.11 Prohibition of Illicit Discharges

The MassDEP Stormwater Management Standard 10 prohibits illicit discharges to the stormwater management system. Illicit discharges are discharges that do not consist entirely of stormwater, except for certain specified non-stormwater discharges. Examples of discharges from the following sources are not considered illicit discharges:

- Firefighting activities*
- Flows from riparian habitats/wetlands
- Foundation drains
- Potable water sources
- Water line flushing
- Dechlorinated swimming pool water
- Footing drains
- Street wash waters
- Landscape irrigation
- Wash water from residential buildings (no detergents)
- Individual residential car washing
- Condensation from air conditioning units
- Uncontaminated groundwater
- Run-on from private driveways caused by precipitation
- Rising groundwater
- Lawn watering
- Diverted stream flows
- Water from crawl space pumps

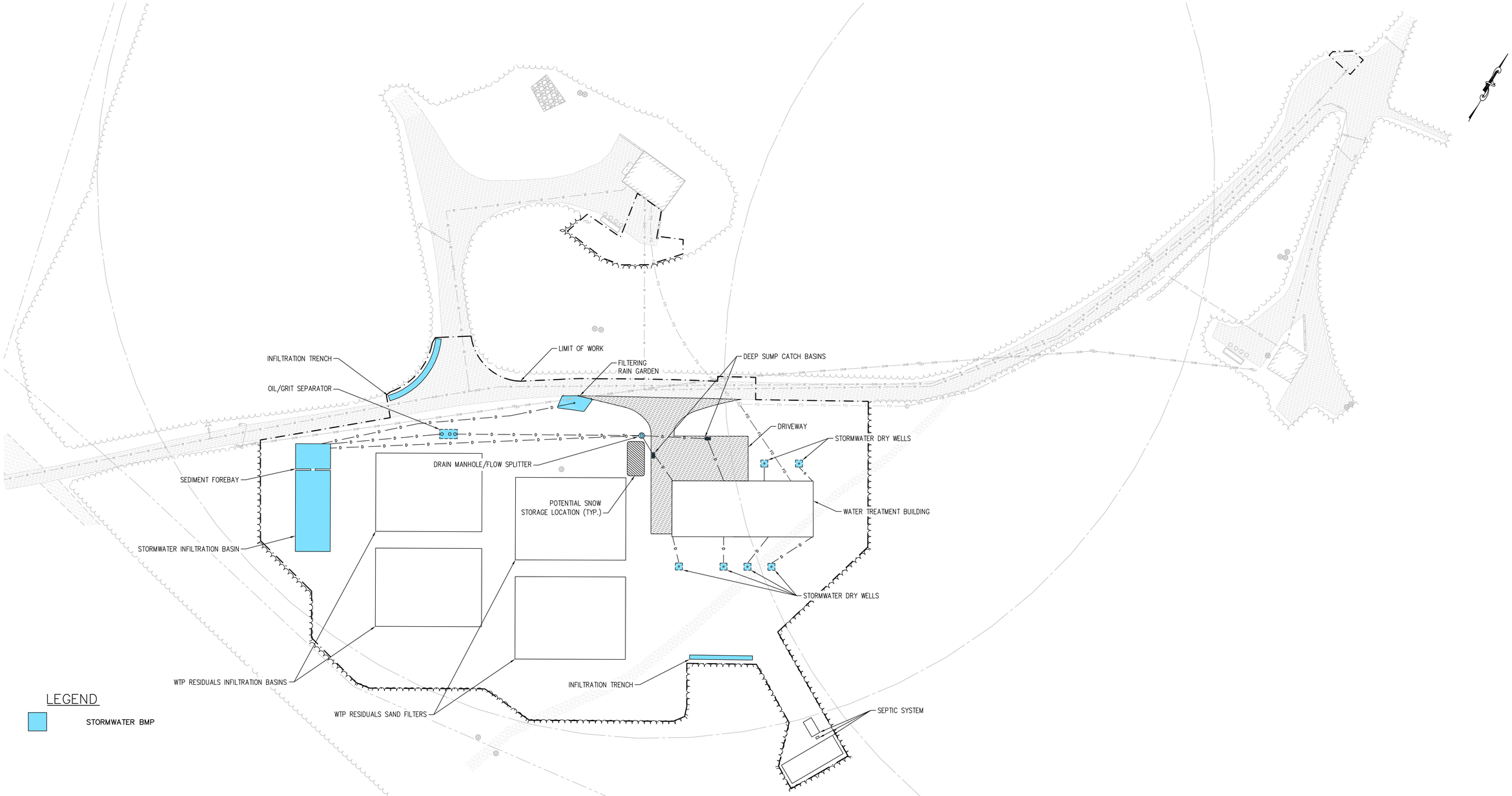
*Water from firefighting activities is allowed and need only be addressed where they are identified as significant sources of pollutants to waters of the United States.

Based on plan review and confirmation in the field, there are no known or proposed illicit connections associated with the Project within the Project limits. Should an interconnection to the stormwater management system be identified, the Owner shall confirm if the connections are authorized. For unauthorized connections, the Owner will investigate the connections and, if they are determined to be illicit, the connections will be managed through the appropriate authorities.

3.12 Nutrient Management Plan

The proposed Project is located within the Barnstable Harbor Embayment within the Wequaquet Lake Watershed, which has a final TMDL issued for fecal coliform. As a Public Water System, fertilizers, herbicides, and pesticides will not be permitted to be used on site. Additionally, the site will be secured from public access, including dog walkers. Although fecal coliform from anthropogenic sources is not anticipated, the proposed design incorporates measures to reduce this pollutant.

The selected BMP that will remove fecal coliform from contaminated runoff is the infiltration basin, as it has a 90% removal efficiency for pathogens. Nutrient management will include inspection and maintenance of the infiltration basin as described above in Section 2.2.



PLAN VIEW

SCALE: 1" = 35'

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REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
OPERATION AND MAINTENANCE PLAN

DRAWING NO.:
AB-1

SHEET NO. 1 OF 1

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C Sheets.dwg

Appendix C – Site Figures

ZONING MAP

of the

TOWN OF BARNSTABLE MASSACHUSETTS

INDEX MAP

SEPTEMBER 1, 1998

APPROVED SEPTEMBER 17, 1998
AMENDED NOVEMBER 12, 1998
AMENDED JULY 15, 1999
AMENDED OCTOBER 26, 2000
AMENDED FEBRUARY 1, 2001
AMENDED JUNE 28, 2001
AMENDED JULY 19, 2001
AMENDED AUGUST 16, 2001
AMENDED NOVEMBER 15, 2001
AMENDED SEPTEMBER 19, 2002
AMENDED APRIL 15, 2004
AMENDED SEPT. 2, 2004
AMENDED NOV. 18, 2004
AMENDED JULY 14, 2005
AMENDED JUNE 1, 2006
AMENDED MAY 3, 2007
AMENDED FEBRUARY 28, 2008
AMENDED APRIL 3, 2008
AMENDED JULY 16, 2009
AMENDED MARCH 4, 2010
AMENDED JUNE 17, 2010
AMENDED OCTOBER 7, 2010
AMENDED JANUARY 19, 2011
AMENDED SEPTEMBER 8, 2011
AMENDED FEBRUARY 16, 2012
AMENDED FEBRUARY 6, 2014
AMENDED MARCH 19, 2015
AMENDED MAY 7, 2015
AMENDED MAY 19, 2016
AMENDED JULY 21, 2016
AMENDED APRIL 27, 2017
AMENDED JUNE 1, 2017
AMENDED FEBRUARY 28, 2019
AMENDED FEBRUARY 4, 2021
AMENDED OCTOBER 21, 2021
AMENDED SEPTEMBER 1, 2023
AMENDED FEBRUARY 2, 2023

SEAL OF THE TOWN OF BARNSTABLE, MASS. 1639. ADOPTED MAY 4, 1889

TOWN OF SANDWICH

TOWN OF MASHPEE

TOWN OF YARMOUTH

Cape Cod Bay

Barnstable Harbor

Centerville Harbor

Hyannis Harbor

Lewis Bay

Nantucket Sound

Great Marshes

Mystic Lake

Middle Pond

Hamblin Pond

Wequaquet Lake

North Bay

East Bay

West Bay

Cotuit Bay

Popponesset Bay

RF

RF-1

RF-2

RG

RD-1

RC

RC-1

RC-2

RB

RB-1

RB-2

CBD

B

IND

IND Ltd

HB

HC

TC

MB-A

MB-B

R-2C

AP

WP

GP

S&D

WBWBD

BA

Map Legend

- HB — Zoning District
- WP — Wellhead Protection Overlay District
- GP — Groundwater Protection Overlay District
- AP — Aquifer Protection Overlay District
  All other areas not identified as Wellhead or Groundwater Protection Overlay Districts
- Adult Use Overlay District
- Dock and Pier Overlay District
- Former Grade 5 School Planned Unit Development Overlay District
- Medical Services Overlay District
- Mixed-Use Sub Zone of the Medical Services Overlay District
- Resource Protection Overlay District
- Shopping Center Redevelopment Overlay District
- Drive Through Restaurant Sub Zone of the Shopping Center Redevelopment Overlay Dist.
- Senior Continuing Care Retirement Community - SCCRCOD 2008-1
- Recreational Shellfish Area and Shellfish Relay Area Dock & Pier Overlay District
- Ground Mounted Solar Photovoltaic Overlay District
- Medical Marijuana Overlay District
- Registered Recreational Marijuana Cultivators, Research Facilities, and Testing Laboratories Overlay
- Craigville Village Neighborhood Overlay
- Long / Short Beach Neighborhood Overlay
- Craigville Beach Neighborhood Overlay
- Centerville River North Bank Neighborhood Overlay
- ★ C-O #12 — Existing Public Well Site
- ★ C-O #18 — Proven Future Public Well Site
- ★ C-O #20 — Proposed Future Public Well Site
- Paved Road
- Unimproved Road
- Railroad Track
- Town Boundary Line
- Marsh Area
- Stream / Edge of Water

SEE TEXT OF ZONING ORDINANCE FOR COMPLETE INFORMATION ON BULK REGULATIONS.

Where a zoning district boundary is located at the edge of a water body, that zone that applies to the land shall apply to structures and uses such as piers and commercial boating operations to the extent of the territorial jurisdiction of the town.

Where zoning district boundaries are located along the edge of a roadway and a distance is shown from such point to another zoning boundary, such distance and points shall be from the edge of the road layout. The ultimate location of such point shall be determined by survey as the line shown on this map is considered an approximation.

Sheet Index Grid



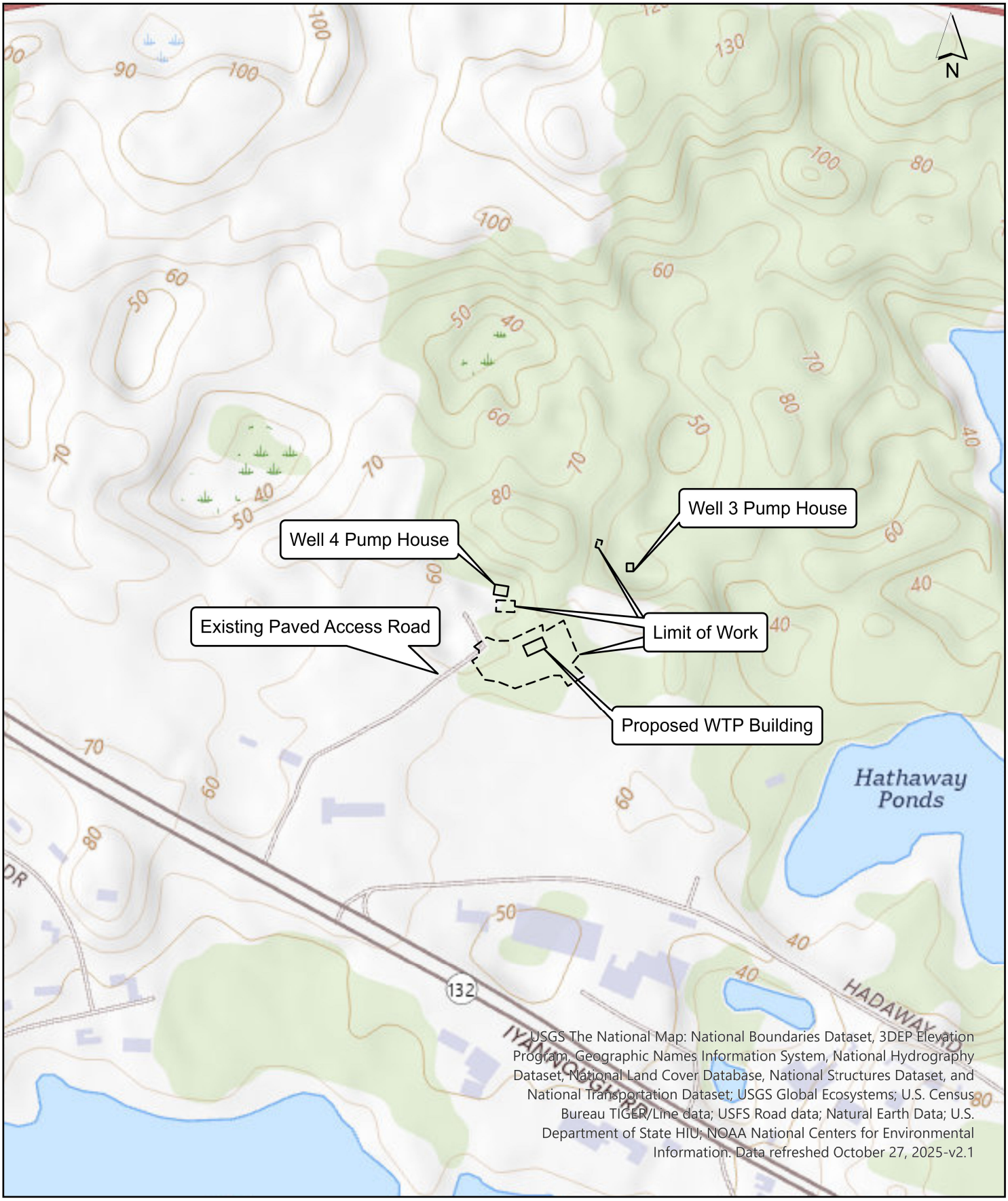
N W E S

SCALE 1"=1800'

feet 3000 2000 1000 0 1/4 1/2 1 mile

1" = 0.34 miles 1:21,600

TOWN OF BARNSTABLE G.I.S. UNIT FILE: townzone.dgn A.N.M. 3-21-2023



0 320 640 1,280 Feet

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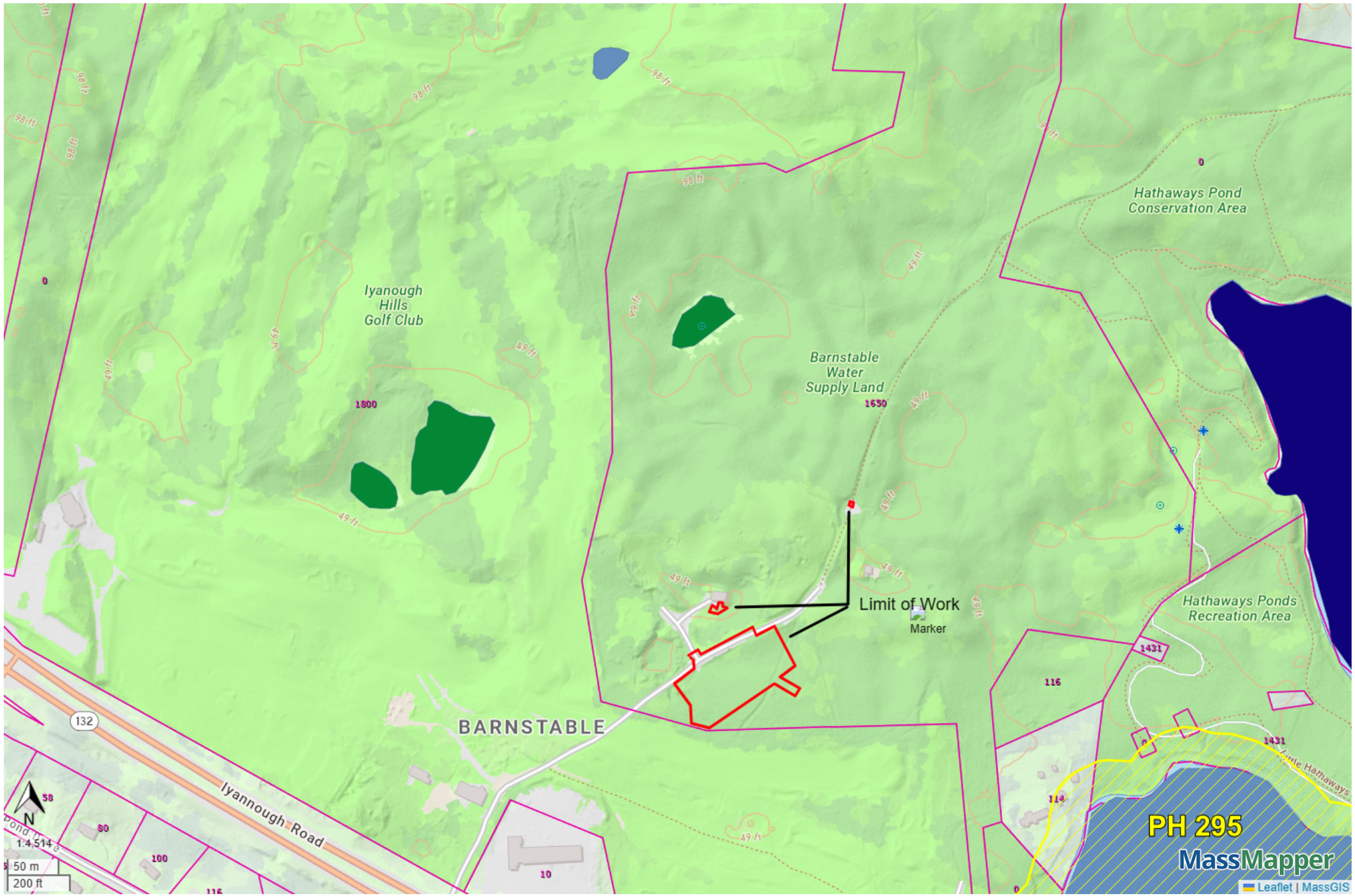
Site Locus Map
Barnstable Fire District Wells 3&4 WTP
Barnstable, Massachusetts
June 2026

MassGIS Environmental Constraints Map



NHESP Priority Habitats of Rare Species

Potential Vernal Pools

NHESP Certified Vernal Pools

Areas of Critical Environmental Concern
ACECs Transparent Green

NWI Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Other

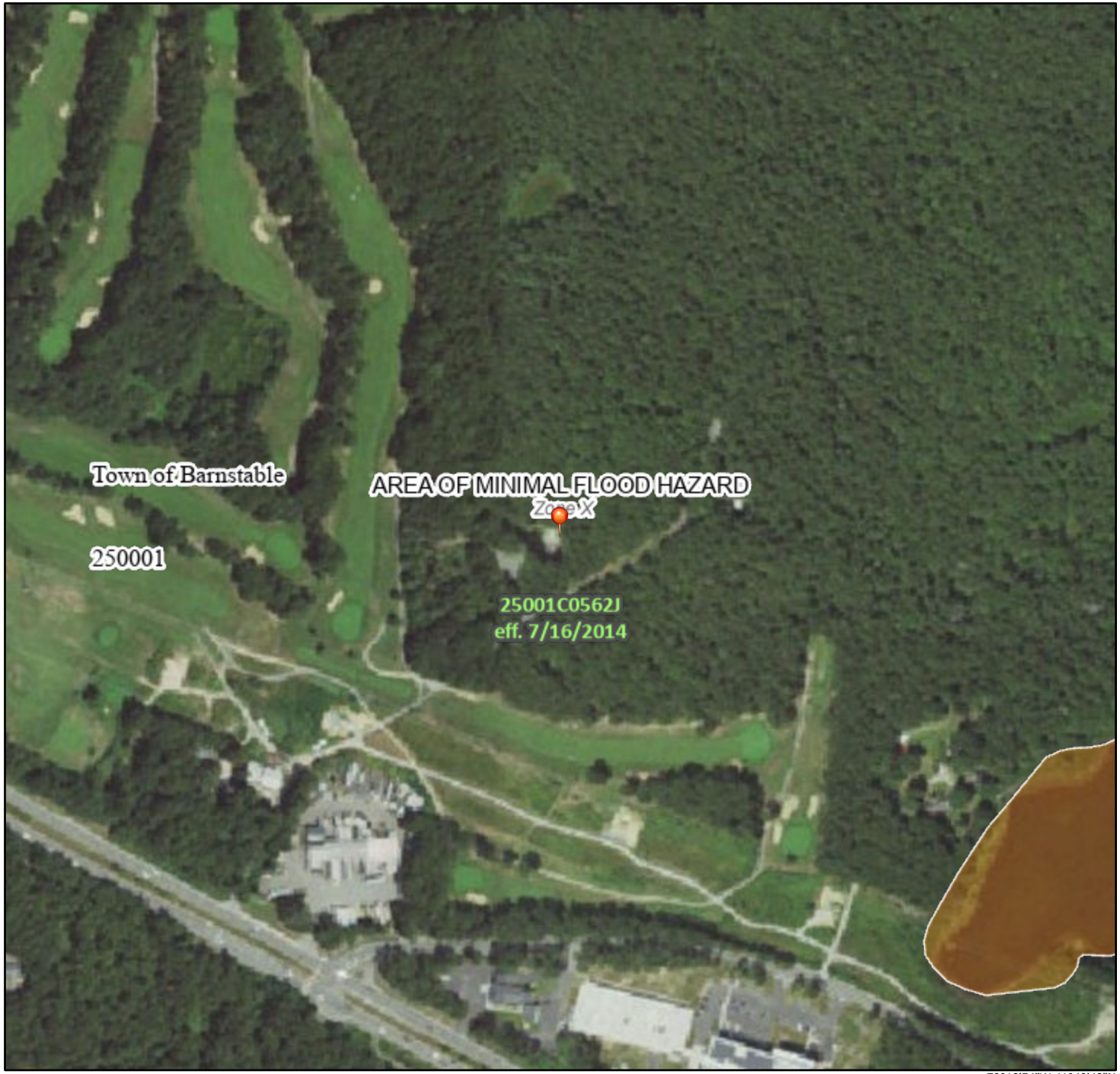
Property Tax Parcels

Printed May 4, 2026

National Flood Hazard Layer FIRMette

FEMA

70°19'32"W 41°41'15"N



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Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

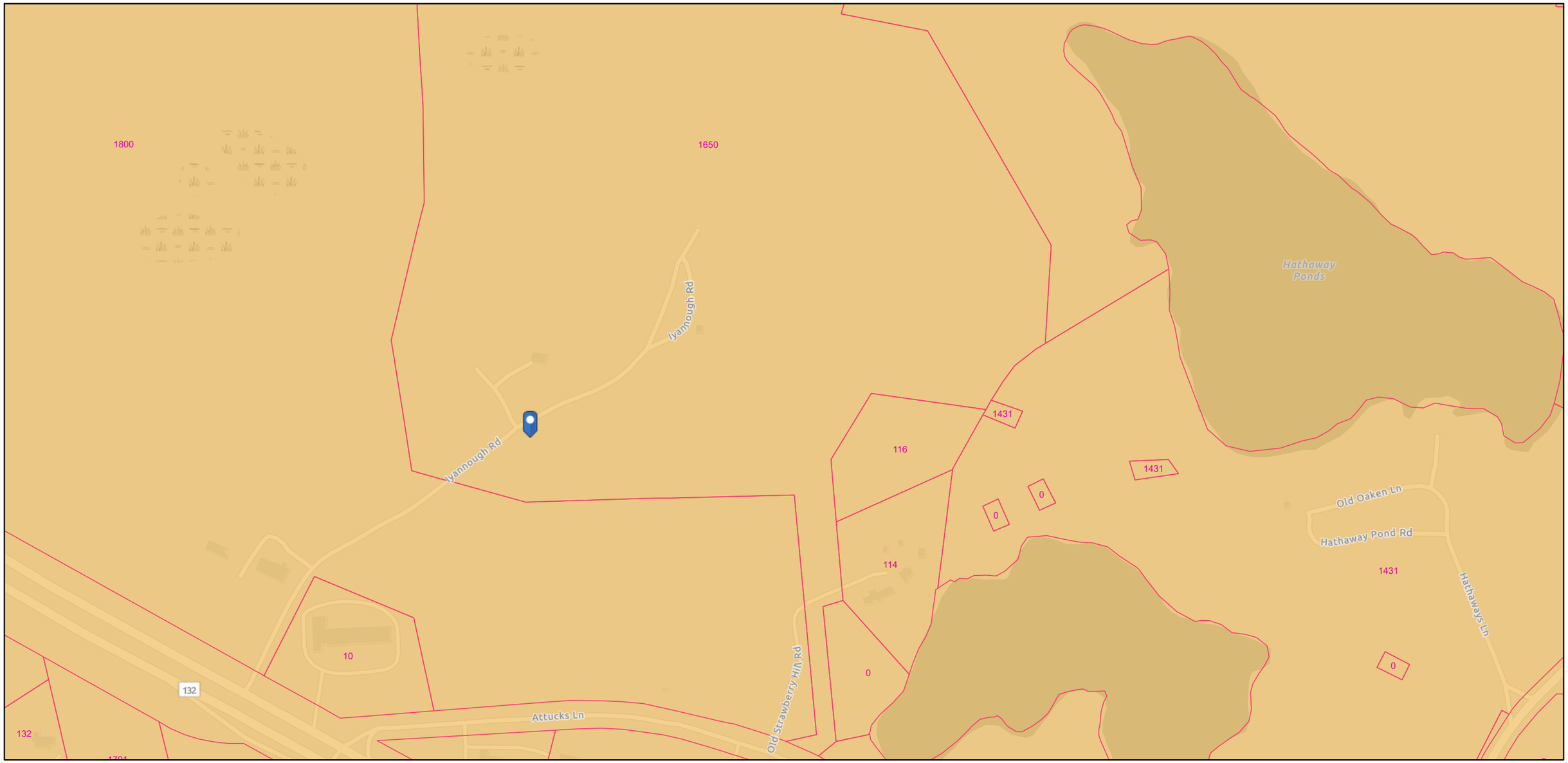
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/6/2026 at 3:26 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Barnstable Fire District Wells 3&4 WTP



4/28/2026, 9:24:33 AM

MassachusettsTMDL_DrainageEstimates

Pathogens

Massachusetts Parcels Feature Layer

1:4,514

0 0.04 0.07 0.15 mi

0 0.05 0.1 0.2 km

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

This map is for planning purposes and represents only the approximate relative location of property, boundaries, or regulated areas and do not take the place of a legal survey or other primary source documentation.

Appendix D – Design Drawings

BARNSTABLE WATER DEPARTMENT
WELLS 3 & 4 WTP

Hyannis Golf Course, Barnstable, Massachusetts

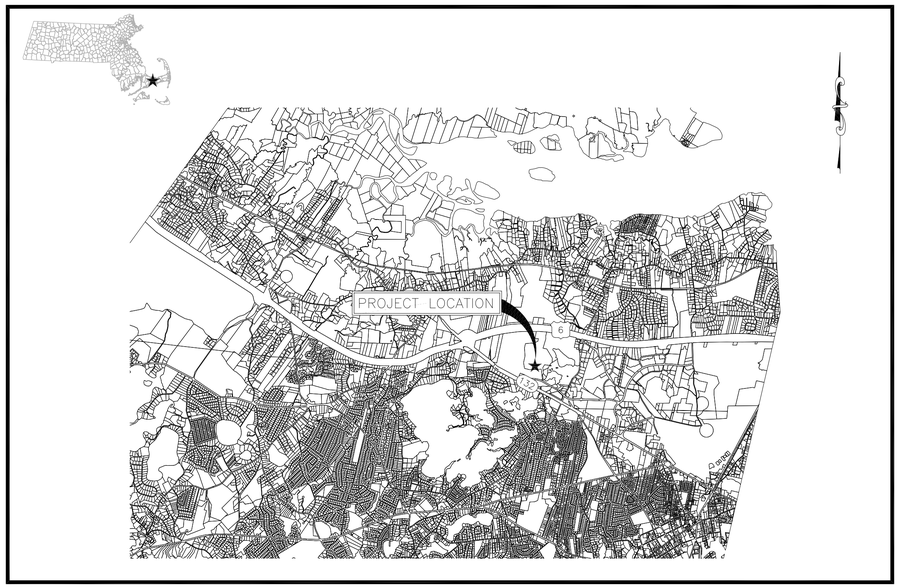
Prepared For:

BARNSTABLE FIRE DISTRICT, WATER DEPARTMENT

P.O. Box 546
Barnstable, Massachusetts
Sean Anderson, Superintendent

Index of Drawings

Sheet No.	Dwg. No.	Description
1	-	COVER SHEET
		CIVIL SHEETS
2	C-1	EXISTING CONDITIONS
3	C-2	SITE LAYOUT
4	C-3	SITE PREPARATION PLAN
5	C-4	UTILITY PLAN
6	C-5	STORMWATER MANAGEMENT PLAN
7	C-6	GRADING AND PAVEMENT PLAN
8	C-7	WELL #4 SITE PLAN
9	C-8	END OF ACCESS ROAD SITE PLAN
10	C-9	LANDSCAPING PLAN
11	C-10	STORMWATER BASIN SECTIONS
12	C-11	RINSEWATER INFILTRATION BASIN SECTIONS
13	C-12	CIVIL DETAILS I
14	C-23	CIVIL DETAILS II
15	C-24	CIVIL DETAILS III
16	C-15	CIVIL DETAILS IV
17	C-16	CIVIL DETAILS V
18	C-17	CIVIL DETAILS VI



Locus Plan
SCALE: 1"=5000'

Contract No. 127.25.01
FOR PERMITTING
JUNE 2026

STEPHEN C. OLSON
6/4/26

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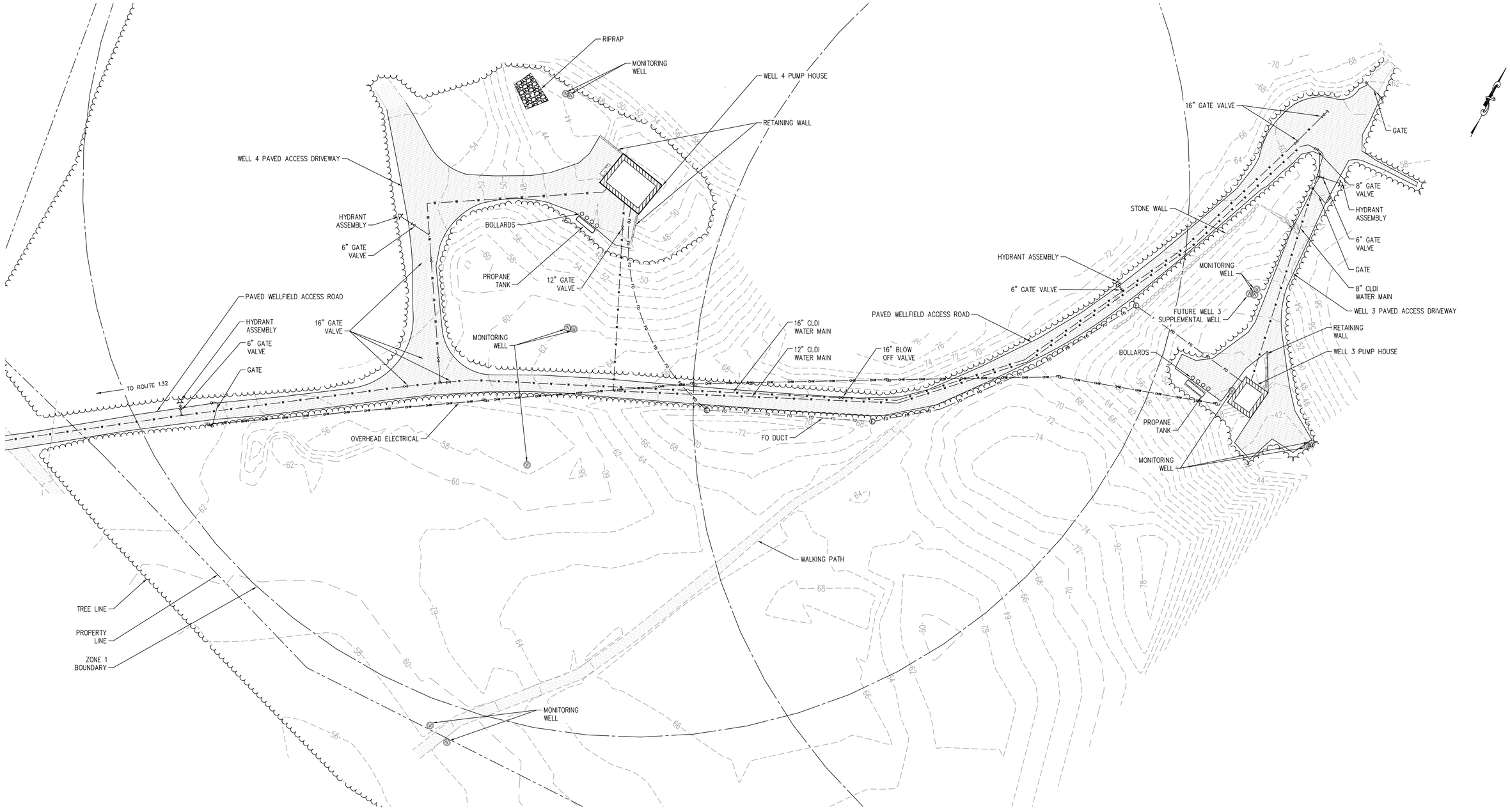

PLAN VIEW

SCALE: 1" = 35'

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REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

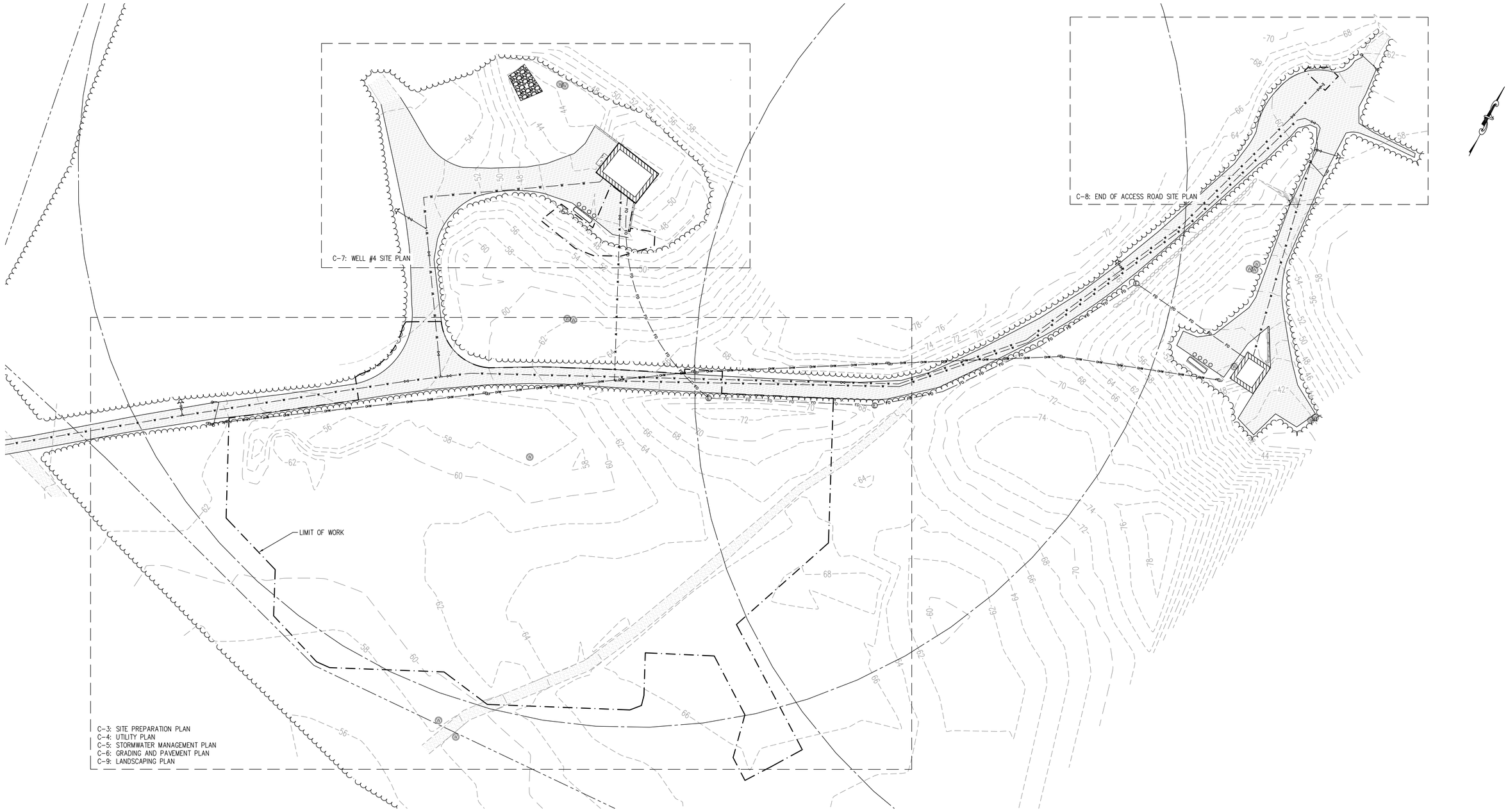
BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
EXISTING CONDITIONS

DRAWING NO.:
C-1

SHEET NO. 2 OF 18

C:\Users\GenevieveH\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire Distrtch\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\XRefs\XR_Existing.dwg



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BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: SITE LAYOUT

DRAWING NO.: C-2

SHEET NO. 3 OF 18

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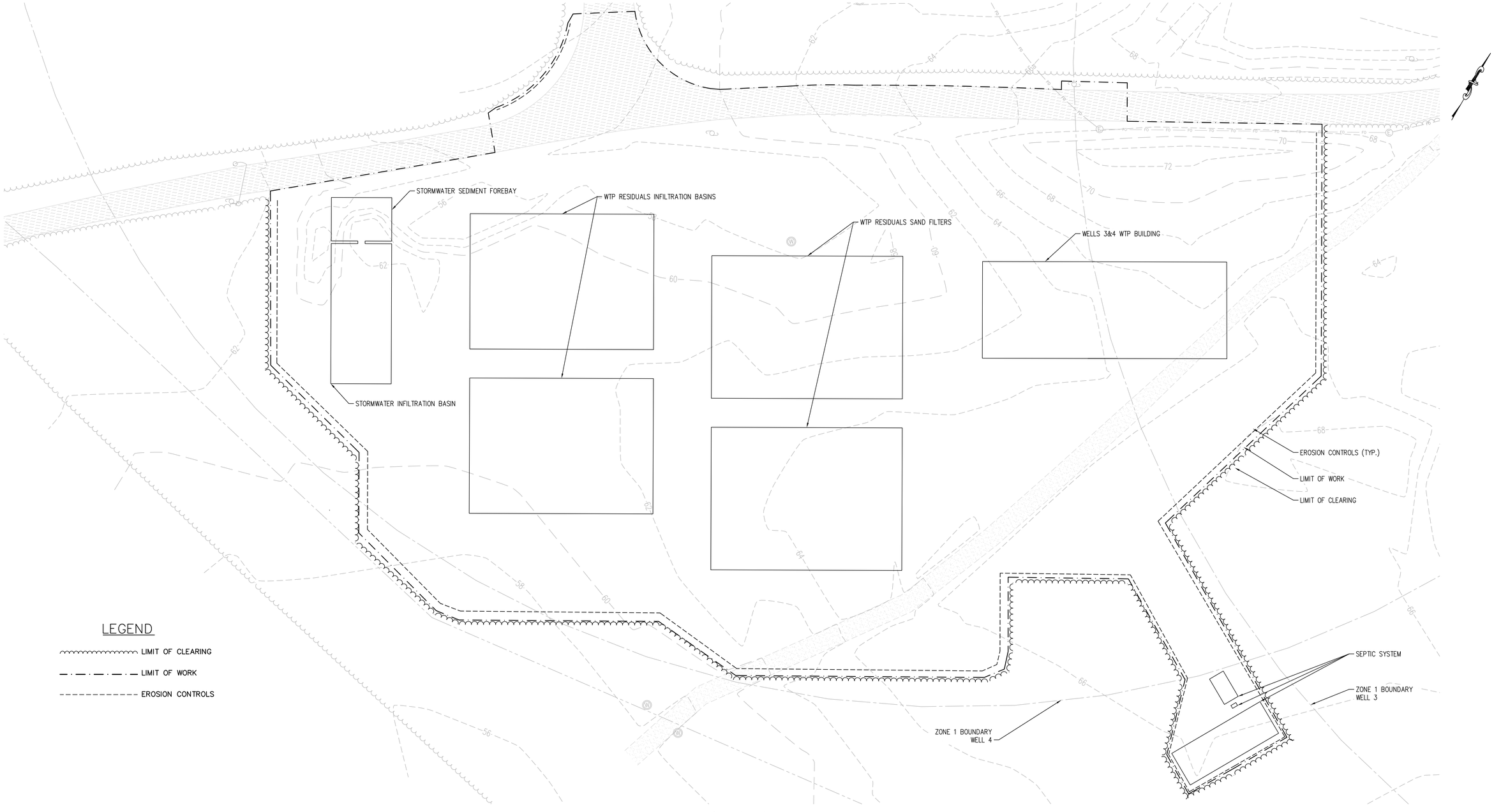

PLAN VIEW

SCALE: 1" = 20'

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6/4/26

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APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
SITE PREPARATION PLAN

DRAWING NO.:
C-3

SHEET NO. 4 OF 18

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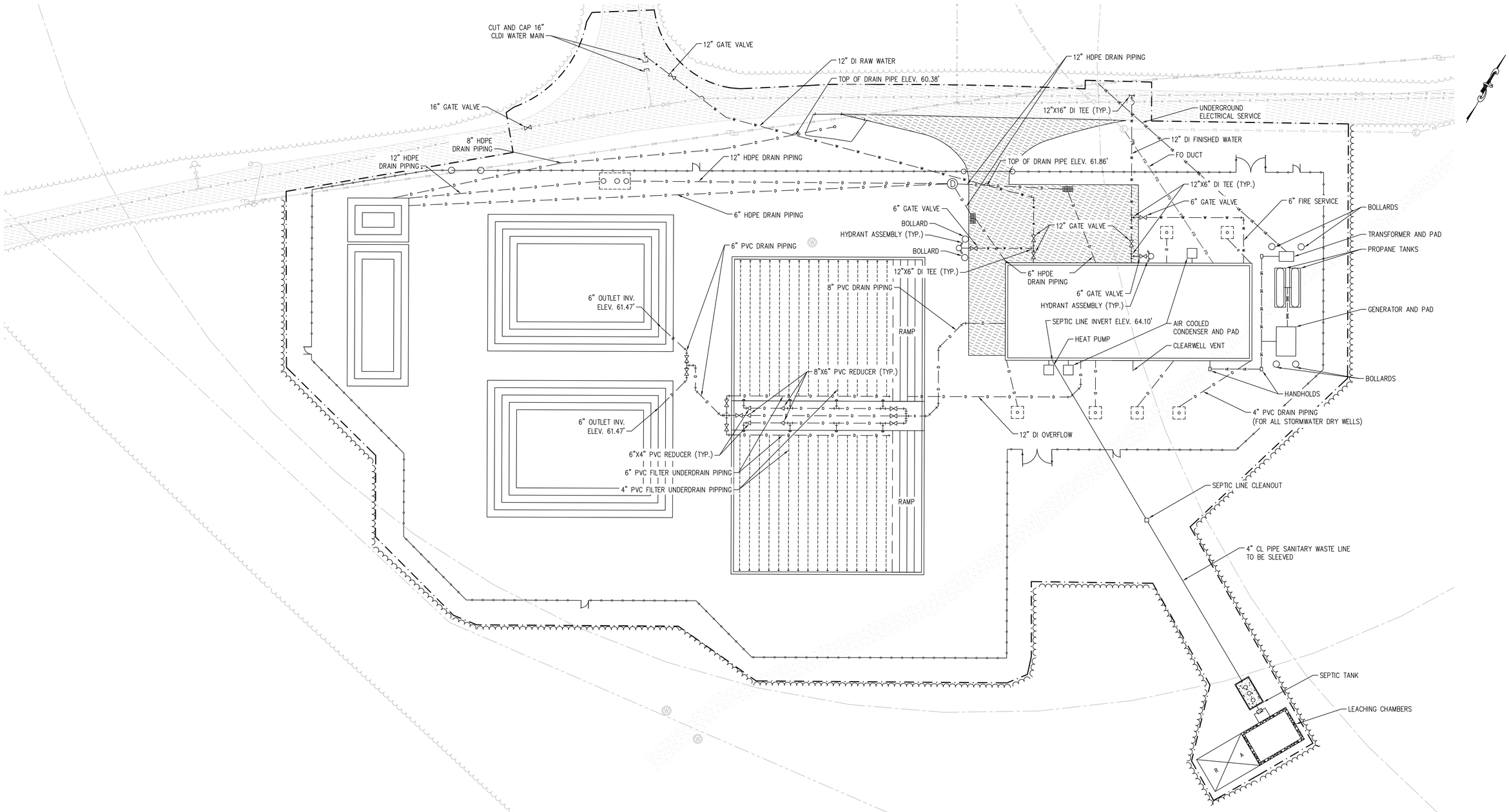

PLAN VIEW

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NO.	DATE	DESCRIPTION

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DATE:	JUNE 2026
SCALE:	1" = 20'
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APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

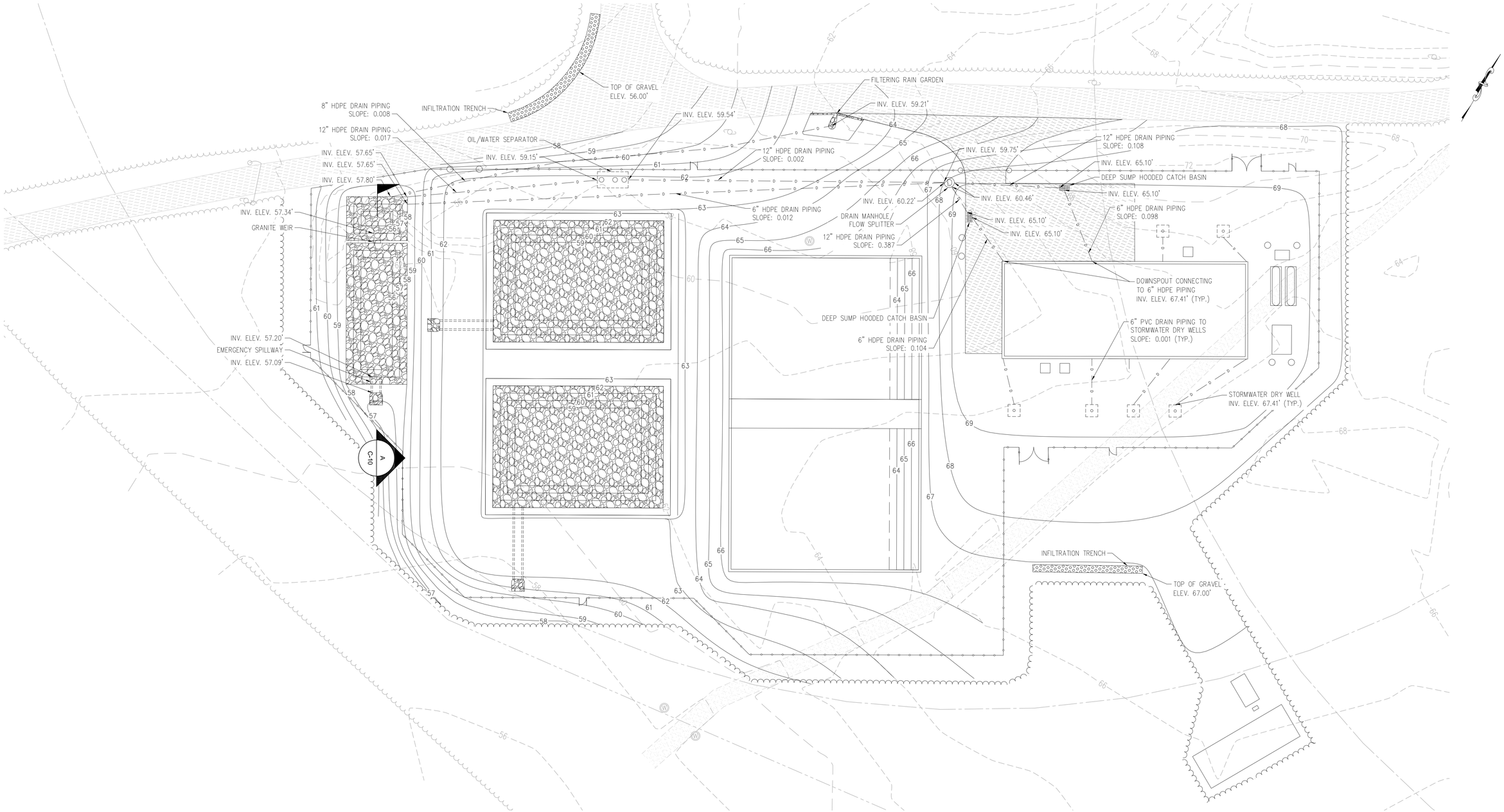
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: UTILITY PLAN

DRAWING NO.: C-4

SHEET NO. 5 OF 18

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C Sheets.dwg



PLAN VIEW

SCALE: 1" = 20'

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DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
STORMWATER MANAGEMENT PLAN

DRAWING NO.:
C-5

SHEET NO. 6 OF 18

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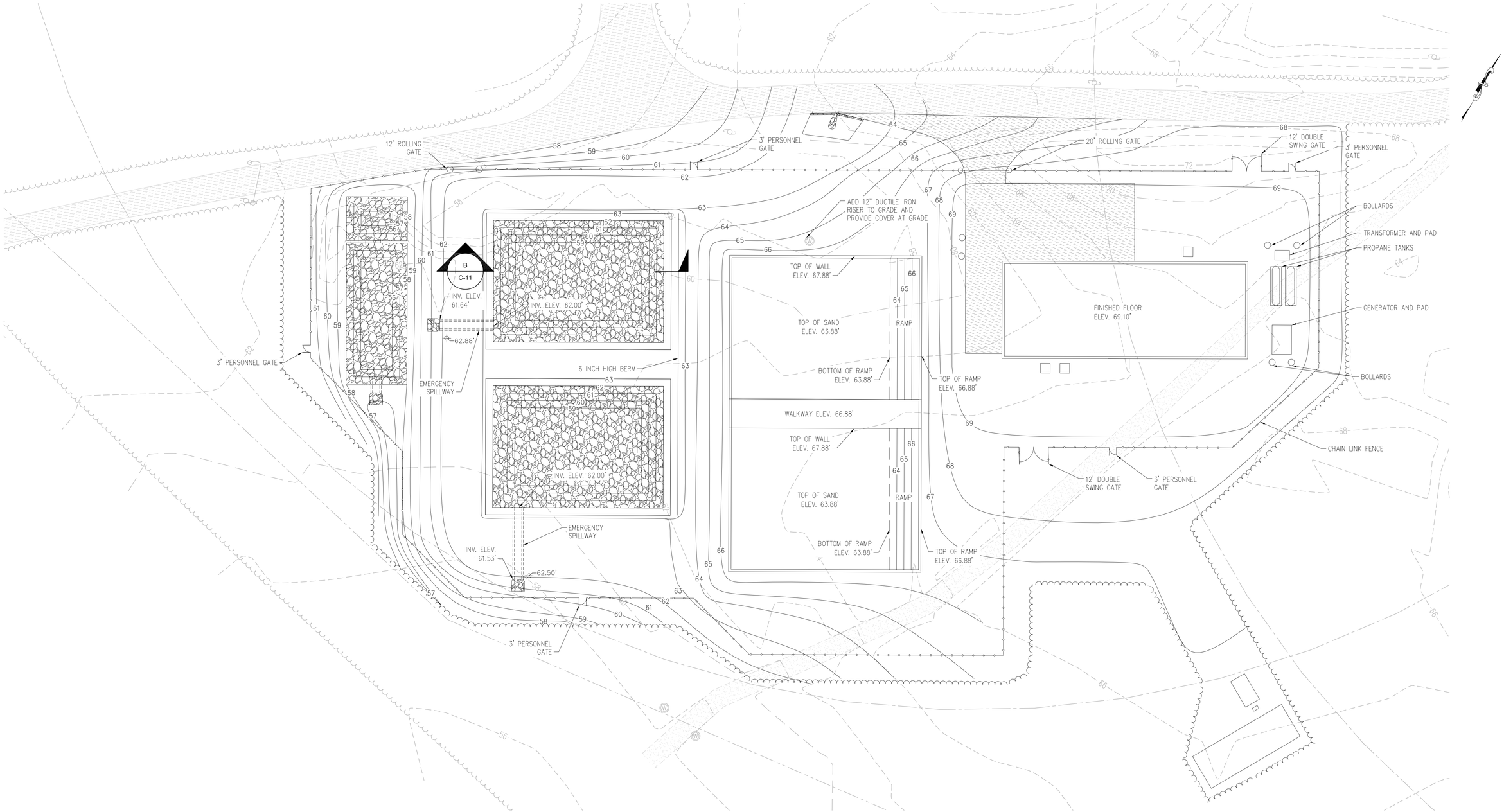

PLAN VIEW

SCALE: 1" = 20'

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NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 20'
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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
GRADING AND PAVEMENT PLAN

DRAWING NO.:
C-6

SHEET NO. 7 OF 18

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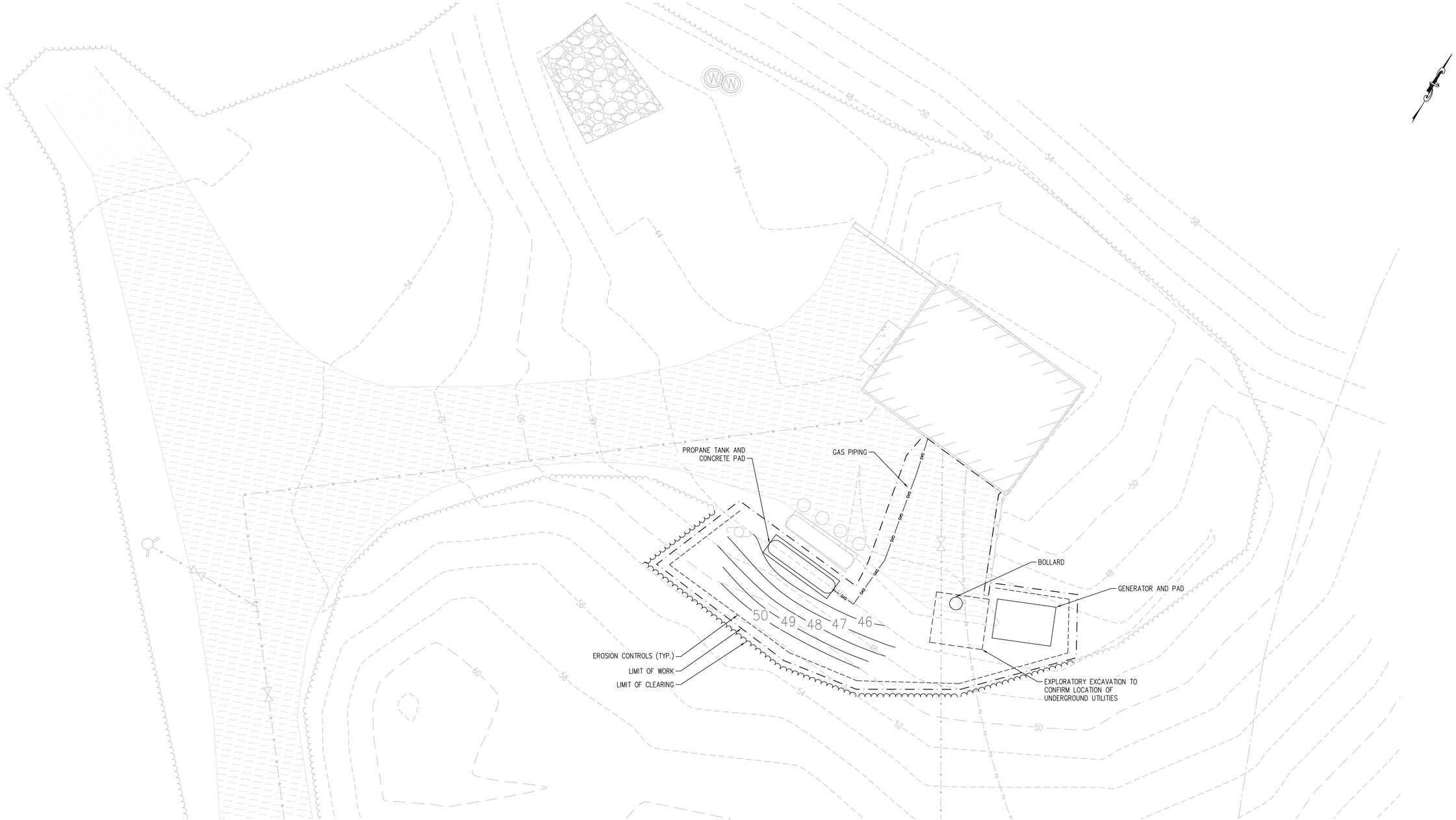

PLAN VIEW

SCALE: 1" = 10'

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WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
WELL #4
SITE PLAN

DRAWING NO.:
C-7

SHEET NO. 8 OF 18

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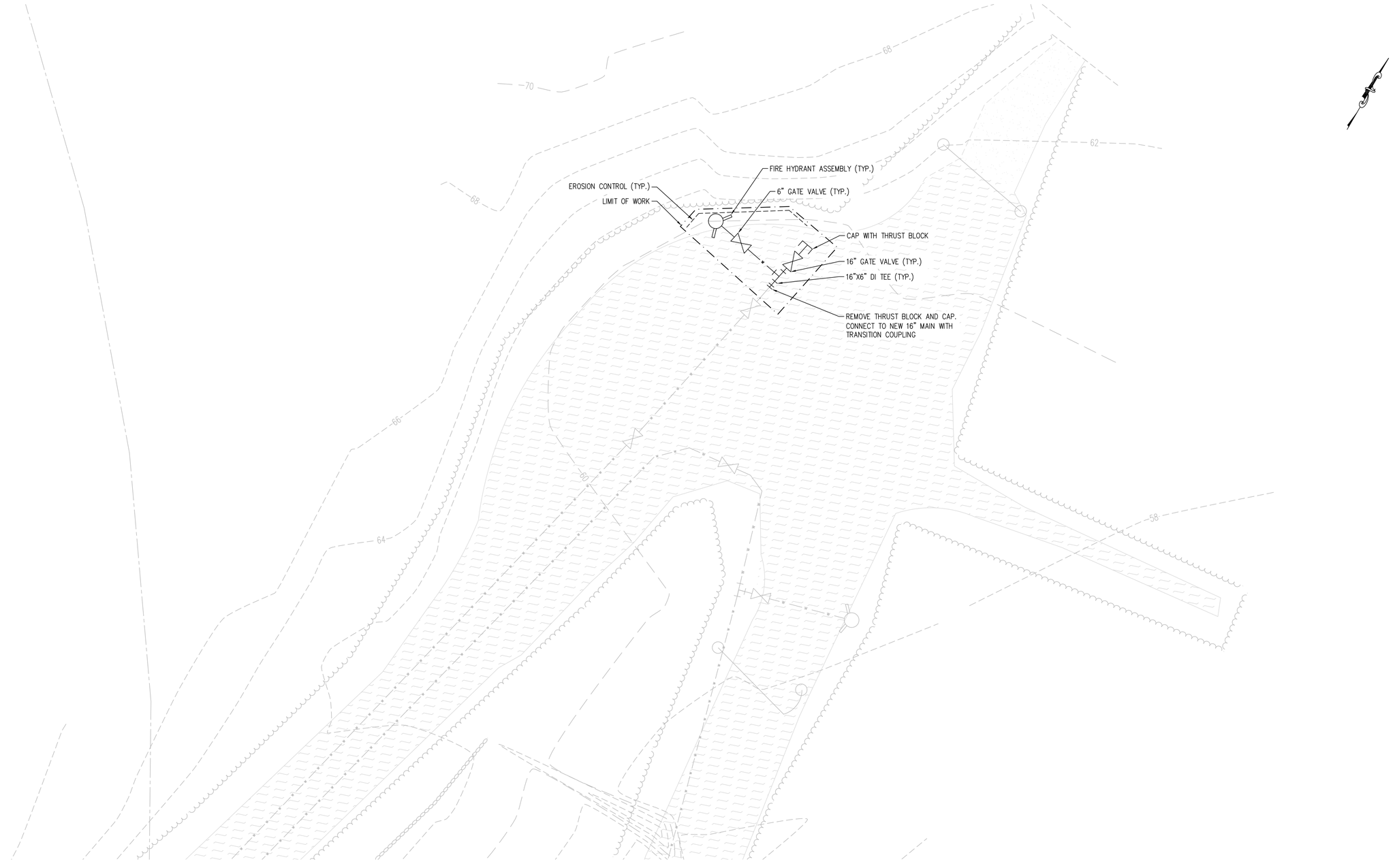

PLAN VIEW

SCALE: 1" = 8'

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COMMONWEALTH OF MASSACHUSETTS
STEPHEN C. OLSON
No. 49386
REGISTERED PROFESSIONAL ENGINEER
6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
END OF ACCESS ROAD SITE PLAN

DRAWING NO.:
C-8

SHEET NO. 9 OF 18

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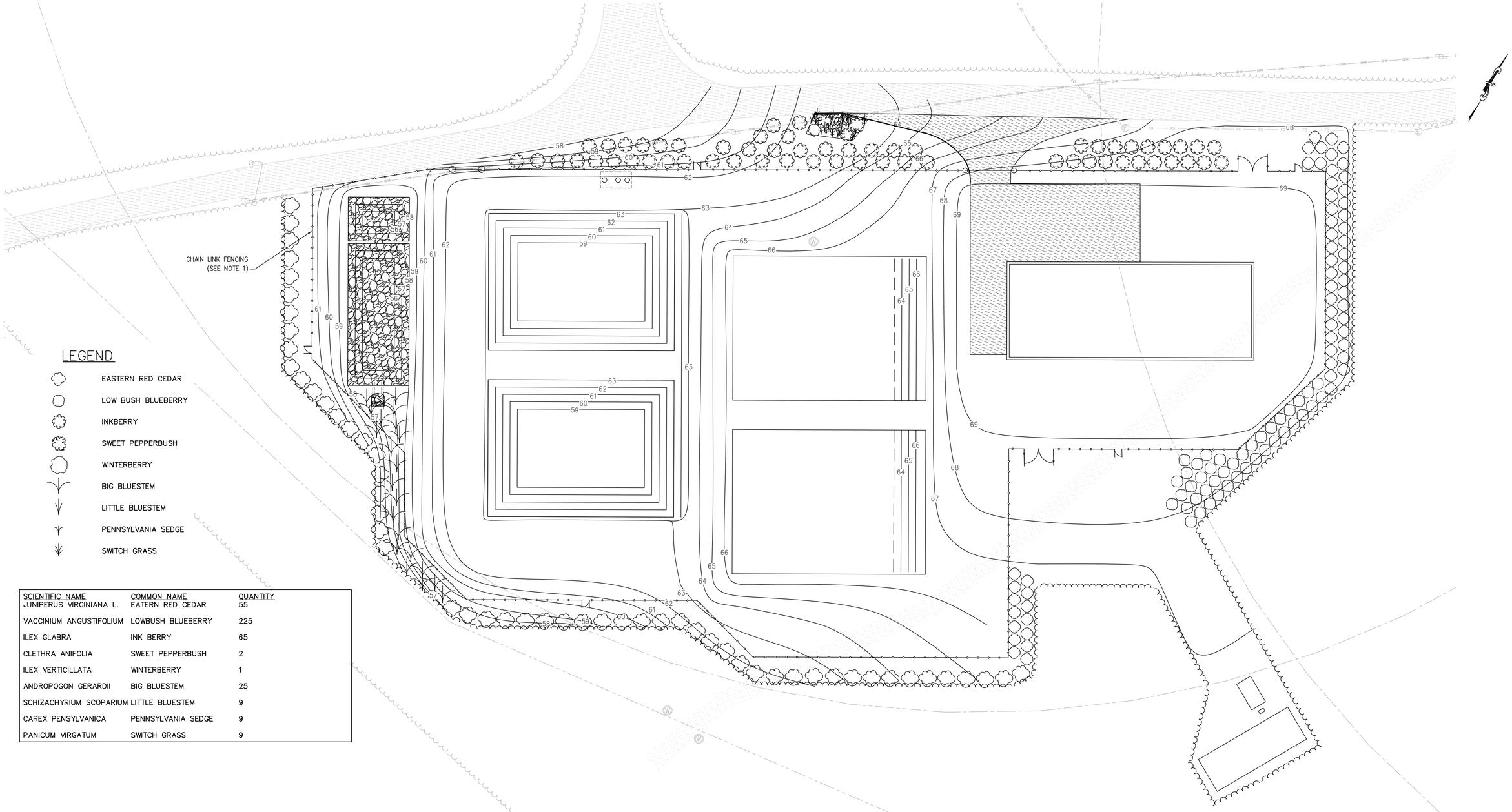

SCIENTIFIC NAME	COMMON NAME	QUANTITY
JUNIPERUS VIRGINIANA L.	EATERN RED CEDAR	55
VACCINIUM ANGUSTIFOLIUM	LOWBUSH BLUEBERRY	225
ILEX GLABRA	INK BERRY	65
CLETHRA ANIFOLIA	SWEET PEPPERBUSH	2
ILEX VERTICILLATA	WINTERBERRY	1
ANDROPOGON GERARDII	BIG BLUESTEM	25
SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	9
CAREX PENSYLVANICA	PENNSYLVANIA SEDGE	9
PANICUM VIRGATUM	SWITCH GRASS	9

NOTES:

1. CHAIN LINK FENCING SHALL BE SEVEN FEET TALL.

PLAN VIEW

SCALE: 1" = 20'

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BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
LANDSCAPING PLAN

DRAWING NO.:
C-9

SHEET NO. 10 OF 18

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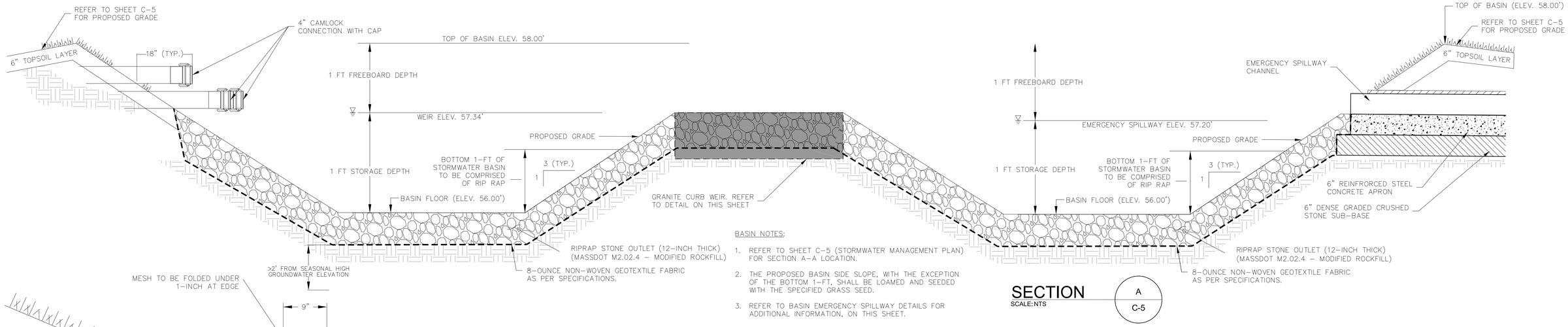


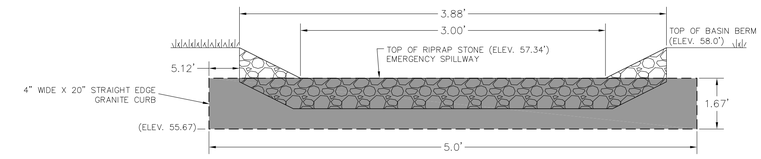
BASIN NOTES:

1. REFER TO SHEET C-5 (STORMWATER MANAGEMENT PLAN) FOR SECTION A-A LOCATION.
2. THE PROPOSED BASIN SIDE SLOPE, WITH THE EXCEPTION OF THE BOTTOM 1-FT, SHALL BE LOAMED AND SEEDED WITH THE SPECIFIED GRASS SEED.
3. REFER TO BASIN EMERGENCY SPILLWAY DETAILS FOR ADDITIONAL INFORMATION, ON THIS SHEET.

SECTION A

SCALE: NTS

A / C-5

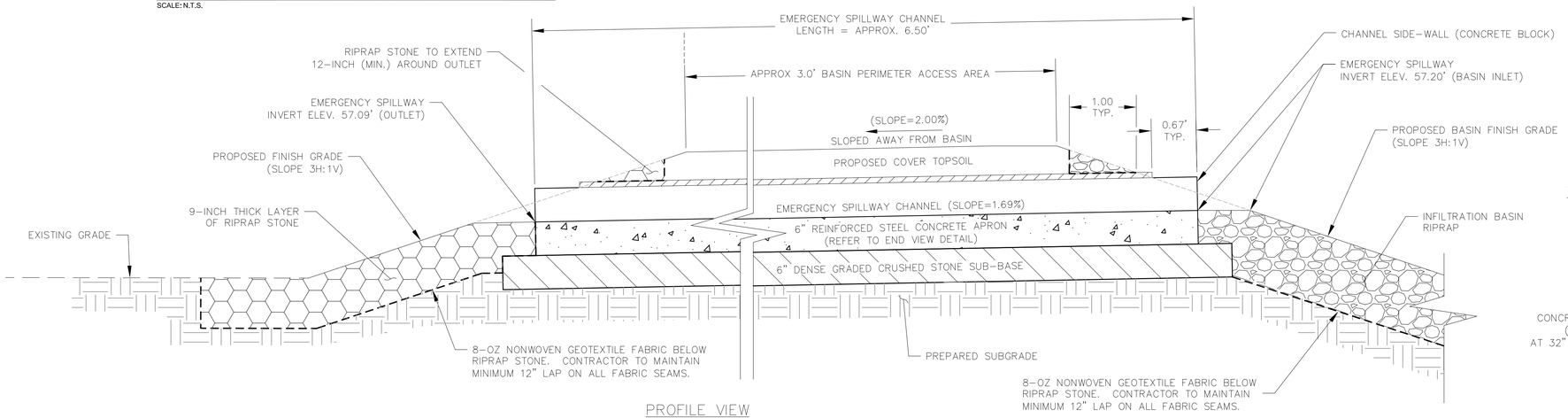


GRANITE CURB WEIR DETIAL

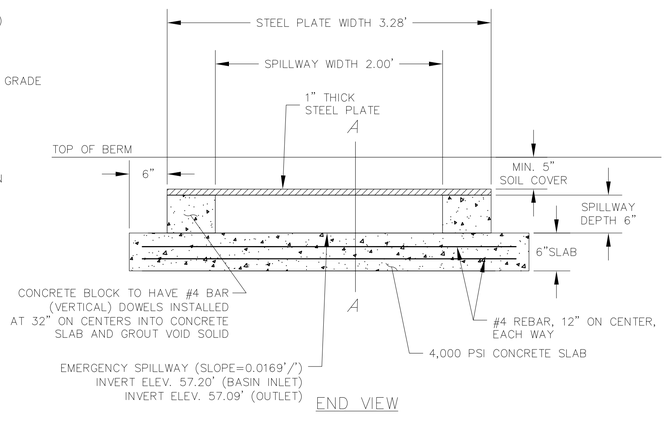
SCALE: N.T.S.

STORMWATER OUTLET DETIAL

SCALE: N.T.S.



PROFILE VIEW



END VIEW

EMERGENCY SPILLWAY DETAIL

SCALE: N.T.S.

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BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: STORMWATER BASIN SECTIONS

DRAWING NO.: C-10

SHEET NO. 11 OF 18

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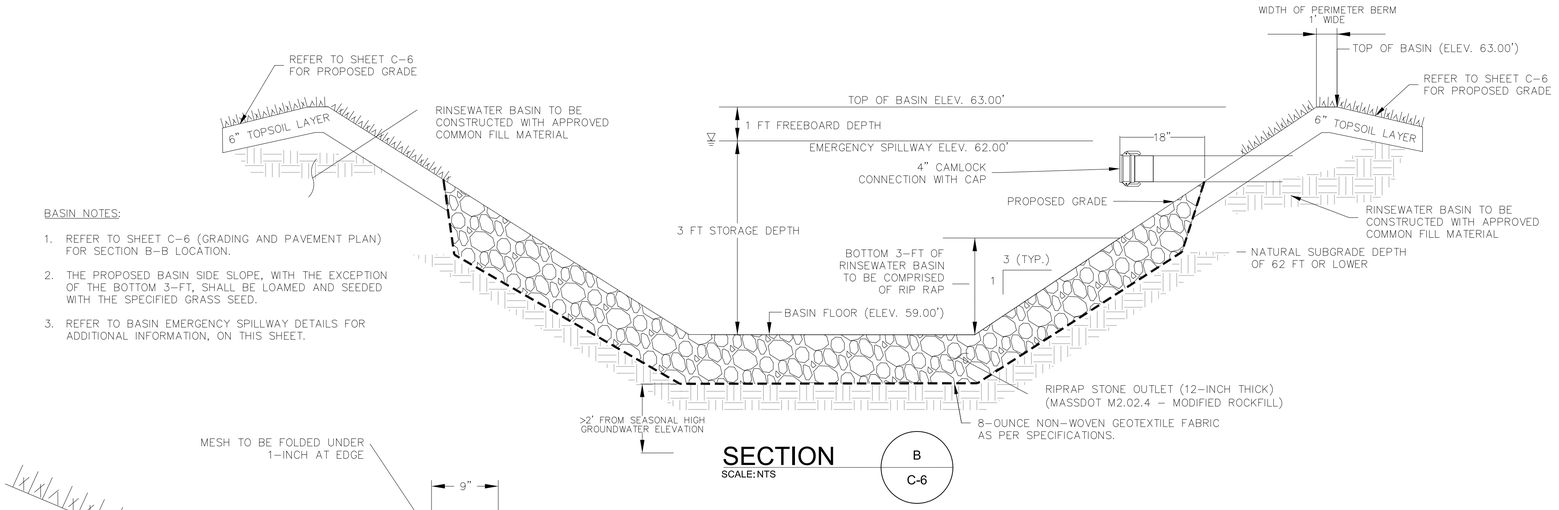


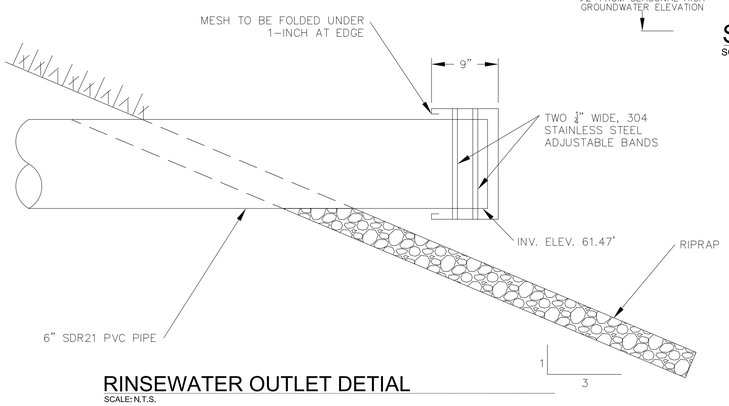
BASIN NOTES:

1. REFER TO SHEET C-6 (GRADING AND PAVEMENT PLAN) FOR SECTION B-B LOCATION.
2. THE PROPOSED BASIN SIDE SLOPE, WITH THE EXCEPTION OF THE BOTTOM 3-FT, SHALL BE LOAMED AND SEEDED WITH THE SPECIFIED GRASS SEED.
3. REFER TO BASIN EMERGENCY SPILLWAY DETAILS FOR ADDITIONAL INFORMATION, ON THIS SHEET.

SECTION

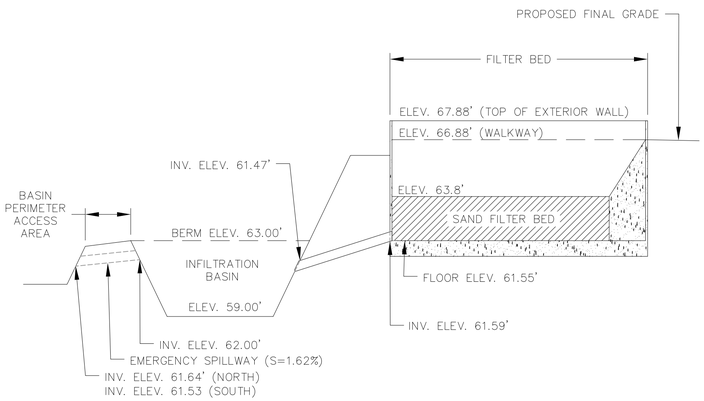
SCALE: NTS

B / C-6



RINSEWATER OUTLET DETIAL

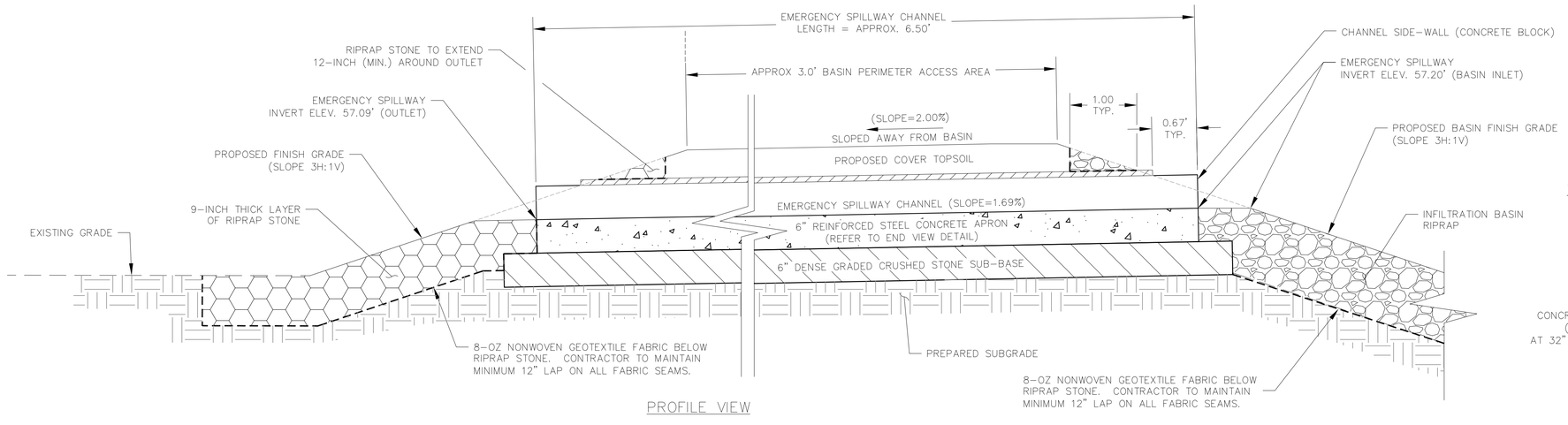
SCALE: N.T.S.



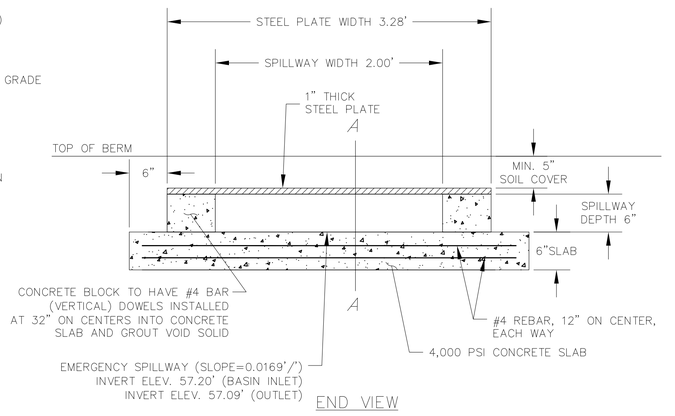
NOTE:
1. PROPOSED SYSTEM IS COMPRISED OF 2 SAND FILTER BEDS AND TWO INFILTRATION BASINS. SECTION SHOWN IS REPRESENTATIVE OF TYPICAL SYSTEM ELEVATIONS.

FILTER BED & INFILTRATION BASIN SYSTEM SECTION

SCALE: N.T.S.



PROFILE VIEW



END VIEW

EMERGENCY SPILLWAY DETAIL

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STEPHEN C. OLSON
No. 37886
REGISTERED PROFESSIONAL ENGINEER
6/4/26

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BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
RINSEWATER INFILTRATION BASIN SECTIONS

DRAWING NO.:
C-11

SHEET NO. 12 OF 18

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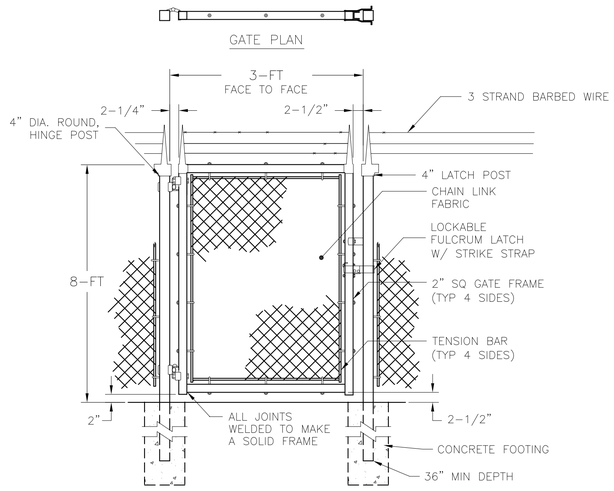
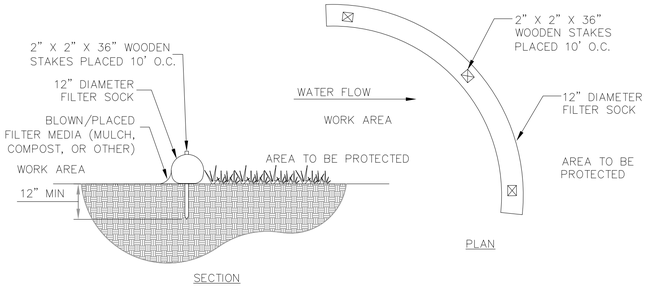


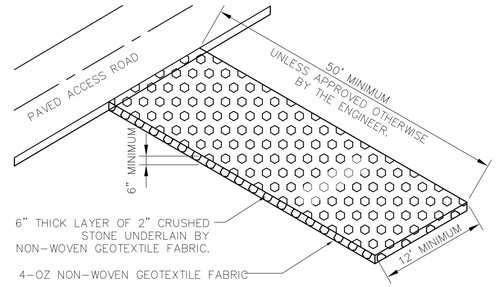
PERSONEL GATE DETAIL

SCALE: N.T.S.



SEDIMENTATION CONTROL BARRIER

SCALE: NOT TO SCALE

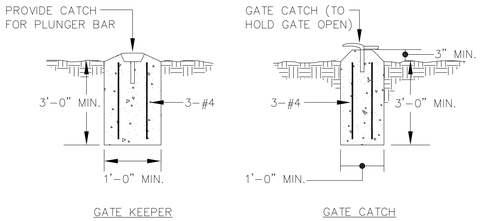


ENTRANCE PAD NOTES:

1. NON–WOVEN GEOTEXTILE FABRIC SHALL BE PLACED OVER THE ENTIRE AREA OF THE CONSTRUCTION ENTRANCE PRIOR TO PLACING STONE.
2. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING SEDIMENT ONTO PUBLIC RIGHT–OF WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, WASHED, OR TRACKED ONTO PUBLIC RIGHT–OF–WAY MUST BE REMOVED PROMPTLY.
3. AT THE COMPLETION OF CONSTRUCTION THE CONTRACTOR SHALL REMOVE THE CONSTRUCTION ENTRANCE PAD AND RESTORE THE SURFACE TO ORIGINAL CONDITION.

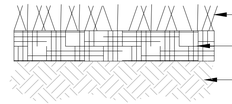
CONSTRUCTION ENTANCE PAD

SCALE: NOT TO SCALE



TYPICAL GATE KEEPER & CATCH DETAIL

SCALE: N.T.S.

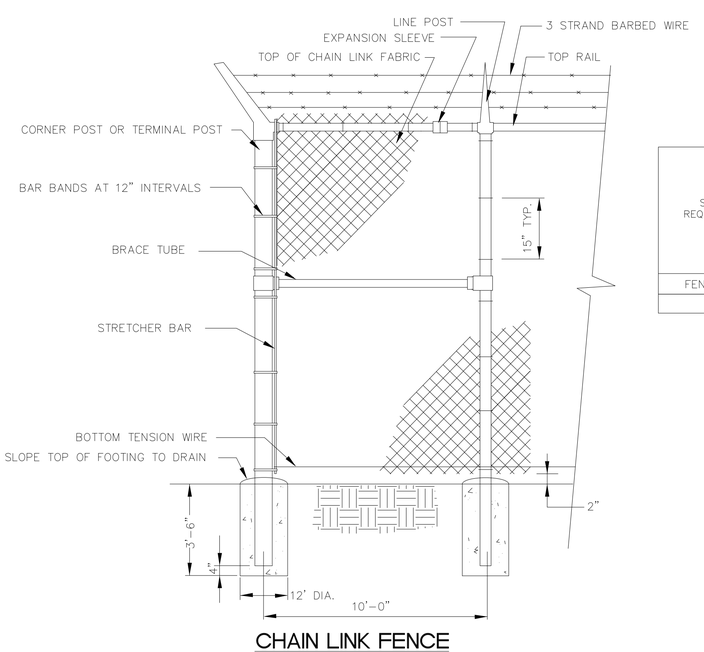


NOTES

1. ALL GRASSED SURFACE SLOPES STEEPER THAN 7H:1V SLOPE SHALL INCLUDE THE INSTALLATION OF EROSION CONTROL BLANKET AFTER THE LOAM, SEED AND FERTILIZER HAVE BEEN PLACE.
2. MATERIAL SPECIFICATIONS FOR THE EROSION CONTROL BLANKET SHALL MEET CURLEX II EROSION CONTROL BLANKET AS MANUFACTURED BY AMERICAN EXCELSIOR COMPANY, OR EQUAL.

GRASSED VEGETATED SURFACE

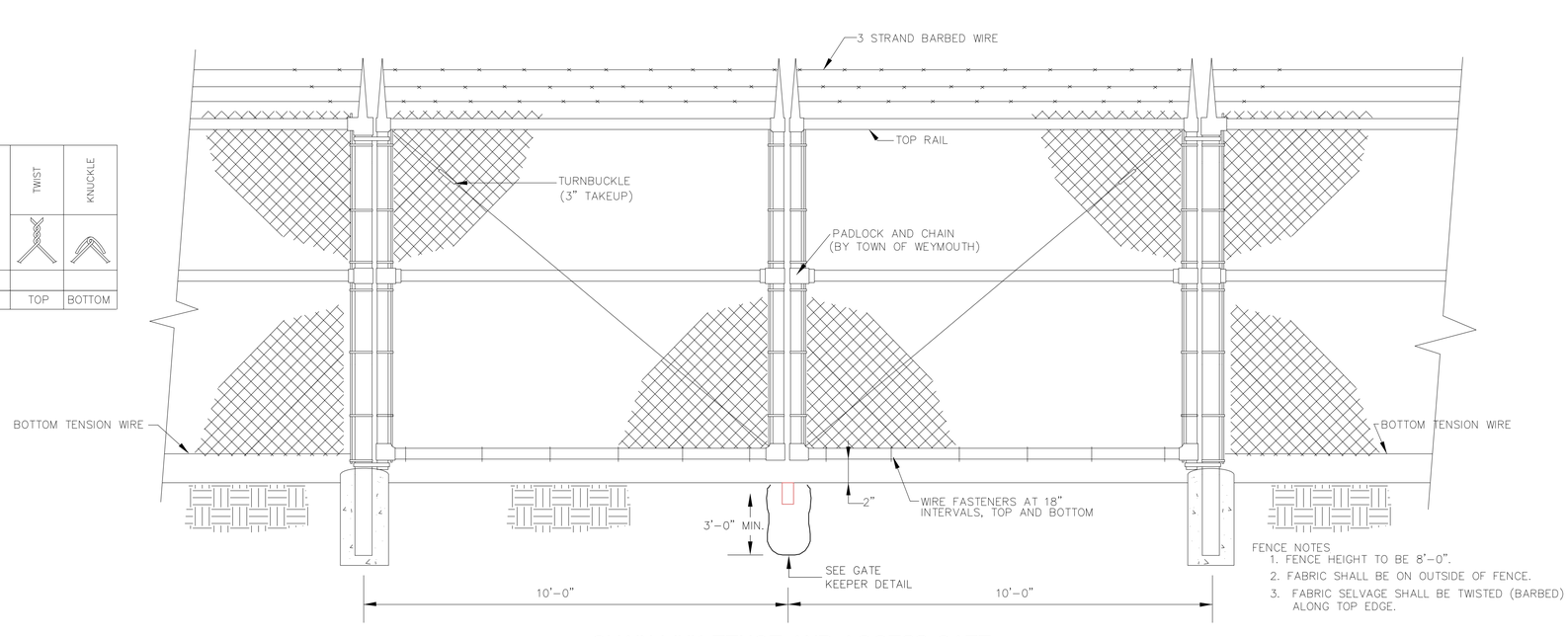
SCALE: NOT TO SCALE



SELVAGE REQUIREMENTS	TWIST	KNUCKLE
FENCE HEIGHT		
8'–0"	TOP	BOTTOM

CHAIN LINK FENCE

N.T.S.



FENCE NOTES

1. FENCE HEIGHT TO BE 8'–0".
2. FABRIC SHALL BE ON OUTSIDE OF FENCE.
3. FABRIC SELVAGE SHALL BE TWISTED (BARBED) ALONG TOP EDGE.

CHAIN LINK FENCE AND ACCESS GATE

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APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS I

DRAWING NO.:
C-12

SHEET NO. 13 OF 18

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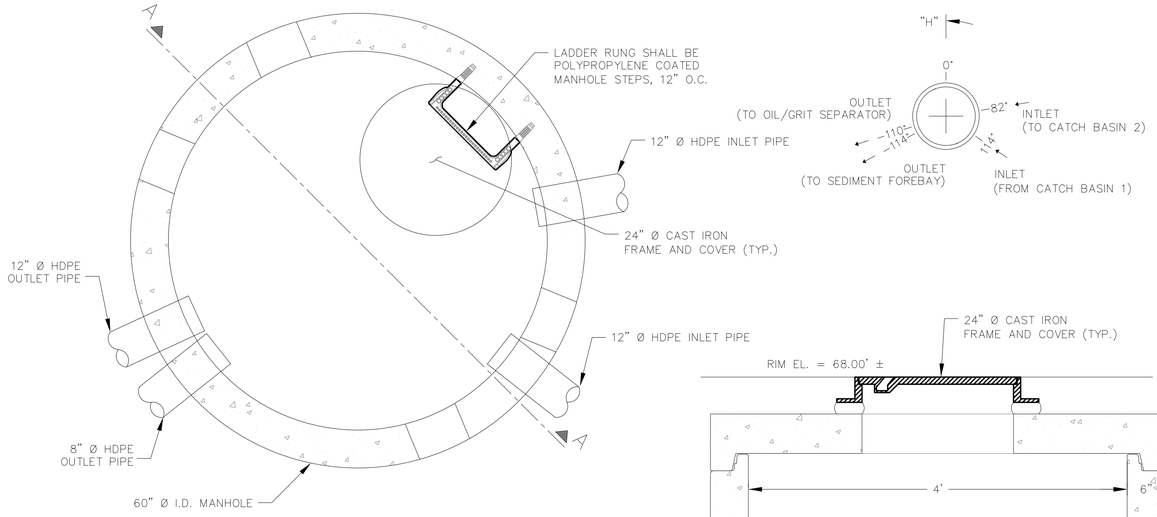
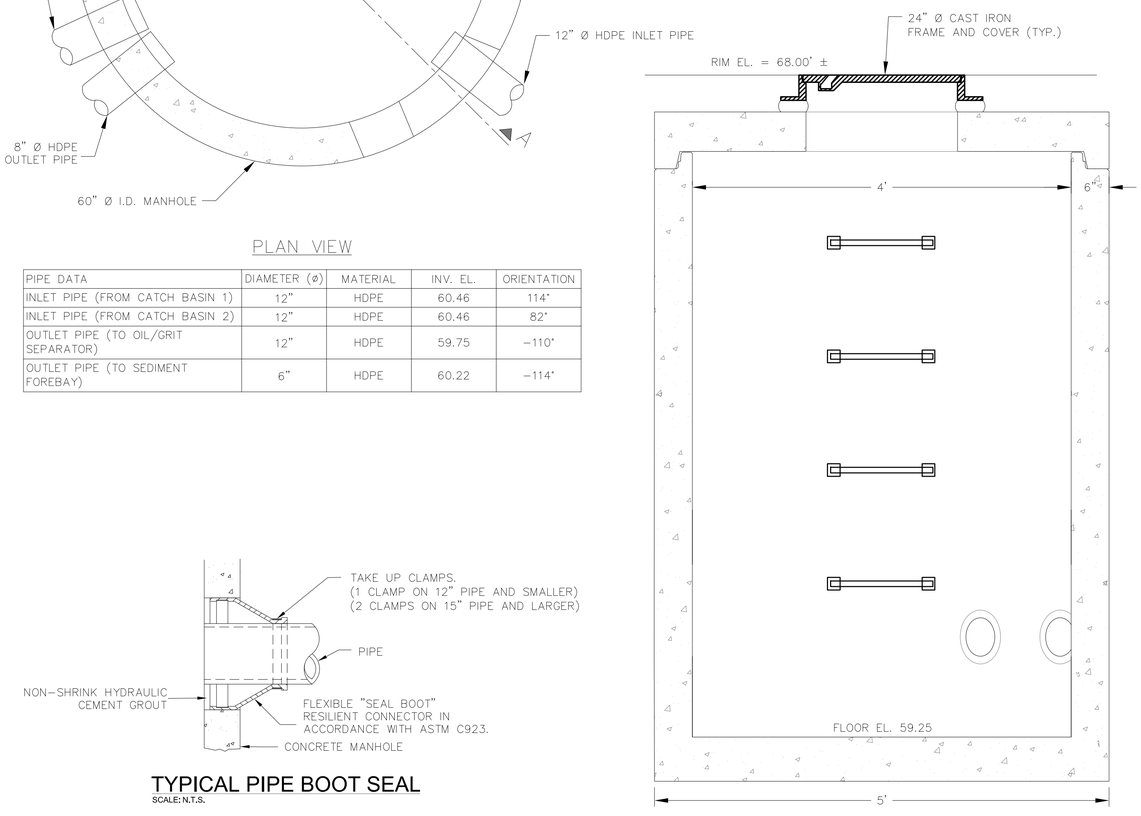


PLAN VIEW

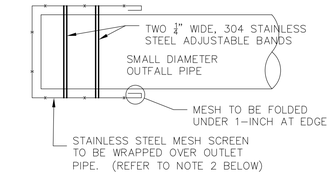
PIPE DATA	DIAMETER (ø)	MATERIAL	INV. EL.	ORIENTATION
INLET PIPE (FROM CATCH BASIN 1)	12"	HDPE	60.46	114°
INLET PIPE (FROM CATCH BASIN 2)	12"	HDPE	60.46	82°
OUTLET PIPE (TO OIL/GRIT SEPARATOR)	12"	HDPE	59.75	-110°
OUTLET PIPE (TO SEDIMENT FOREBAY)	6"	HDPE	60.22	-114°



SECTION A-A

OUTLET CONTROL STRUCTURE DETAIL
SCALE: N.T.S.

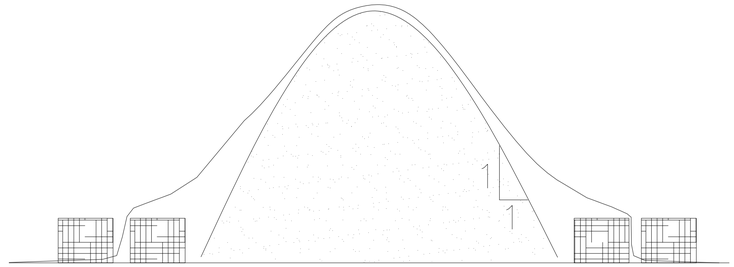
TYPICAL PIPE BOOT SEAL
SCALE: N.T.S.



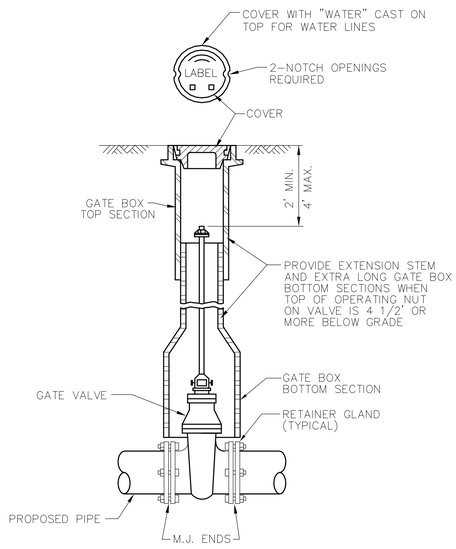
OUTLET SCREEN NOTE:

1. OUTLET SCREEN TO BE INSTALL ON SMALL DIAMETER OUTFALL PIPING, AS CALLED OUT ON THE PLANS.
2. MESH SCREEN SHALL BE SQUARE, STAINLESS STEEL, TYPE 304, WELDED 2 X 2 MESH (SQUARE), 0.4370" X 0.4370" OPENING, 0.063" THICK (16 GAUGE) WIRE DIAMETER, 76% OPEN AREA.

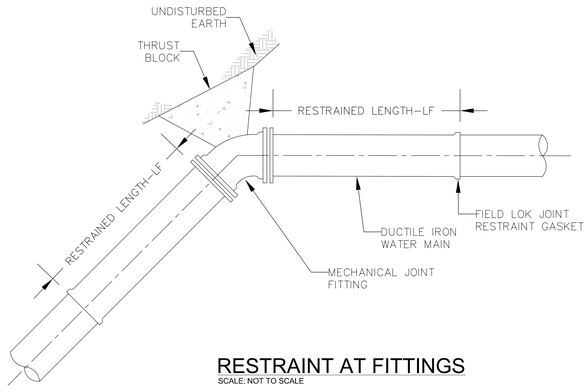
OUTLET SCREEN DETAIL
SCALE: N.T.S.



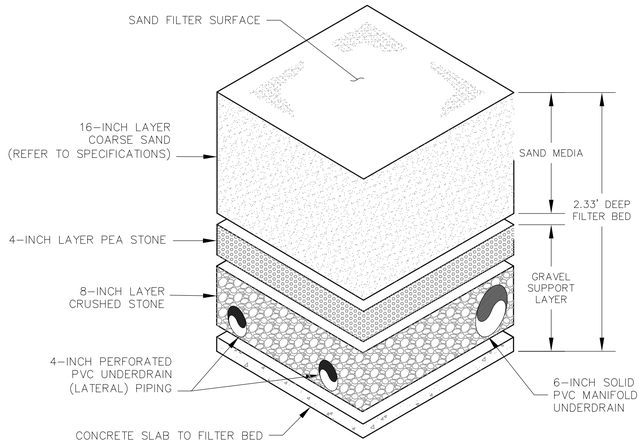
STOCKPILE DETAIL
SCALE: N.T.S.



GATE VALVE AND VALVE BOX DETAIL
SCALE: N.T.S.



RESTRAINT AT FITTINGS
SCALE: NOT TO SCALE



SAND MEDIA NOTES:

1. PERFORATED LATERAL UNDERDRAIN PIPING SHALL BE SPACED AT 4-FT (ON CENTER). PERFORATIONS SHALL BE 1/4-INCH DIA., 6 HOLES PER FOOT LOCATED ON THE BOTTOM. REFER TO PERFORATION DETAIL ON SHEET C-11.

SAND FILTER - MEDIA BED
SCALE: N.T.S.

PIPE SIZE	PLUG SF	PLUG LF	TEE SF	TEE LF	90° BEND SF	90° BEND LF	45° BEND SF	45° BEND LF	22 1/2° BEND SF	22 1/2° BEND LF	11 1/4° BEND SF	11 1/4° BEND LF
6"	2.8	37	2.8	32	4.0	18	2.1	7	1.1	4	1.0	2
8"	4.8	48	4.8	43	6.8	23	3.7	10	1.9	5	1.0	2
10"	7.3	58	7.3	53	10.3	28	5.6	12	2.8	6	1.4	3
12"	10.3	69	10.3	63	14.5	33	7.9	14	4.0	6	2.0	3
16"	17.8	89	17.8	83	25.2	42	13.6	17	7.0	8	3.5	4
20"	27.5	108	27.5	102	38.9	51	21.0	21	10.7	10	5.4	5
24"	39.2	127	39.2	121	55.4	59	30.0	25	15.3	12	7.7	6

RESTRAINT NOTES:

1. MINIMUM SURFACE AREA OF CONCRETE THRUST BLOCK AGAINST UNDISTURBED EARTH – SF (SQUARE FEET)
2. MINIMUM RESTRAINED LENGTH OF PIPE ON EITHER SIDE OF FITTING – LF (LINEAR FEET)
3. THE "SF" VALUES IN THE ABOVE TABLE ARE BASED ON 3,000 P.S.F. SOIL BEARING CAPACITY, 150 P.S.I. TEST PRESSURE AND A 1.5 FACTOR OF SAFETY.
4. THE "LF" VALUES IN THE ABOVE TABLE ARE BASED ON A TYPE 3 LAYING CONDITION, A SAND SILT SOIL DESIGNATION, A 5 FOOT RUN LENGTH, 150 P.S.I. TEST PRESSURE AND A 1.5 FACTOR OF SAFETY.

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REVISIONS

NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

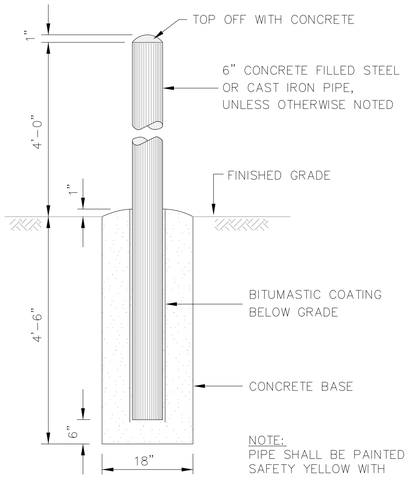
BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE: CIVIL DETAILS II

DRAWING NO.: C-13

SHEET NO. 14 OF 18

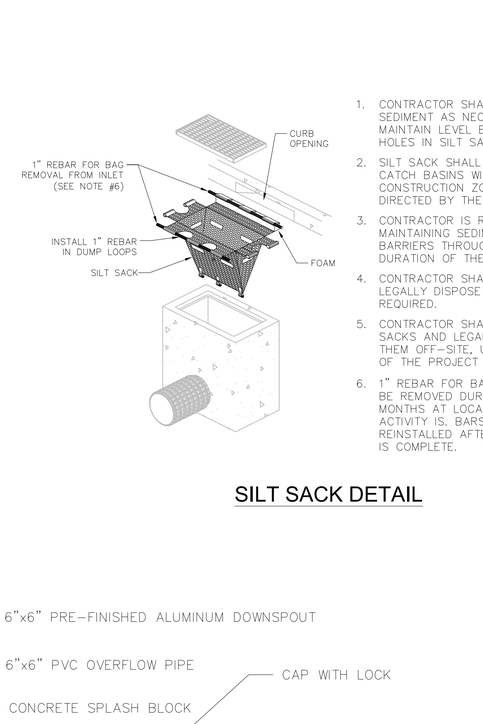
C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C-Delta.dwg



NOTE:
PIPE SHALL BE PAINTED SAFETY YELLOW WITH CATALIZED EPOXY PAINT

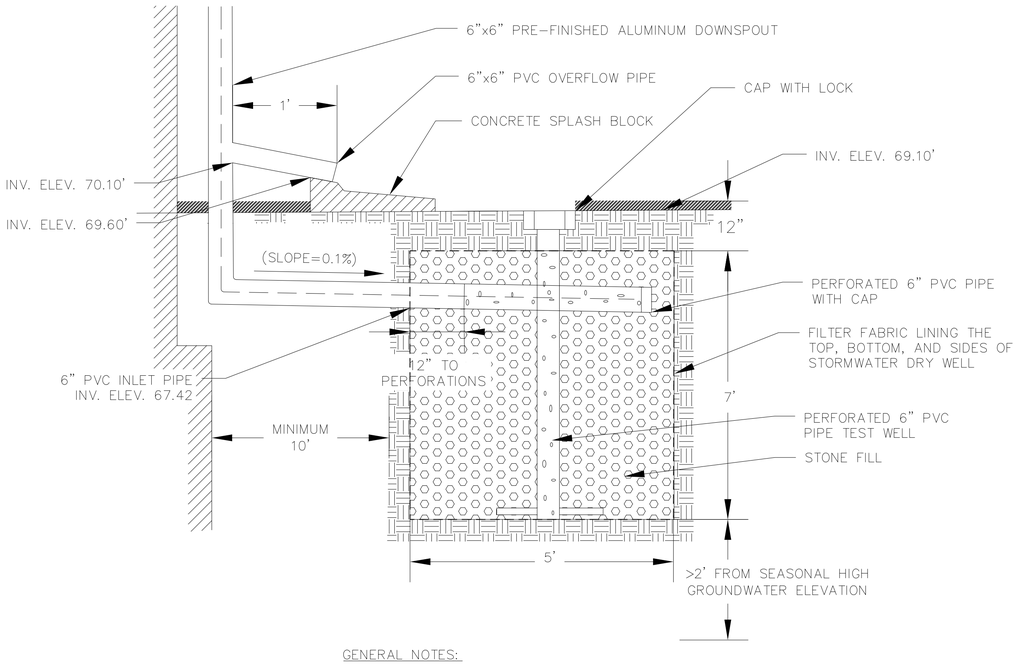
BOLLARD DETAIL

N.T.S.



1. CONTRACTOR SHALL REMOVE SEDIMENT AS NECESSARY TO MAINTAIN LEVEL BELOW OVERFLOW HOLES IN SILT SACK.
2. SILT SACK SHALL BE USED ON ALL CATCH BASINS WITHIN CONSTRUCTION ZONE OR AS DIRECTED BY THE AUTHORITY.
3. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SEDIMENTATION BARRIERS THROUGHOUT THE DURATION OF THE PROJECT.
4. CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF SEDIMENT AS REQUIRED.
5. CONTRACTOR SHALL REMOVE SILT SACKS AND LEGALLY DISPOSE OF THEM OFF-SITE, UPON COMPLETION OF THE PROJECT AND AS REQUIRED.
6. 1" REBAR FOR BAG REMOVAL SHALL BE REMOVED DURING WINTER MONTHS AT LOCATIONS WHERE PLOW ACTIVITY IS. BARS SHALL BE REINSTALLED AFTER SNOW SEASON IS COMPLETE.

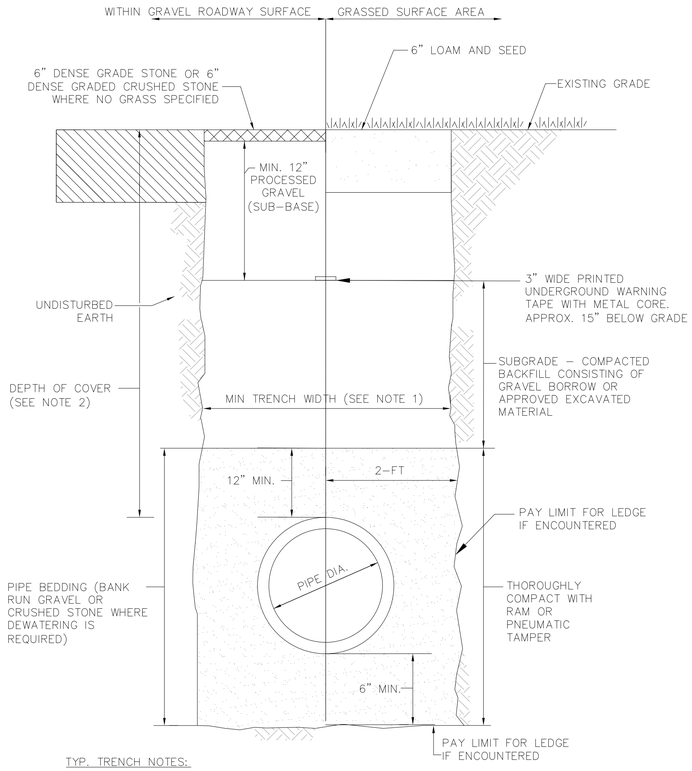
SILT SACK DETAIL



GENERAL NOTES:
1. TEST WELL SHALL BE ANCHORED WITH REBAR.
2. SEE SHEET C-5 FOR STORMWATER DRY WELL LOCATIONS.
3. STONE FILL SHALL BE 1.5"-3.0" IN DIAMETER.

STORMWATER DRY WELL

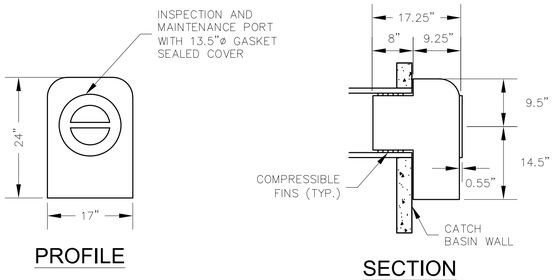
SCALE: N.T.S.



TYP. TRENCH NOTES:
1. MIN. COVER 5' COVER FOR WATER MAIN
2. MIN. 3' COVER FOR STORM DRAIN

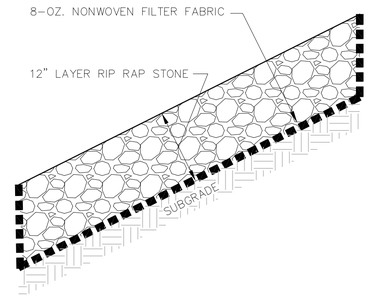
TYPICAL TRENCH DETAIL

SCALE: N.T.S.



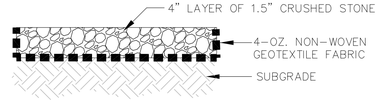
HDPE CATCHBASIN HOOD

SCALE: N.T.S.



RIPRAP SLOPE PROTECTION DETAIL

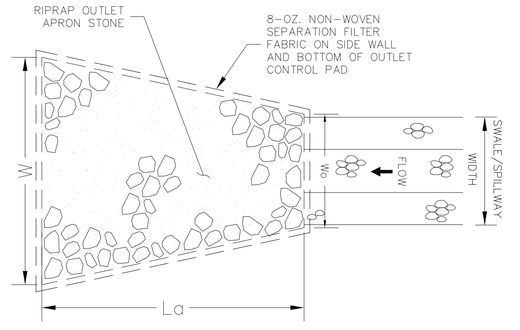
SCALE: N.T.S.



NOTE:
1. CRUSHED STONE SHALL MEET MASSDOT M2.01.7 SPECIFICATION AND GRADATION REQUIREMENTS.
2. CONTRACTOR SHALL PREPARE SUBGRADE TO RECEIVE THE CRUSHED STONE AND SHALL PERFORM AT A MINIMUM PROOF ROLLS THE SUBGRADE FOUR TIMES WITH A PLATE COMPACTOR OR AS DIRECTED BY THE ENGINEER BEFORE PLACING CRUSHED STONE.
3. UPON PLACEMENT OF MATERIAL AND REACHING FINAL GRADE, CONTRACTOR SHALL TAMP CRUSHED STONE WITH PLATE COMPACTOR TO ENSURE MATERIAL IS WELL CONSOLIDATED.

CRUSHED STONE PAD DETAIL

SCALE: N.T.S.



DISCHARGE POINT	La	Wo	W	RIPRAP STONE	LAYER THICKNESS
BASIN EMERGENCY SPILLWAY	6.5'	5.0'	6.5'	D50=4"	9"

RIPRAP OUTLET CONTROL PAD DETAIL

SCALE: N.T.S.

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS STEPHEN C. OLSON 49836 REGISTERED PROFESSIONAL ENGINEER

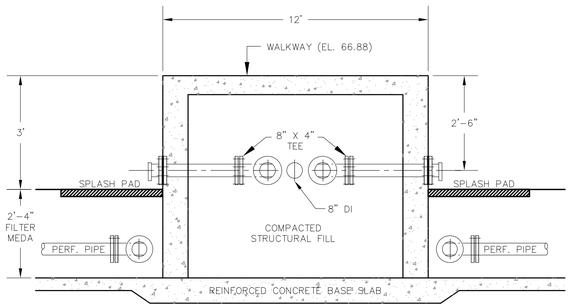
PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

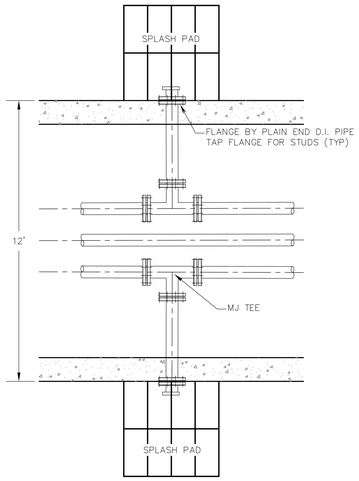
DRAWING TITLE:
CIVIL DETAILS III

DRAWING NO.:
C-14
SHEET NO. 15 OF 18

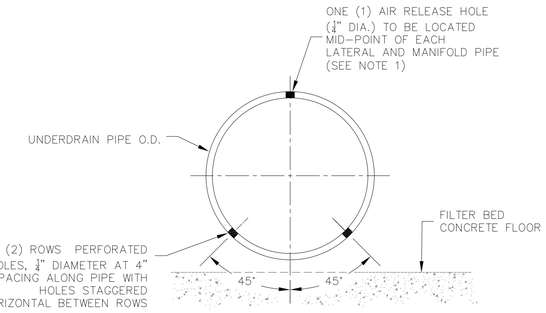
C:\Users\Gennivieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C-Dets.dwg



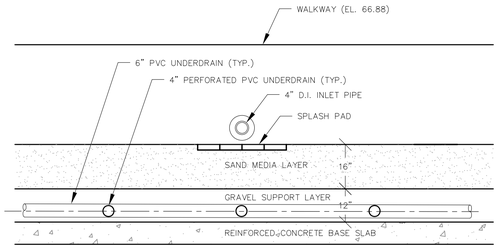
SECTION B - B
SCALE: NTS



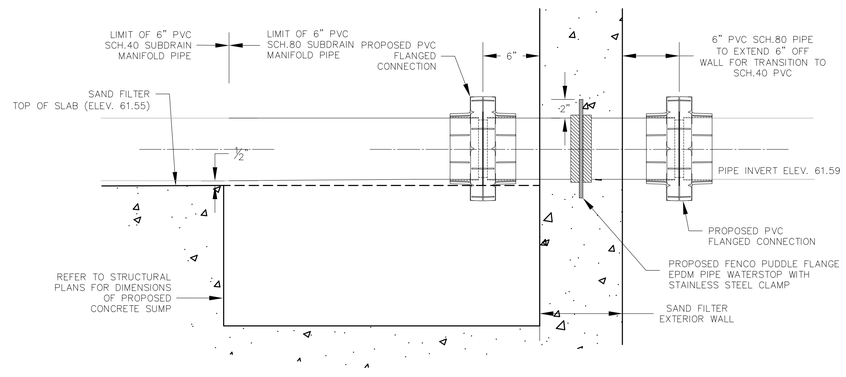
PLAN VIEW - FILTER BED DISCHARGE PIPE
SCALE: NTS



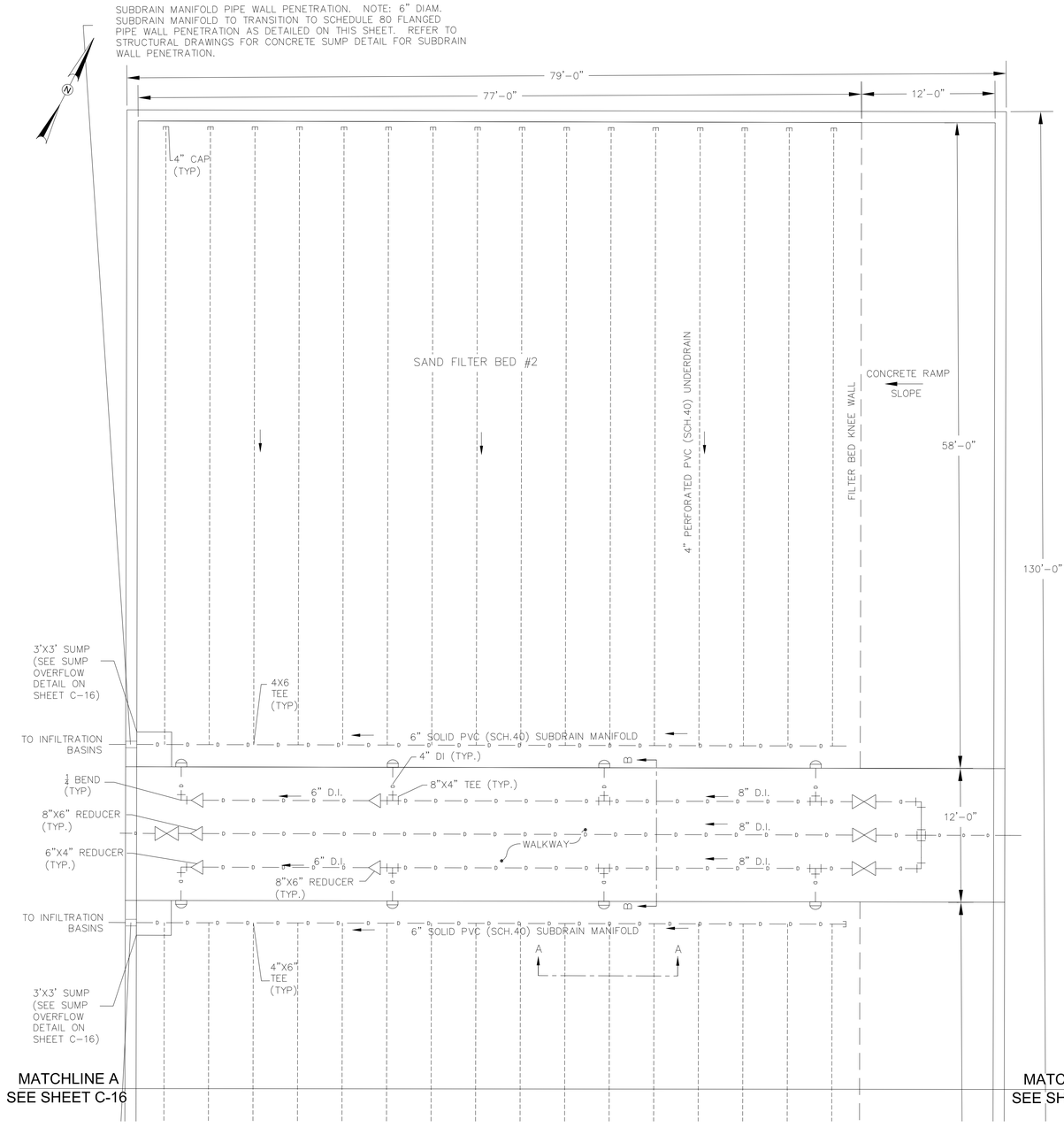
PERFORATION HOLE PLACEMENT DETAIL FOR FILTER BED UNDERDRAIN
SCALE: N.T.S.



SECTION A - A
SCALE: NTS



6-INCH SUBDRAIN MANIFOLD WALL PENETRATION DETAIL
SCALE: N.T.S.



FILTER BED PLAN VIEW
SCALE: NTS

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SCALE ADJUSTMENT GUIDE
0" 1"
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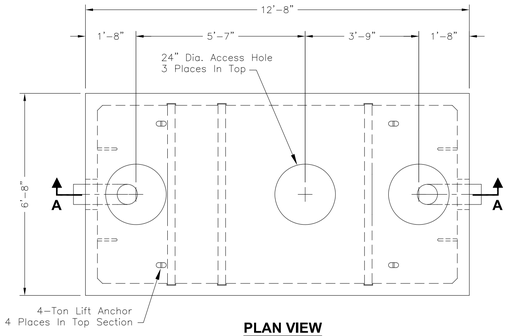
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

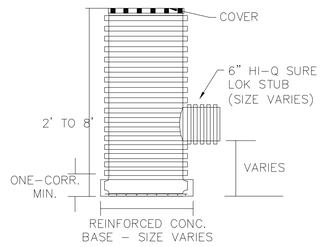
DRAWING TITLE:
CIVIL DETAILS IV

DRAWING NO.:
C-15
SHEET NO. 16 OF 18

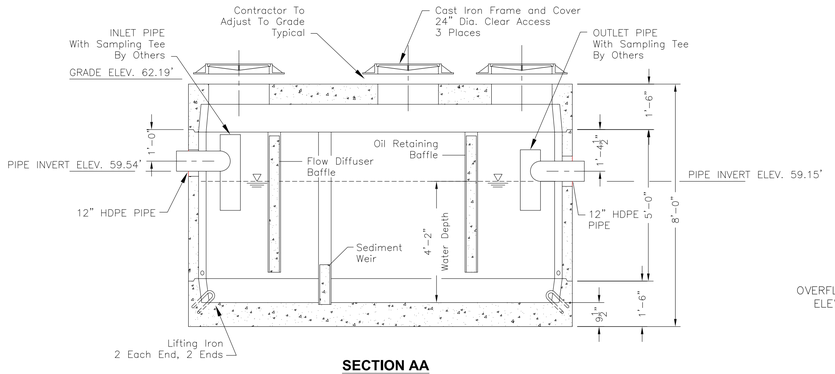
C:\Users\Gennevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A_Drawings\C-Sheets\C-Details.dwg



PLAN VIEW
Castings Not Shown



ROOF DRAIN ACCESS CLANOUT
SCALE: N.T.S.

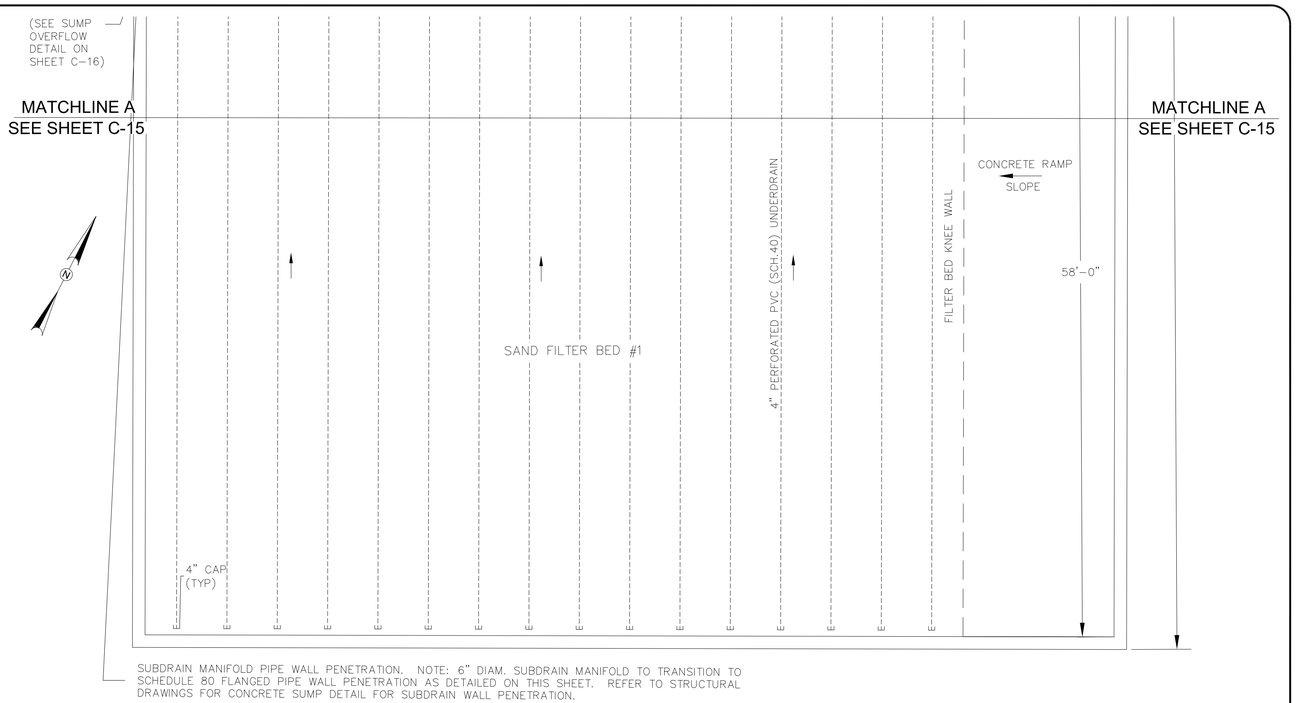


SECTION AA

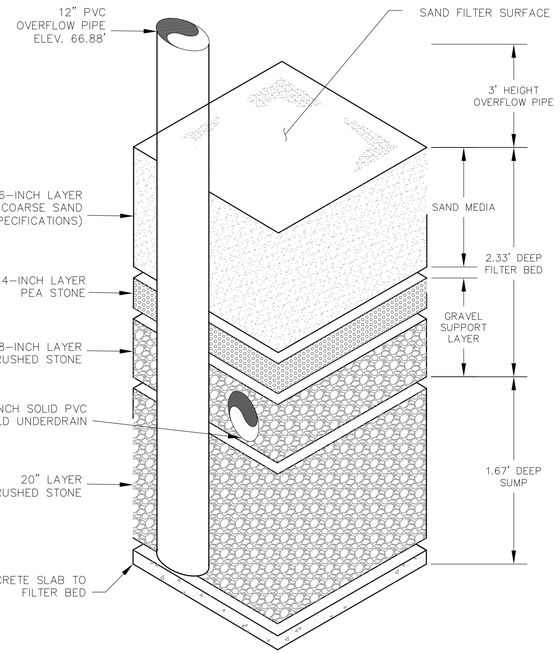
GENERAL NOTES:

1. CONCRETE: 28 DAY COMPRESSIVE STRENGTH f'c = 7,000 PSI
2. STEEL REINFORCEMENT: ATSMA-615 GRADE 60
3. MESH: ATSM A-185 GRADE 65
4. DESIGN: ACL-318-05 BUILDING CODE
   ATSM C-890 MINIMUM STRUCTURAL DESIGN
5. LOADS: HS-20 TRUCK WHEEL W/ 30% IMPACT PER AASHTO
6. OIL/GRIT SEPARATOR CAPACITY = 2,200 GALLONS
7. OIL/GRIT SEPARATOR UNIT SHALL BE OLDCASTLE PRECAST MODEL 612SA OR EQUAL.

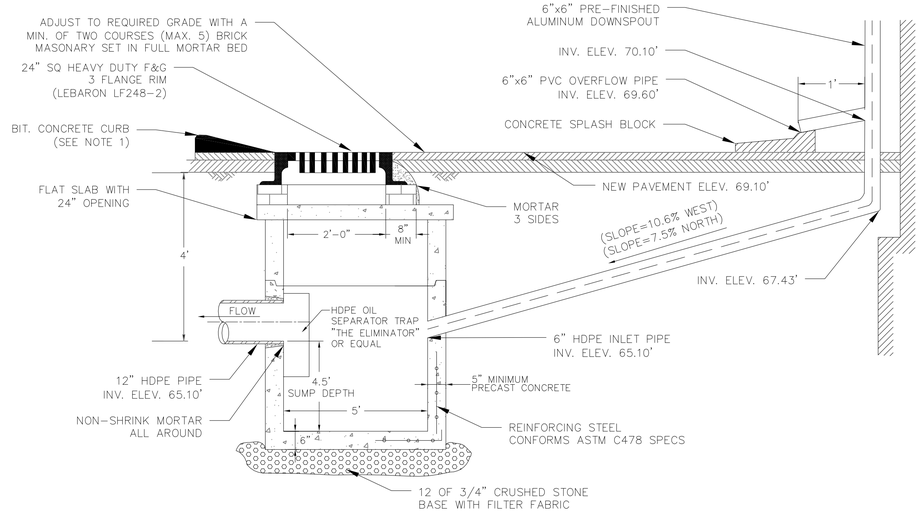
OIL / GRIT SEPARATOR
SCALE: 1" = 30'



FILTER BED PLAN VIEW
SCALE: 3/16" = 1'



SUMP OVERFLOW
SCALE: N.T.S.



GENERAL NOTES:

1. MANHOLE DESIGN TO CONFORM TO LASTEST ASTM C478 SPEC. FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".

PRECAST CONCRETE CATCH BAISN
SCALE: N.T.S.

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COMMONWEALTH OF MASSACHUSETTS STEPHEN C. OLSON REGISTERED PROFESSIONAL ENGINEER 6/4/26

PROJECT NO.:	127.25.01
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BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS V

DRAWING NO.:
C-16
SHEET NO. 20 OF 42

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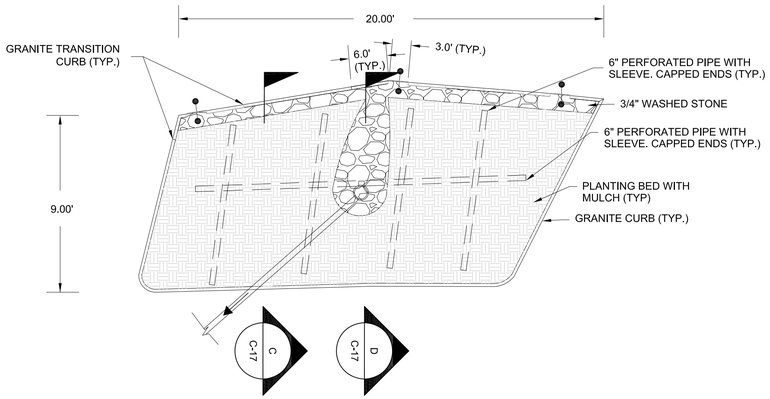
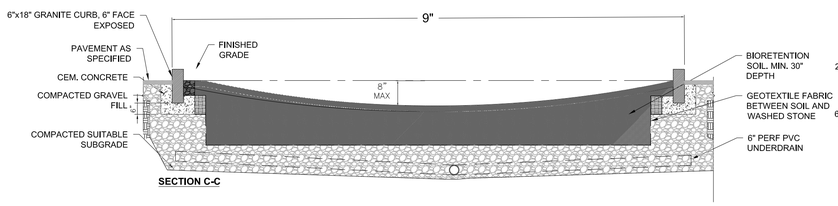
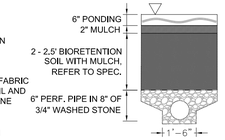


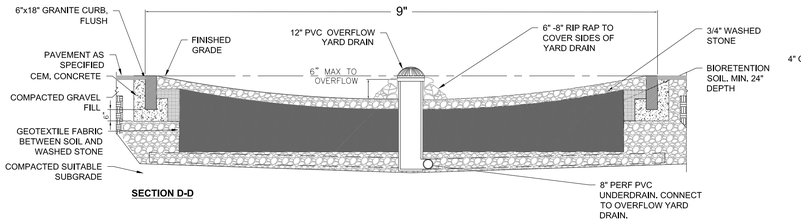
LAYOUT PLAN



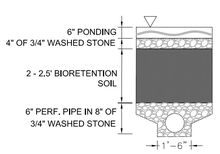
SECTION C-C



BIORETENTION MATERIALS SECTION

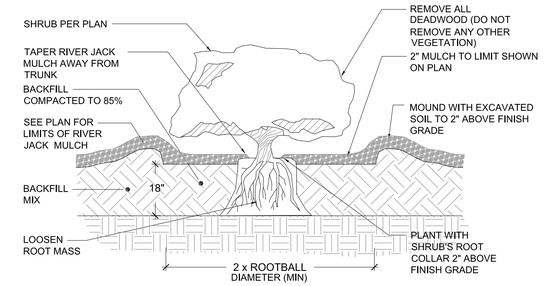


SECTION D-D

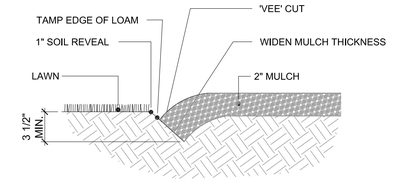


BIORETENTION MATERIALS SECTION

FILTERING RAIN GARDEN
SCALE: N.T.S.

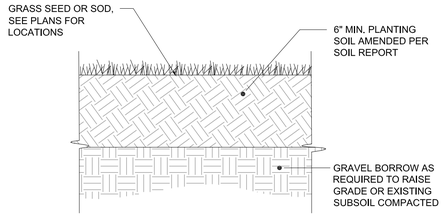


CONTAINER GROWN TREE & SHRUB PLANTING
SCALE: N.T.S.

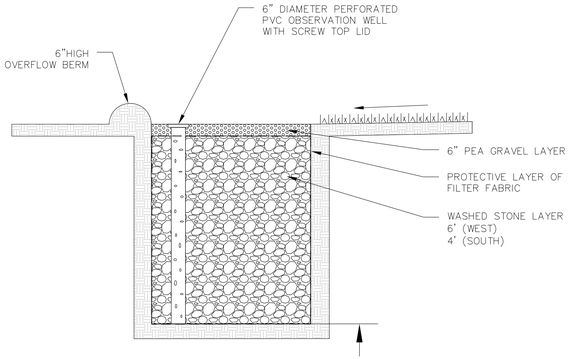


NOTE; LOCATE BEDLINE AS SHOWN ON PLAN.

BEDLINE EDGE
SCALE: N.T.S.

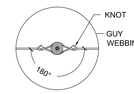


LOAM AND SEED OR SOD
SCALE: N.T.S.



GENERAL NOTES:
1. STONE FILL SHALL BE 2"–5" IN DIAMETER.

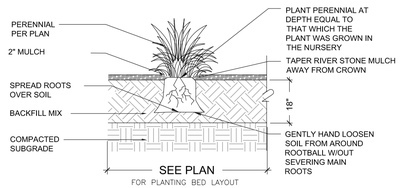
INFILTRATION TRENCH
SCALE: N.T.S.



GUYING DETAIL
NTS

NOTE:
AFTER THE GUARANTEE PERIOD THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REMOVAL OF STAKES AND GUY WEBBING.

EVERGREEN TREE STAKING & PLANTING
SCALE: N.T.S.



PERENNIAL AND GROUND COVER PLANTING
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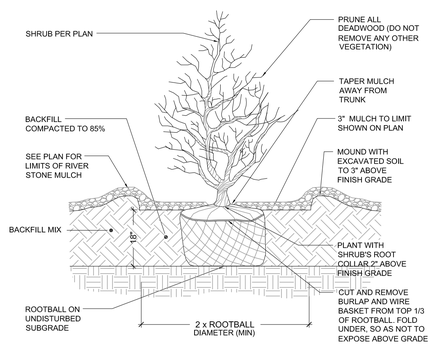

SHRUB PLANTING
SCALE: N.T.S.

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SCALE ADJUSTMENT GUIDE
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COMMONWEALTH OF MASSACHUSETTS — STEPHEN C. OLSON — REGISTERED PROFESSIONAL ENGINEER — 6/4/26

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	AS NOTED
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CIVIL DETAILS VI

DRAWING NO.:
C-17

SHEET NO. 18 OF 18

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Appendix E – Soils Data

Soil Map—Barnstable County, Massachusetts
(Barnstable Fire District Wells 3&4 WTP)



Map Scale: 1:9,580 if printed on B landscape (17" x 11") sheet.

N

0 100 200 400 600 Meters

0 450 900 1800 2700 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Barnstable County, Massachusetts
Survey Area Data: Version 24, Sep 5, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 10, 2022—Jun 30, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	111.4	10.2%
53A	Freetown muck, ponded, coastal lowland, 0 to 1 percent slopes	2.2	0.2%
54A	Freetown and Swansea mucks, coastal lowland, 0 to 1 percent slopes	7.2	0.7%
55A	Freetown coarse sand, 0 to 3 percent slopes, sanded surface	1.4	0.1%
242C	Hinckley loamy sand, 8 to 15 percent slopes	35.3	3.2%
245A	Hinckley loamy sand, 0 to 3 percent slopes	4.6	0.4%
245B	Hinckley loamy sand, 3 to 8 percent slopes	55.3	5.1%
252C	Carver coarse sand, 8 to 15 percent slopes	22.4	2.1%
252D	Carver coarse sand, 15 to 35 percent slopes	22.2	2.0%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	156.8	14.4%
264A	Eastchop loamy fine sand, 0 to 3 percent slopes	45.3	4.2%
264B	Eastchop loamy fine sand, 3 to 8 percent slopes	12.4	1.1%
264C	Eastchop loamy fine sand, 8 to 15 percent slopes	150.5	13.8%
435C	Plymouth loamy coarse sand, 8 to 15 percent slopes	60.6	5.6%
435D	Plymouth loamy coarse sand, 15 to 35 percent slopes	35.9	3.3%
436C	Plymouth loamy coarse sand, 8 to 15 percent slopes, very stony	10.8	1.0%
483C	Plymouth-Barnstable complex, rolling, very bouldery	45.2	4.2%
483D	Plymouth-Barnstable complex, hilly, very bouldery	174.3	16.0%
488C	Barnstable-Plymouth complex, rolling, bouldery	31.1	2.9%
600	Pits, sand and gravel	46.9	4.3%
602	Urban land	35.0	3.2%
665	Udipsamments, smoothed	21.0	1.9%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Totals for Area of Interest		**1,087.9**	**100.0%**

JOHN TURNER CONSULTING

JTC Project No.: 25-04-150
January 13, 2026

GEOTECHNICAL ENGINEERING REPORT

PROPOSED WATER TREATMENT PLANT
FAIRWELL LANE
BARNSTABLE, MASSACHUSETTS

Prepared for:
H_2Olson Engineering, Inc.
10 Riverside Drive, Suite 103
Lakeville, MA 02347

Prepared by:
John Turner Consulting, Inc.

January 13, 2026

Peter Newton, P.G.
H_2Olson Engineering, Inc.
10 Riverside Drive, Suite 103
Lakeville, MA 02347
P: 508-965-2037
E: pgn@h20lsonengineering.com

RE: Geotechnical Engineering Report
Proposed Water Treatment Plant
Fairwell Lane
Barnstable, Massachusetts

Dear Mr. Newton:

John Turner Consulting, Inc. (JTC) is pleased to present this Geotechnical Engineering Report for the above captioned project. The purpose of our services was to obtain information on the subsurface conditions at the site and to provide geotechnical engineering recommendations to support the planning, design, and construction of the proposed development.

This report completes our scope of services under the approved contract. We appreciate the opportunity to assist you on this project and look forward to working with you through its completion. Please do not hesitate to contact us if you have any questions or require additional information.

Respectfully,
JOHN TURNER CONSULTING, INC.



Stephen C. Lanne, PE
Vice President of Engineering
P: 413.222.1675
E: slanne@consultjtc.com

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1.0 PROJECT INFORMATION

To complete our work, JTC referenced the following information that you provided:

- Preliminary Floor Plan, by H_2Olson, Sheet No. M-1, dated October 2025;
- Aerial photographs and surficial geologic maps of the area.

1.1 Site Description

The following table summarizes our understanding of the existing site:

ITEM	DESCRIPTION
Location	Fairwell Lane, Barnstable, MA
Existing Improvements	Undeveloped site
Current Ground Cover	Densely wooded area
Topography	Relatively flat
Regional Geology [1]	End moraine deposits of sand, gravel, and boulders
1. Likely native soils based on local, publicly available surficial geology map	

1.2 Proposed Development

The following table summarizes our understanding of the project:

ITEM	DESCRIPTION
Structure	Single-story water treatment plant Two sand filters
Size	Building – 3,534 square feet (sf) Sand filters – 3,700 sf each
Finished Floor	Elevation (El) = 63 feet (estimated)
Loads	Strip footings: 2 to 3 kips per linear foot (klf) (assumed) Slab-on-grade: 200 pounds per square foot (psf) (assumed)
Basement	Under building slab 40,000 gal water tank Sand filters extended below grade
Cut/Fill - Building	Cut: Up to 10 feet (assumed – for under slab water tank) Up to 3 feet for finished grade (estimated) Fill: Minimal +/- 3 ft (assumed)
Cut/Fill - Site	Cuts: Minimal +/- 3 ft (assumed) Fill: Minimal +/- 3 ft (assumed)

ITEM	DESCRIPTION
Retaining Walls	Up to 10 ft (assumed – for under slab water tank) Up to 6 ft (assumed – for sand filters
Slopes	Unknown
Pavements	Unknown
Drainage Areas	Unknown

2.0 GEOTECHNICAL EXPLORATIONS

The following table summarizes the field exploration program performed at the site:

ITEM	DESCRIPTION
Soil Borings	
Dates	12/4/25 through 12/5/25
Drilling Contractor	GeoSearch, Inc.
Drilling Rig	ATV-mounted CME
Number of Borings	5, B-1 through B-5
Boring Depth Range	22 to 46 feet below ground surface (bgs)
Drilling Method	4¼-inch internal diameter hollow stem augers (HSA)
Sampling Method	Standard Penetration Tests (SPTs) 2-inch outside diameter split-spoon samplers

The attached *Exploration Location Plan* depicts the approximate locations of the explorations.

JTC directed the explorations, field testing, and sampling activities and logged the subsurface conditions encountered at each exploration location. Soil samples were sealed in moisture-tight containers and returned to JTC's office for further review, classification, and/or testing. The explorations were backfilled with spoils prior to departing the site. Laboratory testing results are included in the appendix *Laboratory Testing Reports*.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Subsurface Profile

The following table provides a general summary description of the typical subsurface conditions encountered in the explorations. Detailed descriptions of the conditions observed at each exploration are provided in the appendix *Exploration Logs*.

LAYER	LAYER DESCRIPTION	CLASSIFICATION/TYPE	USCS	DEPTH TO TOP (FEET)	THICKNESS (FEET)	RELATIVE DENSITY/RQD	NOTES
1	Surface Materials	Forest Mat	-	0	0 – 0.3	-	
2	Subsoil	Orange Brown Silty Sand, rootlet	SM	0.2 – 0.3	0.5	Loose	
3	Native Sand	Silty Sand Well Graded Sand with Silt and Gravel Poorly Graded Sand Poorly Graded Sand with Gravel	SM SW SP	0.7	>46	Loose to dense	Typically loose beneath subsoil. Medium dense to dense from 5ft and below

Bedrock was not encountered in the explorations.

3.2 Groundwater

The following table provides a summary description of the observed groundwater levels encountered in the explorations. Detailed descriptions of the conditions observed at each exploration are provided in the appendix *Exploration Logs*.

EXPLORATION NUMBER	GROUNDWATER DEPTH (FEET)	OBSERVATION NOTES
B-2	30	Open borehole
B-5	26	Open borehole

Groundwater level observations made at the time of the explorations should be considered approximate. JTC estimates that this investigation occurred during a period of seasonally normal ground water levels.

Fluctuations in groundwater level should be expected to occur because of seasonal rainfall variations, runoff, grade adjustments on and around the site, as well as surrounding drainage improvements, and other factors. Water may also become temporarily perched over low permeability soils or bedrock. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 EARTHWORK

- Earthwork recommendations apply to site earthwork and subgrade preparation for foundations, slabs-on-grade, pavements, and retaining walls.
- See the appendix *Additional Earthwork Recommendations* for additional guidance.

4.1 Site Preparation

- The Geotechnical Engineer should directly observe key subgrade preparation and earthwork. At a minimum, the Geotechnical Engineer should observe:
  - removal of unsuitable materials within the building footprint
  - observation and proofrolling of foundation and slab-on-grade subgrades, prior to placing fill or preparing for concrete placement
- Subgrade conditions will be influenced by excavation methods, precipitation, stormwater management, groundwater control(s), and/or construction activities. The site soils contain substantial proportions of fine sand and/or silt that may degrade and/or become unworkable when subjected to construction traffic or other disturbance during wet conditions. The Contractor should be aware of these conditions and take precautions to minimize subgrade disturbance.
- The site should be cleared and stripped of existing pavement/concrete; existing trees/vegetation; Topsoil, Rootmat, Forest Mat; loamy/organic-laden Subsoil; spoils generated from other work; and any otherwise unsuitable materials. Stripping should include removal of the root structure of trees and shrubs. Organic soils may be deeper within and around the root structure.
- Loose, soft, wet, and/or otherwise unsuitable soils should be over-excavated to expose suitable soils, or other remedial measures should be taken, as directed by the Geotechnical Engineer. Over-excavations should be backfilled with properly placed and compacted fill, as appropriate for the location.
- Following clearing, stripping, cutting, and/or over-excavation, the exposed subgrade soils should be proof-rolled as recommended in the appendix *Additional Earthwork Recommendations* and to the satisfaction of the Geotechnical Engineer. Proof-rolling should not be performed if the exposed subgrade soils are wet, as this may result in soil pumping and instability. Therefore, the proof-rolling efforts, should be directed by the on-site Geotechnical Engineer.
- Should groundwater be encountered during foundation or utility excavations, it is expected that it will be limited in volume and/or occur as relatively slow seepage which may be controlled through standard sump and pump methods of dewatering. However, wellpoints or other more rigorous means of dewatering may be necessary in the event that sumps and pumps prove unsatisfactory.
- Pavement and slab-on-grade subgrades should be restored and proof compacted after installing utilities.
- The Geotechnical Engineer should be provided and review all earthwork testing and inspection reports.

4.2 Fill Materials

- To facilitate placement, stability of subgrades during construction, and long-term performance of the project, we recommend the following engineered fill material requirements:

FILL TYPE [1]	LOCATION	RECOMMENDATIONS	MINIMUM COMPACTION [2]
Structural Fill	Below and inside settlement sensitive structures	Well-graded, Granular soils; maximum particle size 4 inches; <15% passing #200 sieve	95%
Common Fill	Site fill, behind retaining walls	Granular soils; maximum particle size 6 inches; <25% passing #200 sieve	92% below 3 ft of finished grade or within 3 ft of back of wall 95% within 3 ft of finished grade or beyond 3 ft of back of wall
General Fill	Landscape areas with no site improvements or slopes	Workable soil materials	90%
Non-Frost Susceptible Fill	Within the frost depth below settlement sensitive structures	Granular soils; maximum particle size 4 inches; <8% passing #200 sieve	95%
Slab and Pavement Base Course	Directly below slabs and pavements	Granular soils and crushed rock aggregate blend meeting local DOT requirements	95%
Crushed Stone	As Structural Fill, for wet subgrades, and drainage aggregate	Crushed durable rock; maximum particle size ¾ inch; <10% passing #4 sieve	Multiple passes of compaction equipment until fully seated

1. Fill materials should be free of organics, clays, frozen materials, debris, brush or tree materials, trash, and otherwise unsuitable materials, and be at workable moisture content, i.e. +/- 3% of optimum.
2. Minimum compaction requirements refer to percentage of maximum dry density per ASTM D1557C.

4.3 Re-Use of Site Soils

- Soils excavated during site development may be re-used as engineered fill as tabulated below:

SOIL TYPE	SUITABILITY FOR RE-USE	NOTES
Silty Sand	Common Fill, General Fill	High fines content
Well Graded Sand/Poorly Graded Sand	Structural Fill, Common Fill	

- Materials proposed for re-use should be segregated and stockpiled based on composition. Bulk samples should be submitted for laboratory testing to demonstrate conformance with the project specifications. Non-conforming materials may be blended with more granular soils or aggregate and/or screened to meet the recommended gradation. Alternately, these materials could be used in landscaped areas or disposed of offsite.

5.0 FOUNDATIONS

5.1 Foundation Design Recommendations

- Design recommendations for shallow foundations are tabulated below:

DESCRIPTION	VALUE
Bearing Stratum	Proof-rolled Native Sand
Allowable Bearing Pressure	3,000 psf
Design Frost Depth for Exterior Foundations (from finished grade)	4 feet
Estimated Depth to Groundwater (from existing grade)	>26 ft
Minimum Strip Footing Width	1.5 ft
Minimum Isolated Footing Width	2.5 ft
Estimated Maximum Total Settlement	1 inch
Estimated Maximum Differential Settlement	½ inch
Total Unit Weight of Bearing Material	120 pcf
Friction Angle of Bearing Material	30 degrees
Cohesion of Bearing Material	0 psf
Passive Earth Pressure Coefficient	3.0
Coefficient of Sliding Friction – concrete cast on prepared subgrade	0.4

5.2 Foundation Subgrade Preparation

- The foundation bearing soils should be proof compacted in the presence of the Geotechnical Engineer to densify near surface soils disturbed during the excavation process and to assess stability of the subgrade.
- Due to elevated fines content, foundation subgrade soils may be easily disturbed with increased moisture content and construction traffic. The subgrade could be protected from disturbance with a minimum 6-inch thick layer of ¾-inch minus crushed stone fully-wrapped in a geotextile separation fabric. The fabric and crushed stone should be placed immediately following proof-rolling of the subgrade soils and seated with multiple passes with a plate compactor.
- See the appendix *Additional Earthwork Recommendations* for additional guidance.

5.3 Seismic Considerations

PARAMETER	VALUE
Seismic Site Class	C
Liquefaction Potential	Not Susceptible

5.4 Slab-On-Grade

- Design recommendations for floor slabs-on-grade are tabulated below:

DESCRIPTION	VALUE
Bearing Stratum	Proof-rolled Native Sand
Slab Base Course Thickness	9 inches
Modulus of Subgrade Reaction	125 pci

- The floor slab should be isolated structurally from foundation walls and columns/piers to allow for differential movement.
- The slab-on-grade subgrade should be restored by the Contractor and evaluated by the Geotechnical Engineer following installation of sub-slab utilities.
- The requirement for a moisture/vapor barrier beneath floor slab-on-grade should be evaluated by others.
- Sub-slab drainage is not required.

6.0 RETAINING WALLS

Retaining wall foundations should be designed and subgrades prepared using the same recommendations as building foundations. The following table outlines the recommended lateral earth pressure coefficients for the design of site retaining walls. These parameters are not applicable for the design of reinforced, modular block walls.

WALL CONDITION	LATERAL MOVEMENT (D/H)	EARTH PRESSURE COEFFICIENT (K)	EQUIVALENT FLUID DENSITY ($K*\gamma$) [1,2,3]
Cantilever – Unrestrained - (Active Earth Pressure)	>0.002	Ka = 0.33	42 pcf
Braced - Restrained or Bedrock <H ft behind wall - (At Rest Earth Pressure)	<0.002	Ka = 0.5	63 pcf
Passive - Unrestrained	>0.02	Ka = 3.0	375 pcf

1. Hydrostatic pressures are not included;
2. Assumes level grading in front of and behind the wall;
3. Parameters do not include Factors of Safety.

where: D = deflection at top of wall by rotation or lateral translation
H = exposed height of wall
γ = soil unit weight – 125 pcf – assumes compacted *Common or Structural Fill*

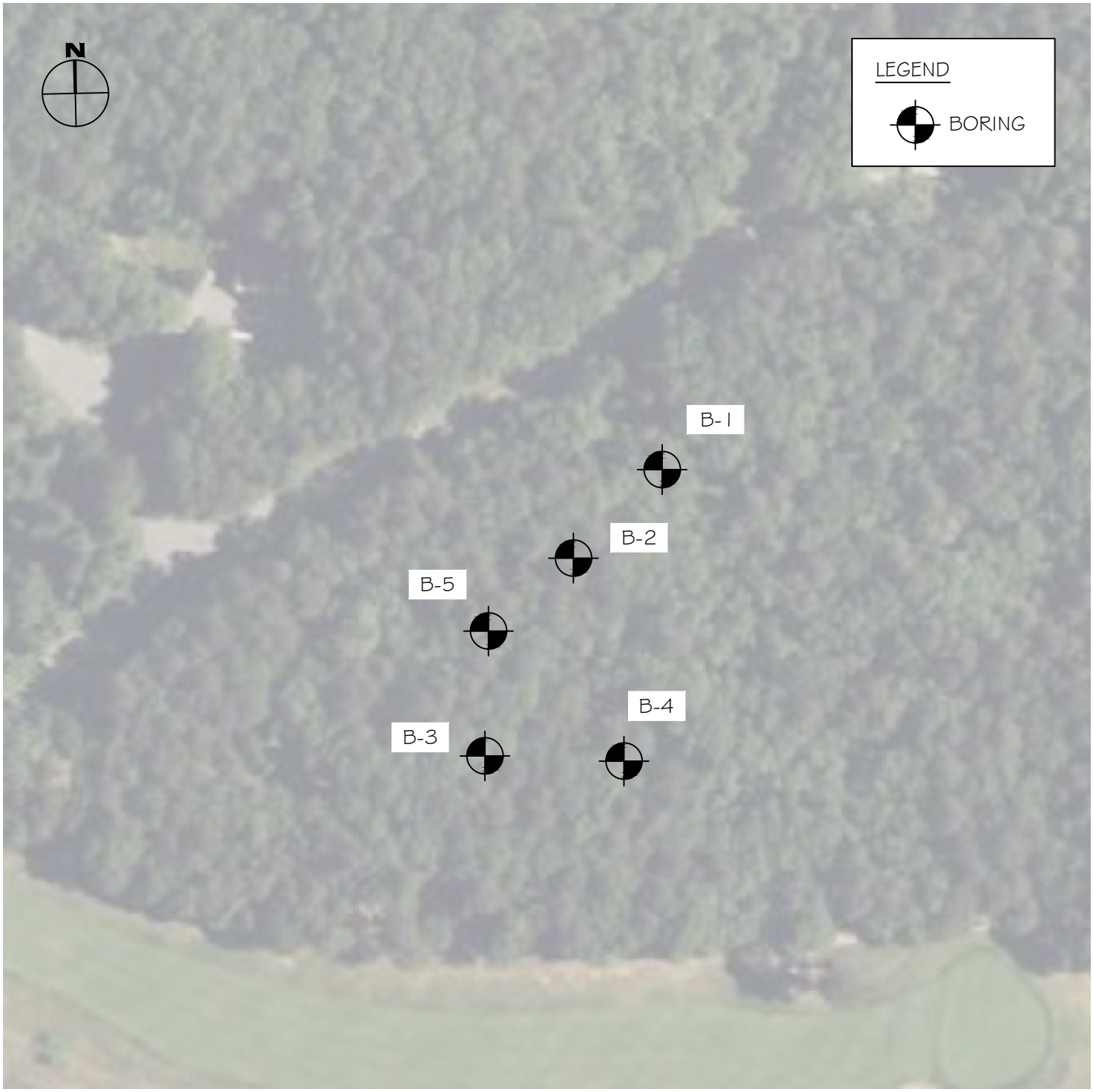
- Retaining walls should be designed to accommodate any possible surcharge loads located within a horizontal distance equal to the height of the wall. Surcharges should be added as a uniform pressure equal to the vertical surcharge pressure multiplied by the appropriate earth pressure coefficient.
- To account for possible soil softening due to saturation and freeze thaw action, passive pressure should be ignored in the upper two feet below finished grade on site retaining walls.
- A drainage system should be installed behind the wall to prevent the buildup of hydrostatic pressure. The drainage system should consist of the following:
  - Chimney Drain - Minimum 12-inch-wide column of Crushed Stone placed directly behind the wall
  - Collector Drain – Minimum 4-inch diameter perforated PVC pipe installed at the base of the chimney drain, discharged through weep holes or into the stormwater collection system.
  - Weep Holes – (For free-standing retaining walls). Minimum 4-inch diameter solid PVC pipe connected at maximum 30-foot spacing to the collector drain and discharging through the face of the retaining wall at least 12 inches above finished grade to limit the potential for clogging from debris, soils, snow/ice, etc.
  - Grading should direct stormwater runoff away from retaining walls, wherever possible. Provide drainage swales at the top of the retaining wall when stormwater cannot be directed away. Surface materials adjacent to the wall should be relatively impermeable to reduce infiltration.
- If drainage is not provided, the design should include retaining hydrostatic pressures.
- The retaining wall design should consider the possibility of future excavations in front of the wall.
- Global stability analysis should be completed for free-standing retaining walls greater than 5 feet in height.

7.0 CLOSING

We recommend that JTC be retained during design development to review the plans and specifications, to assess conformance with our geotechnical recommendations and during the construction phase to evaluate earthwork operations and review subgrade soils for consistency with our assumptions.

We trust the contents of this report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office. The contents of this report are subject to the attached *Limitations*.

APPENDIX A: SITE PLAN & EXPLORATION LOCATION PLAN



Notes:

1. Explorations were performed on December 4, 2025, by GeoSearch, Inc. of Sterling, MA, under the direction of JTC.
2. Exploration locations should be considered approximate.
3. Refer to the Exploration Logs for the subsurface conditions encountered at each exploration location.
4. Basemap source: Aerial Image by Microsoft Corporation, accessed on December 24, 2025.
5. Drawing Scale: 1 inch = 100 feet

DATE:	12/24/2025
JOB #	25-04-150
DRAFT:	AP
DESIGN:	AP
REVIEW:	SL
REVISIONS:	

DRAWING NAME: EXPLORATION LOCATION PLAN

PROJECT: PROPOSED WATER TREATMENT PLANT
BARNSTABLE, MASSACHUSETTS

CLIENT: H2OLSON ENGINEERING, INC.
LAKEVILLE, MASSACHUSETTS

JOHN TURNER CONSULTING

DRAWING #: 1

APPENDIX B: EXPLORATION LOGS & KEY TO SYMBOLS & DESCRIPTIONS

JOHN TURNER CONSULTING

LOG OF BORING No. B-1

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150
CLIENT: H2Olson Engineering, Inc.
PROJECT LOCATION: Fairwell Lane, Barnstable, MA
LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**
DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor
DRILLING METHOD: 4.25-inch HSA **DATE:** 12/4/25
DEPTH TO - WATER> INITIAL: NE **AFTER 24 HOURS:**

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
0	[FOREST MAT] 2 inches dark brown, Silty Sand, rootlets, leaves			SS01	1 1 6 7	
	0.2					
	[SUBSOIL] Orange brown, Silty Sand (SM), rootlets, loose			SS02	4 2 2 4	
	0.7					
5	[NATIVE SAND] Light brown, Silty Sand (SM), loose			SS03	5 8 8 9	
	Tan, Well graded Sand (SW) with Silt and Gravel, medium dense			SS04	8 9 11 11	
10	Tan, Poorly Graded Sand (SP), medium dense			SS05	5 6 7 7	
15	-becomes coarser			SS06	4 9 10 14	
20				SS07	8 9 13 13	
25	-mottling			SS08	4 8 13 12	
	-1/2 inch grey-brown seam of very fine sand					
30	-becomes dense			SS09	7 13 34 26	
	Boring terminated at 32 ft.					
35						

TEST RESULTS
Plastic Limit ⊢⊣ Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-2

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150
CLIENT: H2Olson Engineering, Inc.
PROJECT LOCATION: Fairwell Lane, Barnstable, MA
LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**
DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor
DRILLING METHOD: 4.25-inch HSA **DATE:** 12/4/25
DEPTH TO - WATER> INITIAL: ▽ 30 **AFTER 24 HOURS:** ▽

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
0	[FOREST MAT] 2 inches dark brown, Silty Sand, rootlets, leaves			SS01	1 1 2 1	
	0.2 [SUBSOIL] Brown, Silty Sand (SM), rootlets, very loose			SS02	1 2 3 5	
	0.7 [NATIVE SAND] Light brown to tan, Well Graded Sand (SW) with Silt and Gravel, loose			SS03	7 12 7 7	
5	Tan, Poorly Graded Sand (SP), medium dense			SS04	6 7 8 15	
10				SS05	14 10 15 17	
15				SS06	11 21 20 27	
20	-becomes coarser			SS07	10 15 17 17	
25	-mottling			SS08	52 9 10 13	
30 ▽				SS09	5 7 9 10	
	Boring terminated at 32 ft.					
35						

TEST RESULTS
Plastic Limit ⊢⊣ Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-3

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150

CLIENT: H2Olson Engineering, Inc.

PROJECT LOCATION: Fairwell Lane, Barnstable, MA

LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**

DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor

DRILLING METHOD: 4.25-inch HSA **DATE:** 12/4/25

DEPTH TO - WATER> INITIAL: NE **AFTER 24 HOURS:**

TEST RESULTS

Plastic Limit ⊢⊣ Liquid Limit

Water Content - ●

Penetration - ▨

10 20 30 40 50

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
0	[FOREST MAT] 3 inches dark brown, Silty Sand, rootlets, leaves			SS01	1 1 1 1	
	0.2					
	[SUBSOIL] Orange brown, Silty Sand (SM), rootlets, very loose			SS02	2 3 4 4	
	0.7					
5	[NATIVE SAND] Light brown to tan, Silty Sand (SM), loose to medium dense			SS03	4 5 6 7	
				SS04	7 7 10 9	
10	Tan, Poorly Graded Sand (SP) with gravel, medium dense			SS05	8 11 14 20	
15				SS06	10 12 13 18	
20				SS07	14 13 13 18	
	Boring terminated at 22 ft.					
25						
30						
35						

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-4

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150

CLIENT: H2Olson Engineering, Inc.

PROJECT LOCATION: Fairwell Lane, Barnstable, MA

LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**

DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor

DRILLING METHOD: 4.25-inch HSA **DATE:** 12/4/25

DEPTH TO - WATER> INITIAL: NE **AFTER 24 HOURS:**

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
0	[FOREST MAT] 2 inches dark brown, Silty Sand, rootlets, leaves			SS01	3 3 3 3	
	0.2 [SUBSOIL] Orange brown, Silty Sand (SM), rootlets, loose			SS02	4 6 6 7	
	0.7 [NATIVE SAND] Light brown to tan, Silty Sand (SM), loose to medium dense			SS03	2 3 3 9	
5	Tan, Poorly Graded Sand (SP) with gravel, loose to medium dense			SS04	7 7 8 9	
10				SS05	6 7 9 9	
15	-becomes coarser			SS06	4 6 6 8	
20				SS07	3 3 7 15	
	Boring terminated at 22 ft.					
25						
30						
35						

TEST RESULTS

Plastic Limit ⊢⊣ Liquid Limit

Water Content - ●

Penetration - ▨

10 20 30 40 50

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-5

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150
CLIENT: H2Olson Engineering, Inc.
PROJECT LOCATION: Fairwell Lane, Barnstable, MA
LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**
DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor
DRILLING METHOD: 4.25-inch HSA **DATE:** 12/5/25
DEPTH TO - WATER> INITIAL: ▽ 26 **AFTER 24 HOURS:** ▽

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200	TEST RESULTS
0	[FOREST MAT] 2 inches dark brown, Silty Sand, rootlets, leaves			SS01	1/12 - 1 1		Plastic Limit ⊢⊣ Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50
	0.2 [SUBSOIL] Orange brown, Silty Sand (SM), rootlets			SS02	2 2 3 9		
5	0.7 [NATIVE SAND] Light brown, Silty Sand (SM), very loose to loose			SS03	3 4 6 5		
	5 Tan, Well Graded Sand (SW) with Silt and Gravel, medium dense to dense			SS04	7 9 10 10		
10				SS05	11 16 19 20		
15				SS06	7 10 10 12		
20	Tan, Poorly Graded Sand (SP), loose to medium dense mottling			SS07	7 12 12 7		
25	-becomes coarser			SS08	4 13 7 5		
30				SS09	7 2 3 13		
35				SS10	4 4 4		

This information pertains only to this boring and should not be interpreted as being indicative of the site.

JOHN TURNER CONSULTING

LOG OF BORING No. B-5

PROJECT: Proposed Water Treatment Plant **PROJECT NO.:** 25-04-150

CLIENT: H2Olson Engineering, Inc.

PROJECT LOCATION: Fairwell Lane, Barnstable, MA

LOCATION: Fairwell Lane, Barnstable, MA **ELEVATION:**

DRILLER: GeoSearch, Inc. **LOGGED BY:** A. Pryor

DRILLING METHOD: 4.25-inch HSA **DATE:** 12/5/25

DEPTH TO - WATER> INITIAL: ▽ 26 **AFTER 24 HOURS:** ▽

Depth (feet)	Description	Graphic	Elevation (feet)	Sample No.	Blow Counts	% < #200
					4	
40				SS11	12 15 5 5	
45				SS12	33 15 12 12	
	Boring terminated at 46 ft.					
50						
55						
60						
65						
70						

TEST RESULTS

Plastic Limit ⊢—⊣ **Liquid Limit**

Water Content - ●

Penetration - ▨

10 20 30 40 50

This information pertains only to this boring and should not be interpreted as being indicative of the site.

MAJOR DIVISIONS			SYMBOLS		TYPICAL NAMES
COARSE-GRAINED SOILS OVER 50% > No.200 SIEVE SIZE	GRAVELS MORE THAN 1/2 OF COARSE FRACTION > No.4 SIEVE SIZE	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW		Well-graded gravels or gravel-sand mixtures, little or no fines
			GP		Poorly graded gravels or gravel-sand mixtures, little or no fines
		GRAVELS WITH OVER 15% FINES	GM		Silty gravels, gravel-sand mixtures
			GC		Clayey gravels, gravel-sand-clay mixtures
	SANDS MORE THAN 1/2 OF COARSE FRACTION < No.4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 5% FINES	SW		Well-graded sand or gravelly sands, little or no fines
			SP		Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH OVER 15% FINES	SM		Silty sand, sand-silt mixtures
			SC		Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS OVER 50% < No.200 SIEVE SIZE	SILTS & CLAYS LIQUID LIMIT 50% OR LESS		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LIQUID LIMIT GREATER THAN 50%		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH		Inorganic clays of high plasticity, fat clays
			OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS			PT		Peat and other highly organic soils

JOHN TURNER CONSULTING

KEY TO SYMBOLS AND DESCRIPTIONS

TYPICAL SYMBOLS

- Shelby Tube
- Auger Cuttings
- Standard Split Spoon Sample
- 3" Split Spoon Sample
- Rock Core
- Dynamic Cone Penetrometer
- Vane Shear
- Bulk/Grab Sample
- Geoprobe Sample
- Sonic or Vibro-Core Sample
- Water Table (at time of drilling)
- Water Table (after 24 hours)

SOIL MOISTURE MODIFIERS

Term	Description
Dry	Absence of moisture; dusty, dry to touch
Moist	Damp but no visible water
Wet	Visible free water

The descriptor "damp" should not be used (use "moist").
The descriptor "saturated" should not be used (use "wet").

WELL SYMBOLS

- Recessed Cover Set in Concrete
- Top of Well, Recessed Pipe
- Covered Riser
- Capped Riser w/ Locking Cover
- Pipe Riser
- Concrete Seal
- Gravel Backfill
- Assorted Cuttings
- Bentonite Slurry
- Bentonite Pellets
- Silica Sand, blank PVC
- Slotted Pipe w/ Sand
- Endcap on Pipe Packed in Sand
- Silica Sand, No Pipe (End Plug)

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.75
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.75
SAND	No. 4 to No. 200	4.75 to 0.075
coarse	No. 4 to No. 10	4.75 to 2.00
medium	No. 10 to No. 40	2.00 to 0.425
fine	No. 40 to No. 200	0.425 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

RELATIVE DENSITY/CONSISTENCY

Gravel, Sand, and Silt (nonplastic)		Silt (plastic) and Clay		
N-Value	Relative Density	N-Value	Su	Consistency
0 - 4	Very Loose	0 - 2	0 - 250	Very Soft
5 - 10	Loose	3 - 4	251 - 500	Soft
11-30	Medium Dense	5 - 8	501 - 1000	Medium Stiff
31 - 50	Dense	9 - 15	1001 - 2000	Stiff
51 +	Very Dense	16 - 30	2001 - 4000	Very Stiff
		31 +	4001+	Hard

Standard Penetration Testing (SPT) N_{60} based on blows per 12 inches.
WR = Weight of Rods; WH = Weight of Hammer

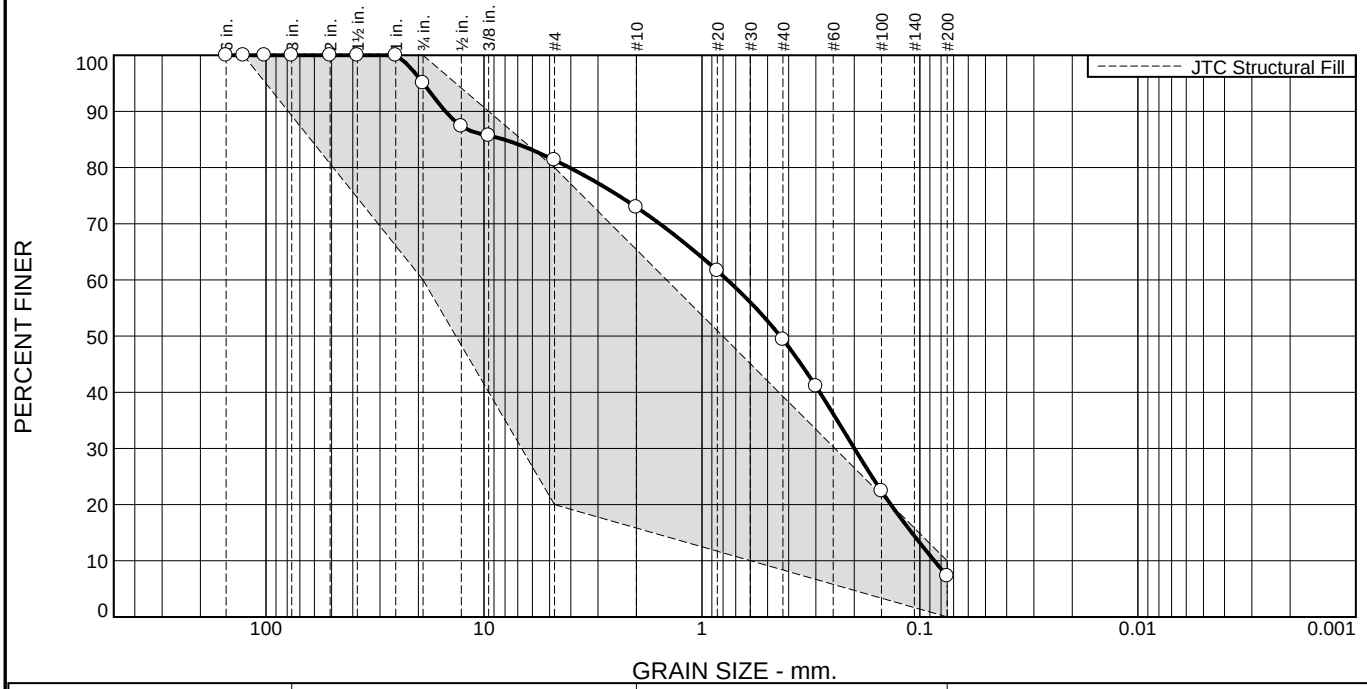
PERCENT OR PORTIONS OF SOIL

Term	Description
Parting:	> 1/16 in.
Seam:	0.5 in. to 1/16 in.
Layer:	12 in. to 0.5 in.
Stratum:	> 12 in.
Pocket:	Small erratic deposit
Lens:	Lenticular deposit
Occasional:	One or less per foot of thickness
Frequent	More than one per foot of thickness
Varved	Alternating seams or layers of silt and/or clay and sometimes f. sand

REFERENCE: UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488-93

APPENDIX C: LABORATORY TESTING REPORTS

Particle Size Distribution Report



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	27.0	23.6	42.1	7.3	

Test Results (ASTM C 136 & ASTM C 117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
6	100.0		
5	100.0	100.0	
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	95.1	60.0 - 100.0	
1/2	87.4		
3/8	85.7		
#4	81.3	20.0 - 80.0	X
#10	73.0		
#20	61.6		
#40	49.4		
#50	41.1		
#100	22.4		
#200	7.3	0.0 - 10.0	

* JTC Structural Fill

Material Description

Well Graded Sand with Silt and Gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SW-SM **AASHTO (M 145)=**

Coefficients

D_{90}= 15.0277 D_{85}= 8.1091 D_{60}= 0.7643
D_{50}= 0.4375 D_{30}= 0.1998 D_{15}= 0.1089
D_{10}= 0.0858 C_u= 8.91 C_c= 0.61

Remarks

3.8% Moisture

Date Received: 12/12/25 **Date Tested:** 12/15/25

Tested By: Alex Bair

Checked By: Mike Bronstein

Title: Branch Manager

Sample Number: B-1 SS03 **Depth:** 5-7 **Date Sampled:** 12/12/25

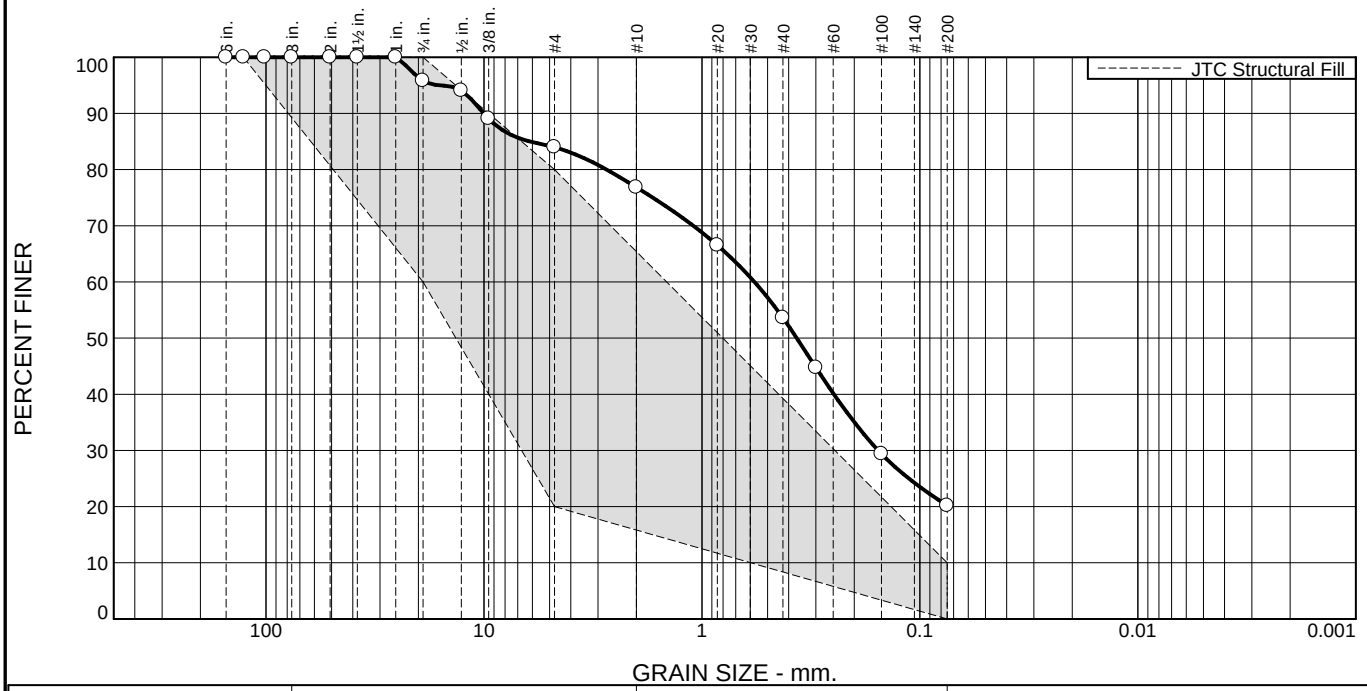
JOHN TURNER CONSULTING

Client: H2Olson Engineering, Inc.

Project: Proposed Water Treatment Plant
Fairwell Lane, Barnstable, MA

Project No: 25-04-150 **Figure**

Particle Size Distribution Report



% +3"	% Gravel	% Sand		% Fines	
		Coarse	Fine	Silt	Clay
0.0	23.1	23.3	33.4	20.2	

Test Results (ASTM C 136 & ASTM C 117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
6	100.0		
5	100.0	100.0	
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	95.8	60.0 - 100.0	
1/2	94.1		
3/8	89.1		
#4	84.0	20.0 - 80.0	X
#10	76.9		
#20	66.5		
#40	53.6		
#50	44.8		
#100	29.4		
#200	20.2	0.0 - 10.0	X

* JTC Structural Fill

Material Description

Silty Sand with Gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 10.0203 D_{85}= 6.1527 D_{60}= 0.5743
D_{50}= 0.3674 D_{30}= 0.1554 D_{15}=
D_{10}= C_u= C_c=

Remarks

8.7% Moisture

Date Received: 12/12/25 **Date Tested:** 12/15/25

Tested By: Alex Bair

Checked By: Mike Bronstein

Title: Branch Manager

Sample Number: B-5 SS02 **Depth:** 2-4 **Date Sampled:** 12/12/25

JOHN TURNER CONSULTING

Client: H2Olson Engineering, Inc.

Project: Proposed Water Treatment Plant
Fairwell Lane, Barnstable, MA

Project No: 25-04-150 **Figure**

APPENDIX D: SITE PHOTOGRAPHS

JOHN TURNER CONSULTING

PHOTO LOG

John Turner Consulting, Inc.	
Photo No. **1**	**Date:** 12/5/2025



Description: Site, facing South

Site Location: Fairwell Lane, Barnstable, MA	
Photo No. **2**	**Date:** 12/5/2025



Description: Drill Rig

John Turner Consulting, Inc.	
Photo No. **3**	**Date:** 12/5/2025



Description: B-1 (5-7 ft)

Site Location: Fairwell Lane, Barnstable, MA	
Photo No. **4**	**Date:** 12/5/2025



Description: B-5 (2-4 ft)

APPENDIX E: ADDITIONAL EARTHWORK RECOMMENDATIONS

Fill Placement and Compaction Recommendations

- The adequacy of compaction efforts should be verified by field density testing compared to the maximum theoretical density of the material as determined by ASTM D1557, Method C.
- All fill materials should be placed in lifts not exceeding 12 inches for heavy ride-on, vibratory rollers and 8 inches for hand-operated plate compactors.
- Crushed Stone should be placed in lifts, seated with compaction equipment, and completely wrapped in geotextile separation fabric.
- Where Recycled Building Materials are used as Structural Fill, placement and compaction should be observed by the Geotechnical Engineer.
- Fill should not be placed on soft, saturated, or frozen subgrade soils.

Grading and Drainage

- Grading and drainage should be provided at the site to direct stormwater runoff away from site improvements to reduce the likelihood of water ponding near the structure.
- Roof drains should discharge at least 5 feet from buildings or connect to the stormwater collection system.
- Drainage swales and/or edge drains should be added near the toe of slopes grading downward into the site to collect stormwater runoff. The swales or drains should be designed to direct stormwater runoff away from site improvements.
- Permanent fill or cut slopes should have a maximum slope of 2.5H:1V (horizontal to vertical) or flatter for dry conditions and 3H:1V for wet/submerged conditions. Steeper slopes may be possible with implementation of a slope stabilization system.
- All slopes should be protected from erosion during and after construction.

Removal of Existing Features

- Existing buildings, structures, associated foundations (including footings, foundation walls, slabs-on-grade, and/or basements), and/or utilities, should be completely removed from within proposed building areas. The resulting excavations should be replaced/backfilled with properly placed and compacted *Structural Fill.*
- Existing structures or subsurface utilities, including any private septic tank, leach field, and associated piping, located in areas outside of the proposed building areas may be removed or abandoned in place. Utilities abandoned in place should be plugged or capped to prevent migration of water. Tanks left in place should be filled. Structural elements to remain in place should be at least 3 feet below existing grade. Slabs left in place should be drilled or periodically broken to prevent ponding of water.

Subgrade Preparation

- Footing subgrades should be level or suitably benched and free of standing water and/or debris.
- Foundation subgrade soils should be protected against physical disturbance, precipitation, and/or frost throughout construction. The Contractor should be responsible for the means and methods to protect the foundation subgrade during construction.
- If shallow and/or perched groundwater is encountered, it must be removed in advance of excavation and continuously maintained at least 2 feet below the bottom of excavation and subsequent construction grade until the backfilling is complete.
- Over-excavation below foundations, if required, should include the *Foundation Zone of Influence (FZOI)* defined as the area extending from the edges of the footing outward and downward at a 1H:1.5V (horizontal to vertical) splay of bearing.

- The Contractor should take precautions to minimize subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing construction traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling excavations and footings as soon as practicable, grading and compacting exposed subgrades to promote surface water run-off and prevent ponding, and maintaining an effective dewatering program, as necessary.
- The following minimal proof-rolling efforts should be expected.
  - Building pad: 8 passes with a 10-ton smooth-drum roller
  - Foundation Trenches: 8 passes with a 5-ton smooth-drum roller
  - Utility Trenches: 4 passes with a vibratory plate compactor
  - Site: 8 passes with a 10-ton smooth-drum roller
- Proof-rolling should not be performed if the exposed subgrade soils are wet because this may result in soil pumping and instability. The proof-rolling efforts, including the number of passes and whether to use static or vibratory methods, should be directed by the Geotechnical Engineer
- Safe temporary excavation and/or fill slopes are the responsibility of the Contractor. Excavations should be conducted in accordance with local, state, and federal (OSHA) requirements, at a minimum. If an excavation cannot be properly sloped or benched due to space limitations, adjacent structures, water seepage, or other reasons, the Contractor should install an engineered excavation support system.
- If the subgrade should become frozen, wet, or disturbed, the affected material should be removed, or should be scarified, moisture conditioned, and recompacted.
- Proper groundwater control and stormwater management are necessary to maintain site stability. Groundwater should be removed in advance and continuously maintained at least 2 feet below the working construction grade until earthworks and/or backfilling are complete.
- If groundwater seepage and/or wet soils are observed at subgrade level, a ¾-inch minus crushed stone base may be placed over the exposed subgrade soils. The stone should be completely wrapped with a geotextile separation fabric. The fabric and stone should be immediately placed over the undisturbed subgrade and then tamped with a plate compactor until exhibiting stable conditions.
- Fill should not be placed on soft, saturated, or frozen subgrade soils.

Construction Dewatering

- Any seepage of groundwater or collected precipitation should be intercepted and maintained below the excavation bottom such that construction proceeds in the dry.
- Water collected from dewatering efforts should be screened and discharged per the project permits.

Foundation Backfill

- To minimize the potential for foundation wall damage during backfill and compaction activities, foundation wall backfill should be placed in a manner that maintains balanced fill height on both sides of the wall.

Construction Monitoring and Quality Control Testing

- A qualified geotechnical engineer or representative should be retained to review the site preparation and grading activities and foundation subgrade preparations, at a minimum. Similarly, quality control testing, including in-place field density and moisture tests, should be performed to confirm that the specified compaction is achieved. It is recommended that JTC be retained to provide earthwork construction monitoring and quality control testing services.

APPENDIX F: ASFE GEOTECHNICAL ENGINEERING REPORT INFORMATION

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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IIGER06085.0MRP

APPENDIX G: LIMITATIONS

Explorations

1. The analyses and recommendations presented in this report are based in part upon the data obtained from widely-spaced subsurface explorations. Subsurface conditions between exploration locations may vary from those encountered at the exploration locations. The nature and extent of variations between explorations may not become evident until construction. If variations appear, it will be necessary to re-evaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to portray the typical subsurface conditions at the site. The boundaries between strata are approximate and have been developed by interpretation of widely-spaced explorations and samples; actual strata transitions may be different at each location and across the site. For specific information, refer to the individual exploration logs.
3. Water level readings have been made in the explorations under conditions stated on the logs. This data has been reviewed and interpretations have been made in the text of this report. However, fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the conditions at the time the measurements were made.

Review

1. We recommend that John Turner Consulting, Inc. (JTC) be retained to review the design drawings and specifications to evaluate the appropriate implementation of our geotechnical engineering recommendations.
2. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed, and the conclusions of the report modified or verified in writing by JTC

Construction

1. We recommended that JTC be retained during construction to observe compliance with the design concepts, specifications, and recommendations and to recommend changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.
2. Site safety, excavation support, and dewatering requirements are the responsibility of others.

Use of Report

1. This report has been prepared by JTC for the exclusive use of the addressee for the specific project discussed. All considerations are based on the available information, in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.
2. This report was completed for preliminary design purposes and may be limited in scope. The report includes our geotechnical recommendations for the project. The final drawings and specifications may or may not have followed our recommendations. The report should be considered a reference document, not a specification.
3. The scope of services for this report did not include any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such conditions, other studies should be undertaken.

FORM 11: SOIL EVALUATION FORM

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

Location Address or Lot No. : 1650 Iyannough Rd
BFD #3&4 WTP

Deep Hole Number: Resid 1 Date: 5/15/26 Time: 0800 Weather: Clr 55°
Location (identify on site plan):
Land Use: Slope (%): 0% Surface Stones: NONE
Vegetation:
Landform:
Position on landscape (sketch on the back):
Distances from:
Open Water Body (ft) N/A
Possible Wet Area (ft) N/A
Drinking Well (ft) ~350'
Drainage way (ft)
Property Line (ft)
Other (ft)

DEEP OBSERVATION HOLE LOG

Depth from Surface (in)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsel)	Soil Motting	Other (Structure, Stress, Boulder, Consistency, Gravel)
3"	A	LOAM	DK BROWN	NONE	
18"	B	SILTY SAND	TAN	NONE	
24"	C	"	GRAY	ERRATIC AT 24"	DISCONTINUOUS MOTTLE AT 24"
132"	C		TAN/GRAY	NONE	TAN/GRAY F-M SAND SOME GRAVEL

PERCOLATION TEST

Test Pit No.			
Perc Depth			
Start Pre-Soak			
End Pre-Soak			

Parent Material (geologic):
Depth to Groundwater: >11' Standing Water in Hole: NONE Depth to Bedrock:
Estimated Seasonal High Ground Water: >25' Weeping from Pit Face: NONE
Site Passed: Site Failed:
Performed by: Witnessed by:

SOIL EVALUATION FORM

Location Address or Lot No. :

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

Deep Hole Number: Resid 2 Date: 5/15/26 Time: 0845 Weather: O/C 50°F

Location (identify on site plan):

Land Use: Slope (%): 0% Surface Stones: N/A

Vegetation:

Landform:

Position on landscape (sketch on the back):

Distances from:

Open Water Body (ft) Drainage way (ft)

Possible Wet Area (ft) N/A Property Line (ft)

Drinking Well (ft) Other (ft)

DEEP OBSERVATION HOLE LOG

Depth from Surface (in)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsel)	Soil Motting	Other (Structure, Stress, Boulder, Consistency, Gravel)
3"	A	LOAM			COBBLES in top 6"
18"	B	SILTY SAND			
24	C	SILTY SAND w/ GRAVEL		NONE	RUST STREAK AT 40" - inconsistent
120"					

PERCOLATION TEST

Test Pit No.			
Perc Depth			
Start Pre-Soak			
End Pre-Soak			

Parent Material (geologic): Outwash

Depth to Groundwater: >30' Standing Water in Hole: No Depth to Bedrock:

Weeping from Pit Face: No

Estimated Seasonal High Ground Water:

Site Passed: Site Failed:

Performed by: Witnessed by:

FORM 11: SOIL EVALUATION FORM

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS

Location Address or Lot No.: ~~Sub-1~~ 1650 Iyannough Rd Barnstable

Deep Hole Number: SW-1 Date: 3/15/26 Time: 12:00pm Weather: O/C 50°
Location (identify on site plan):
Land Use: Slope (%): 0% Surface Stones: None
Vegetation:
Landform:
Position on landscape (sketch on the back):
Distances from:
Open Water Body (ft) N/A Drainage way (ft) N/A
Possible Wet Area (ft) Property Line (ft)
Drinking Well (ft) Other (ft)

DEEP OBSERVATION HOLE LOG

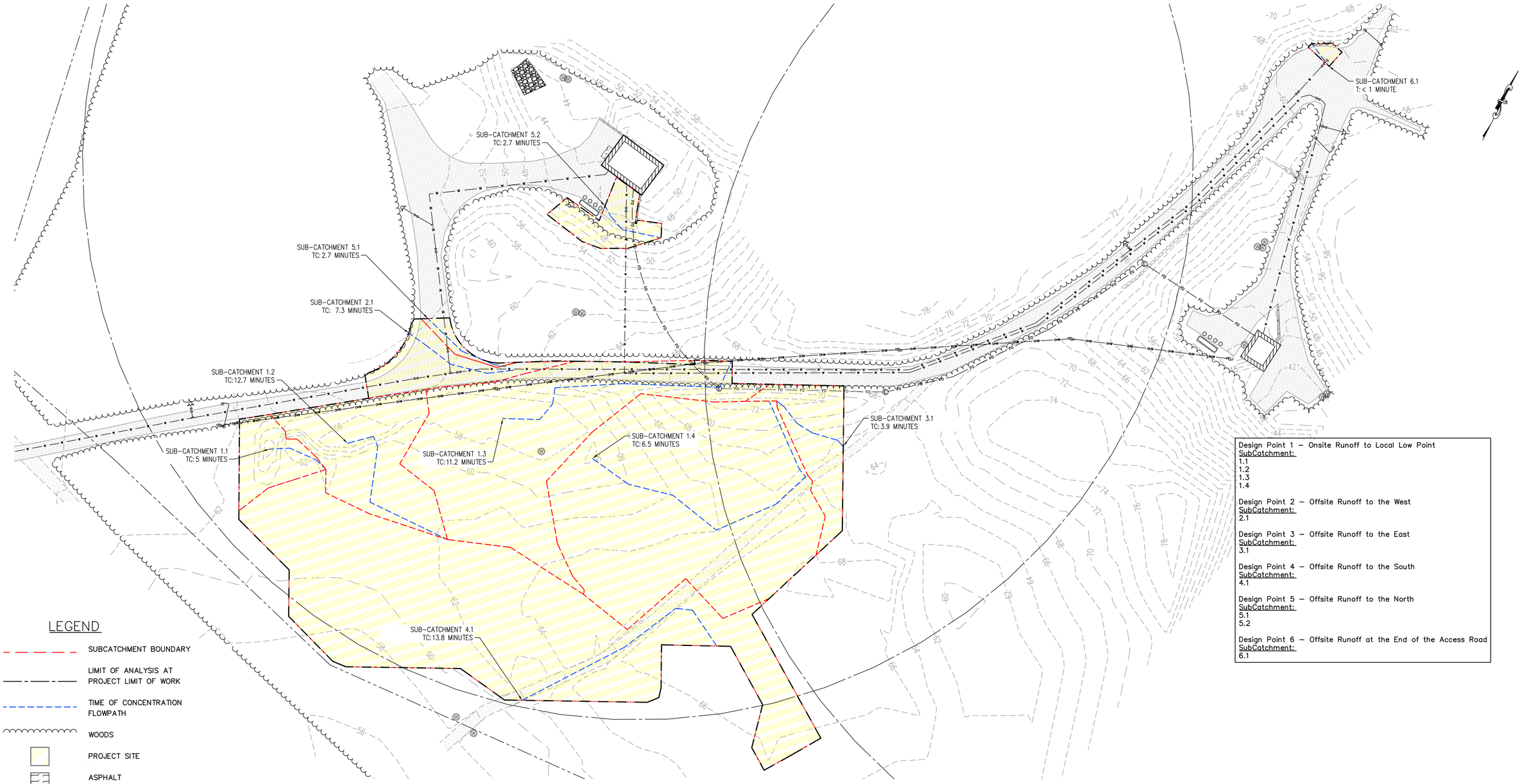
Depth from Surface (in)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsel)	Soil Motting	Other (Structure, Stress, Boulder, Consistency, Gravel)
0-3"	~~Loam~~ A	Loam	DK Br		
3-13"	B	Loamy Silt	Br		
13-84"	C	~~Silt Sand~~ Sand	Tan	None	F-M SAND, Some Silt, Little gravel at 2'
84-120					SAME

PERCOLATION TEST

Test Pit No.			
Perc Depth			
Start Pre-Soak			
End Pre-Soak			

Parent Material (geologic): Outwash
Depth to Groundwater: >30' Standing Water in Hole: No Depth to Bedrock:
Estimated Seasonal High Ground Water: >30' Weeping from Pit Face: No
Site Passed: Site Failed:
Performed by: Witnessed by:

Appendix F – Watershed Plans



LEGEND

- SUBCATCHMENT BOUNDARY
- LIMIT OF ANALYSIS AT PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT

Design Point 1 – Onsite Runoff to Local Low Point
SubCatchment:
1.1
1.2
1.3
1.4

Design Point 2 – Offsite Runoff to the West
SubCatchment:
2.1

Design Point 3 – Offsite Runoff to the East
SubCatchment:
3.1

Design Point 4 – Offsite Runoff to the South
SubCatchment:
4.1

Design Point 5 – Offsite Runoff to the North
SubCatchment:
5.1
5.2

Design Point 6 – Offsite Runoff at the End of the Access Road
SubCatchment:
6.1

PLAN VIEW

SCALE: 1" = 35'

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

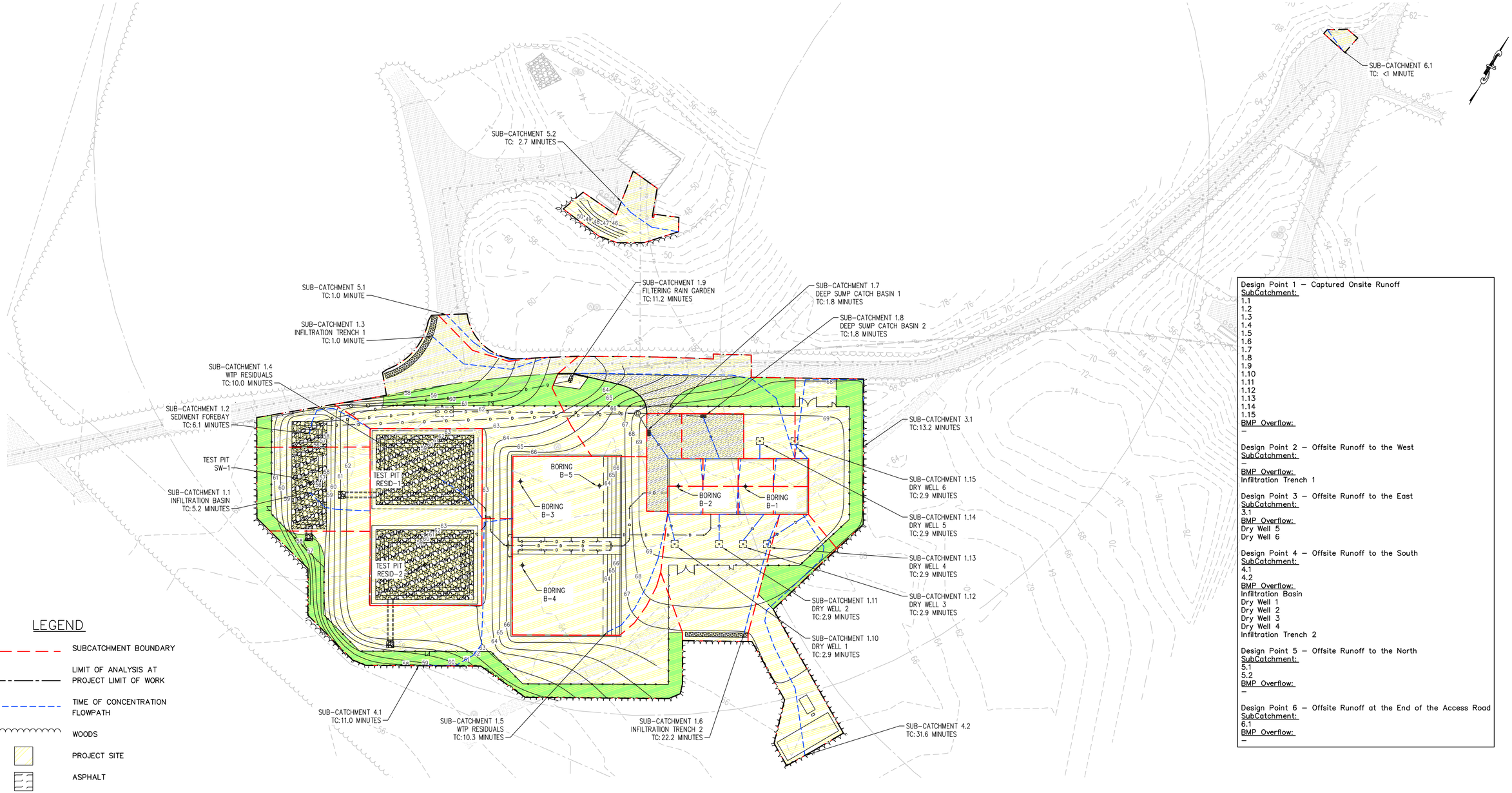
BARNSTABLE FIRE DISTRICT
WELLS 3 & 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
EXISTING WATERSHED PLAN

DRAWING NO.:
AF-1

SHEET NO. 1 OF 3

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\XRefs\XR_Existing.dwg



Design Point 1 – Captured Onsite Runoff
SubCatchment:
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
1.10
1.11
1.12
1.13
1.14
1.15
BMP Overflow:
–

Design Point 2 – Offsite Runoff to the West
SubCatchment:
–
BMP Overflow:
Infiltration Trench 1

Design Point 3 – Offsite Runoff to the East
SubCatchment:
3.1
BMP Overflow:
Dry Well 5
Dry Well 6

Design Point 4 – Offsite Runoff to the South
SubCatchment:
4.1
4.2
BMP Overflow:
Infiltration Basin
Dry Well 1
Dry Well 2
Dry Well 3
Dry Well 4
Infiltration Trench 2

Design Point 5 – Offsite Runoff to the North
SubCatchment:
5.1
5.2
BMP Overflow:
–

Design Point 6 – Offsite Runoff at the End of the Access Road
SubCatchment:
6.1
BMP Overflow:
–

LEGEND

- SUBCATCHMENT BOUNDARY
- LIMIT OF ANALYSIS AT PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT
- BRUSH

PLAN VIEW

SCALE: 1" = 35'

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

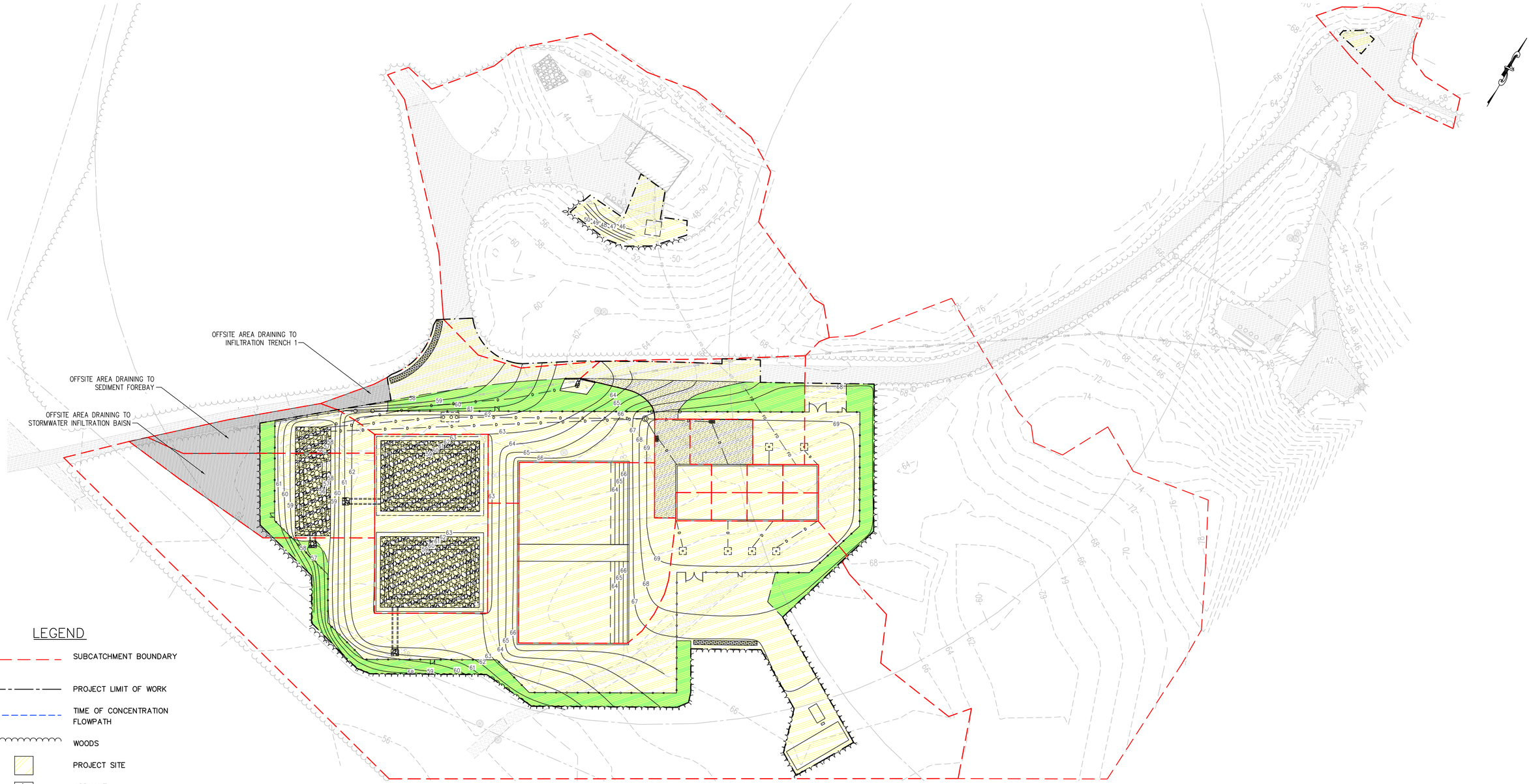
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
PROPOSED WATERSHED PLAN

DRAWING NO.:
AF-2

SHEET NO. 2 OF 3

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C-Sheets.dwg



LEGEND

- SUBCATCHMENT BOUNDARY
- PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT
- BRUSH
- OFFSITE AREAS DRAINING TO PROPOSED DRAINAGE SYSTEM

PLAN VIEW

SCALE: 1" = 35'

FOR PERMITTING

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

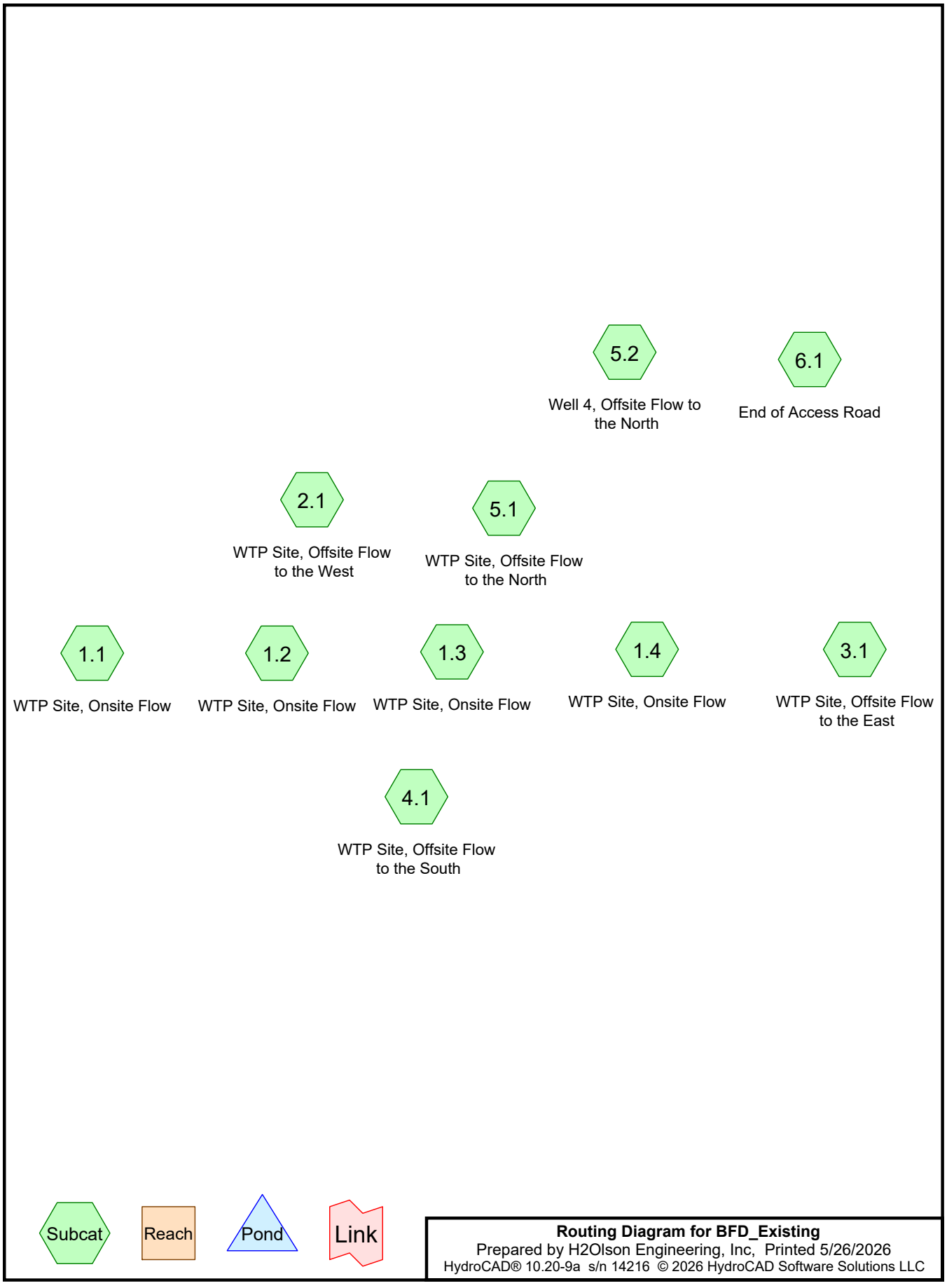
DRAWING TITLE:
PROPOSED OFFSITE CONTRIBUTION PLAN

DRAWING NO.:
AF-3

SHEET NO. 3 OF 3

C:\Users\Genevieve\H2Olson Engineering, Inc\H2O - 03 Projects\127 - Barnstable Fire District\127.25.02 - Well 3&4 WTP Design\01 Design\A. Drawings\C-Sheets\C Sheets.dwg

Appendix G – Existing Conditions HydroCAD Model Results



Routing Diagram for BFD_Existing
Prepared by H2Olson Engineering, Inc, Printed 5/26/2026
HydroCAD® 10.20-9a s/n 14216 © 2026 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type II 24-hr		Default	24.00	1	3.39	2
2	10-Year	Type II 24-hr		Default	24.00	1	4.95	2
3	25-Year	Type II 24-hr		Default	24.00	1	5.92	2
4	100-Year	Type II 24-hr		Default	24.00	1	7.41	2
5	RMAT 50-Year	Type II 24-hr		Default	24.00	1	8.70	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.052	49	50-75% Grass cover, Fair, HSG A (1.4, 3.1, 4.1)
0.008	39	>75% Grass cover, Good, HSG A (2.1)
0.132	98	Paved parking, HSG A (1.3, 2.1, 5.1, 5.2, 6.1)
1.594	30	Woods, Good, HSG A (1.1, 1.2, 1.3, 1.4, 3.1, 4.1)
0.311	45	Woods, Poor, HSG A (4.1, 5.2)
2.097	**37**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.097	HSG A	1.1, 1.2, 1.3, 1.4, 2.1, 3.1, 4.1, 5.1, 5.2, 6.1
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.097		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.052	0.000	0.000	0.000	0.000	0.052	50-75% Grass cover, Fair	1.4, 3.1, 4.1
0.008	0.000	0.000	0.000	0.000	0.008	>75% Grass cover, Good	2.1
0.132	0.000	0.000	0.000	0.000	0.132	Paved parking	1.3, 2.1, 5.1, 5.2, 6.1
1.594	0.000	0.000	0.000	0.000	1.594	Woods, Good	1.1, 1.2, 1.3, 1.4, 3.1, 4.1
0.311	0.000	0.000	0.000	0.000	0.311	Woods, Poor	4.1, 5.2
2.097	**0.000**	**0.000**	**0.000**	**0.000**	**2.097**	**TOTAL AREA**	

Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=0.00"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.00 cfs 0.000 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>2.40"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.26 cfs 0.014 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>2.92"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.05 cfs 0.002 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=0.56"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.03 cfs 0.002 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>2.92"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.03 cfs 0.001 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.020 af Average Runoff Depth = 0.11"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

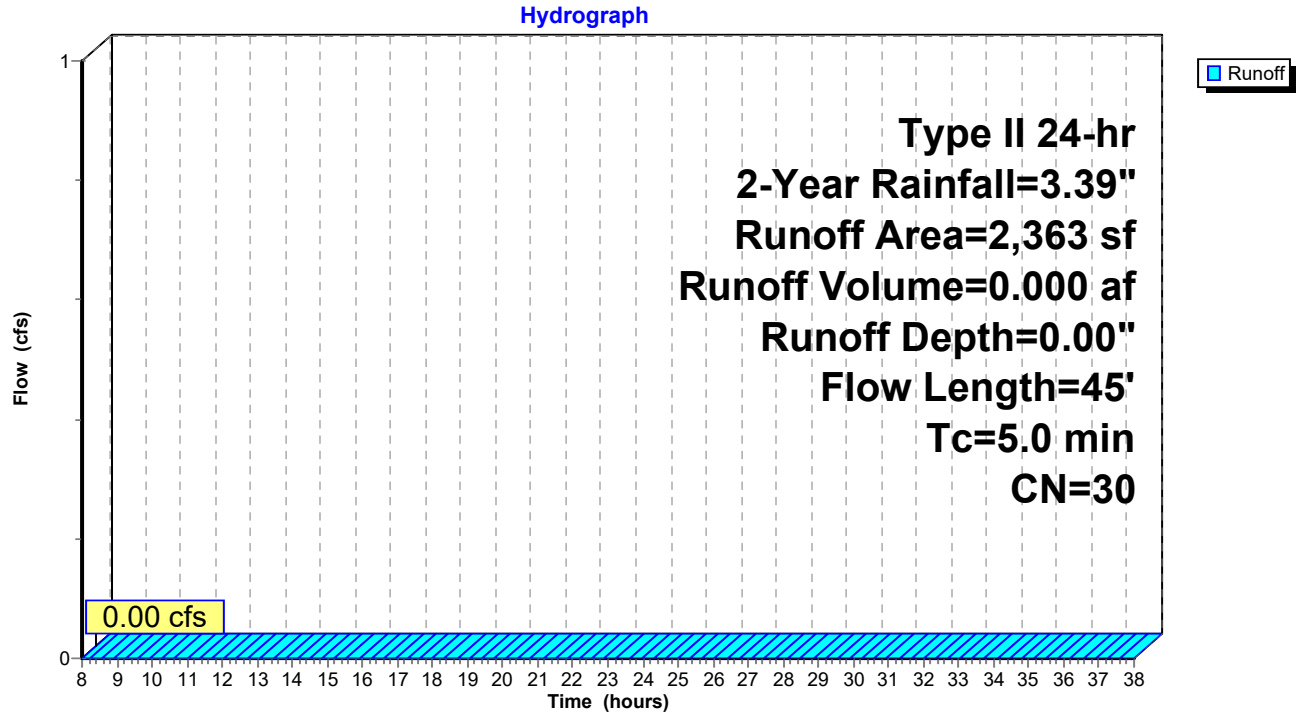
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

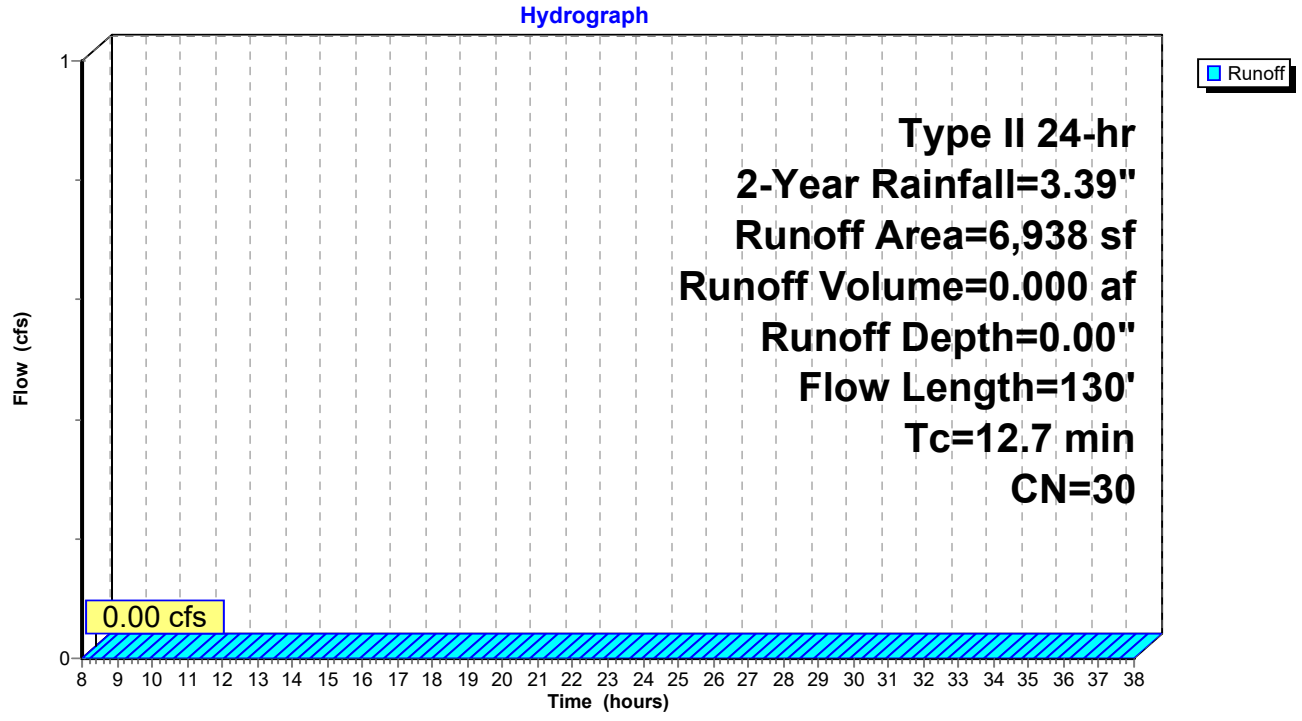
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

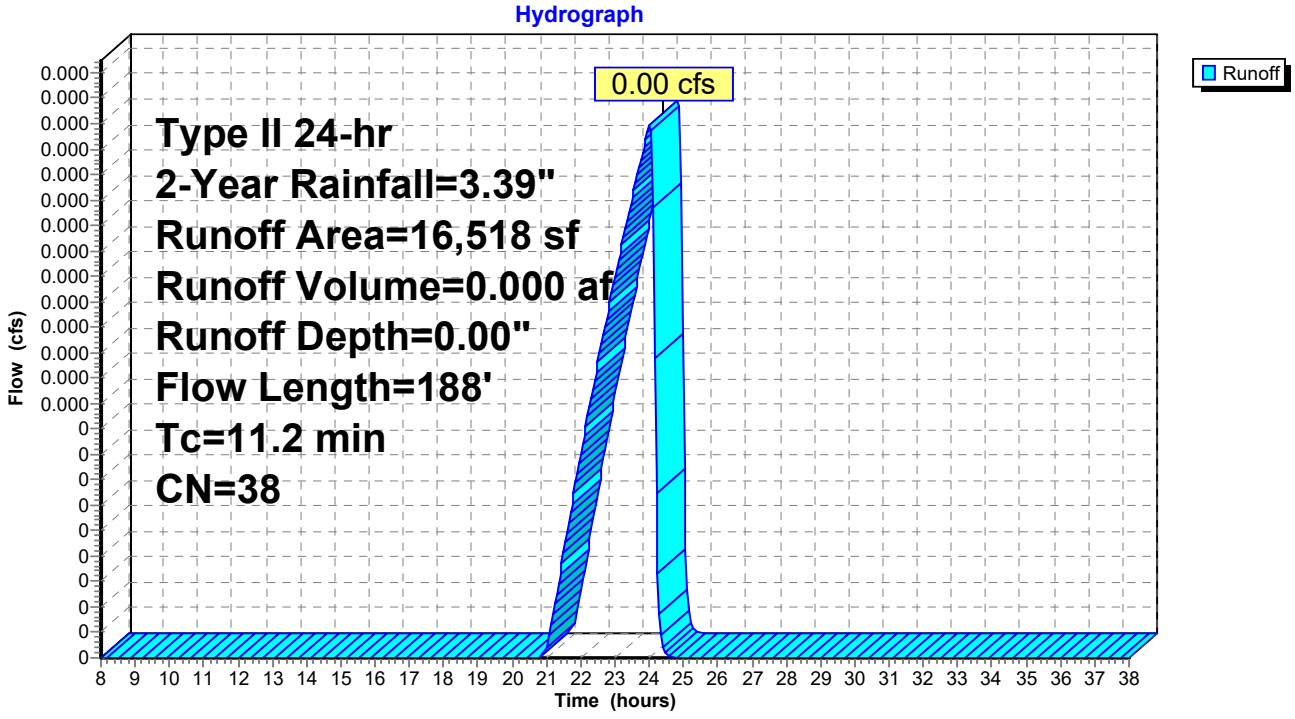
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

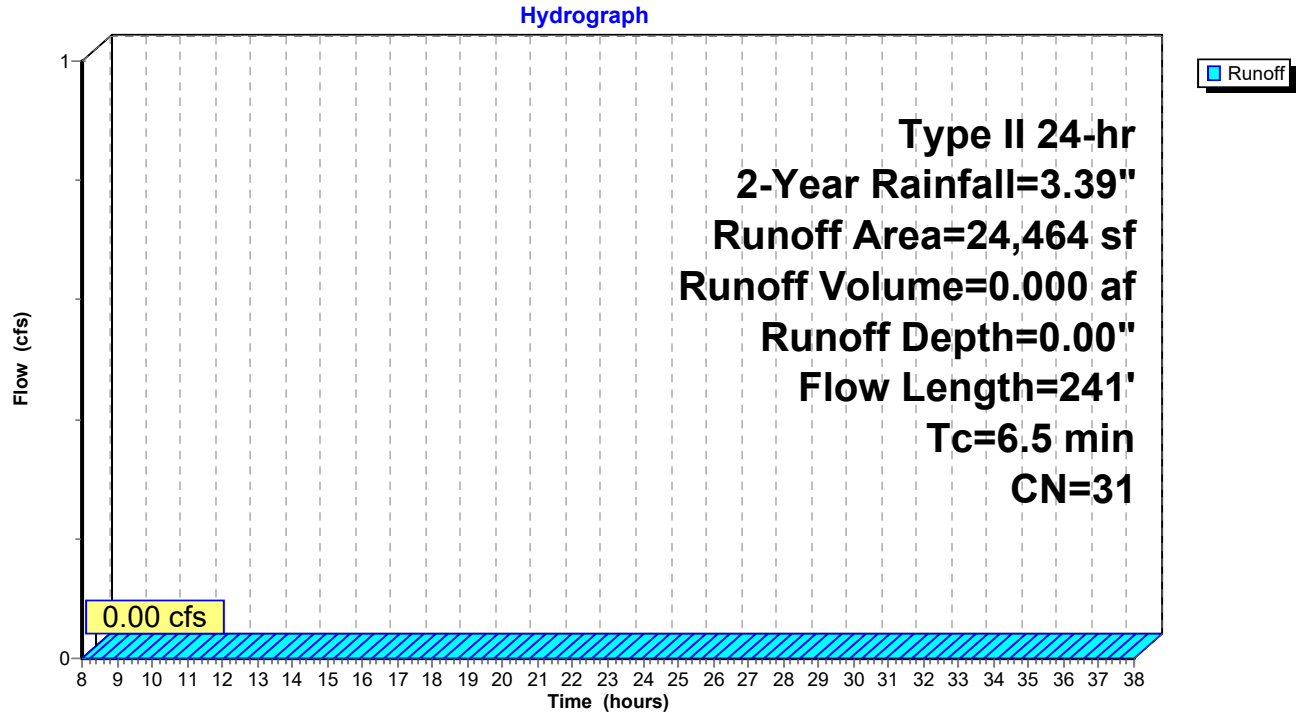
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

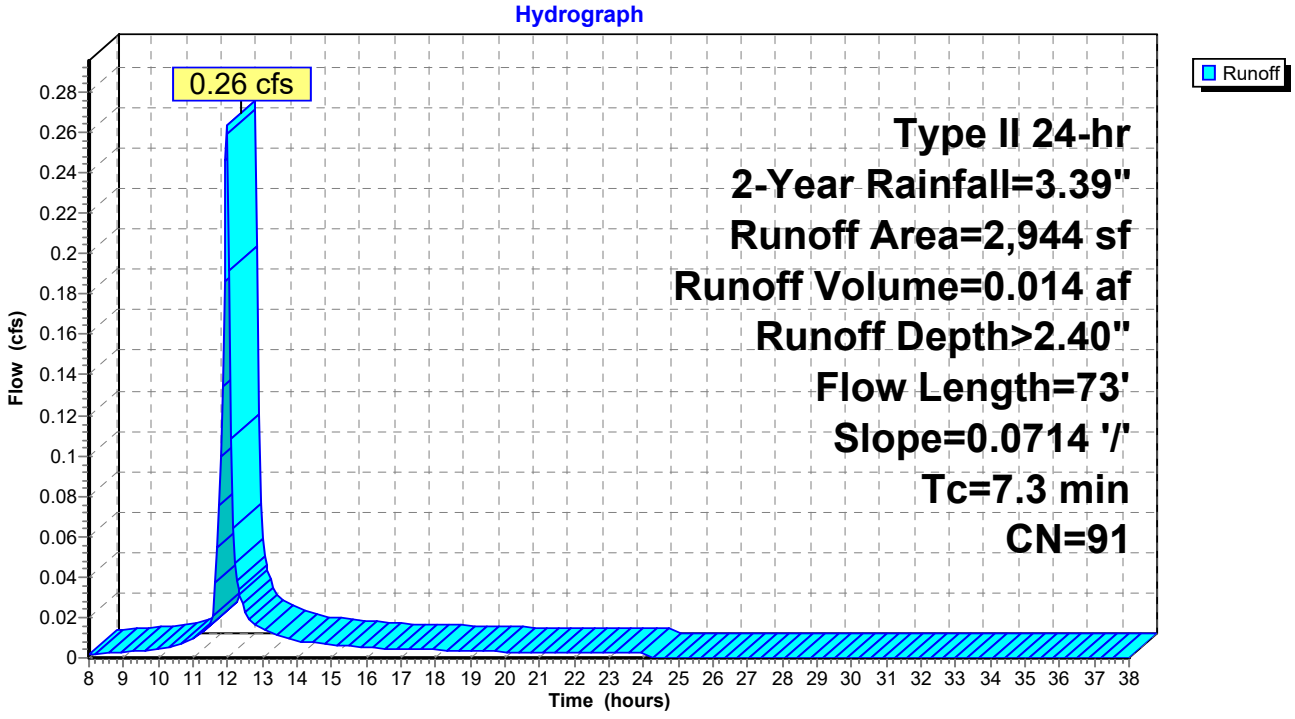
Runoff = 0.26 cfs @ 11.98 hrs, Volume= 0.014 af, Depth> 2.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

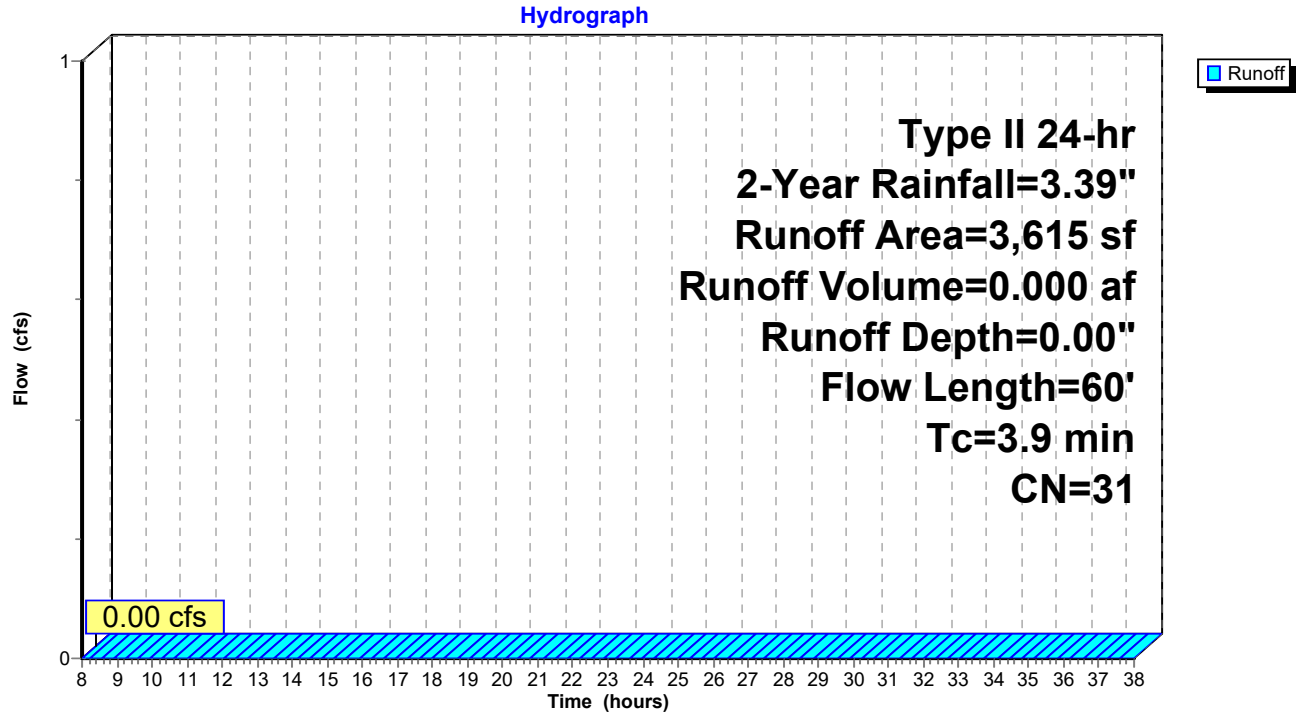
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

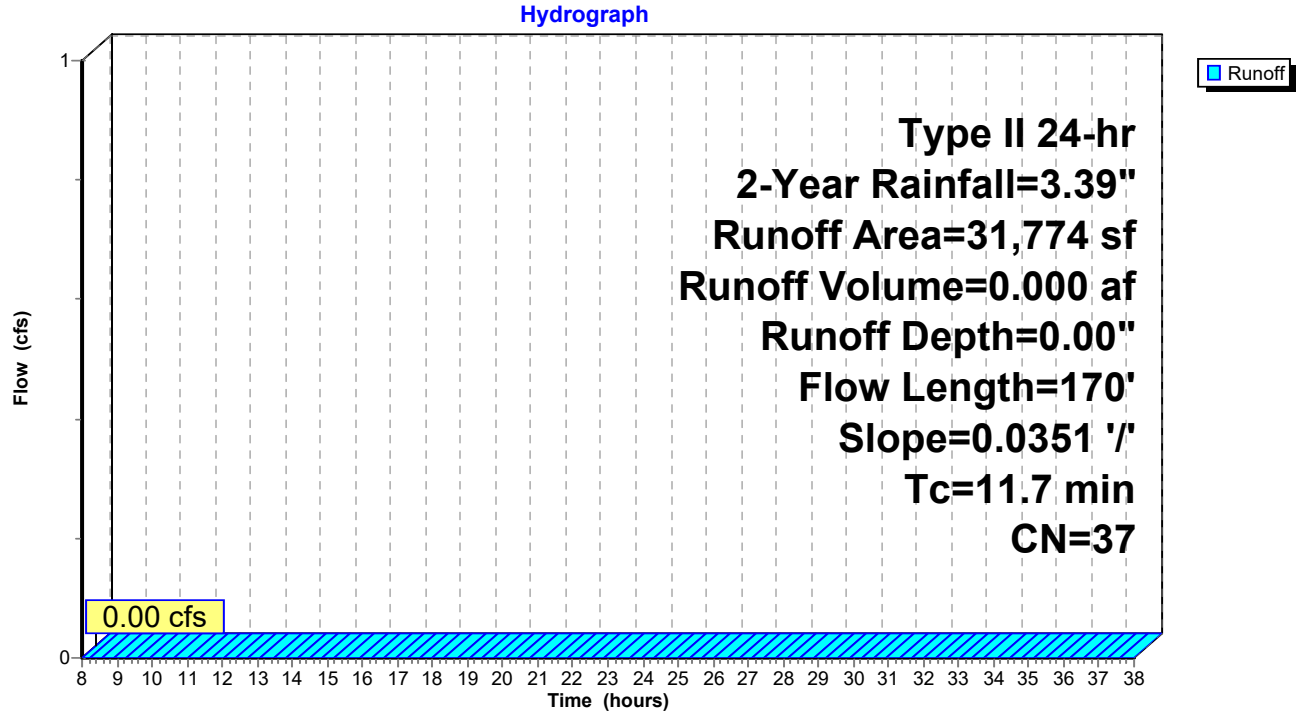
Runoff = 0.00 cfs @ 8.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

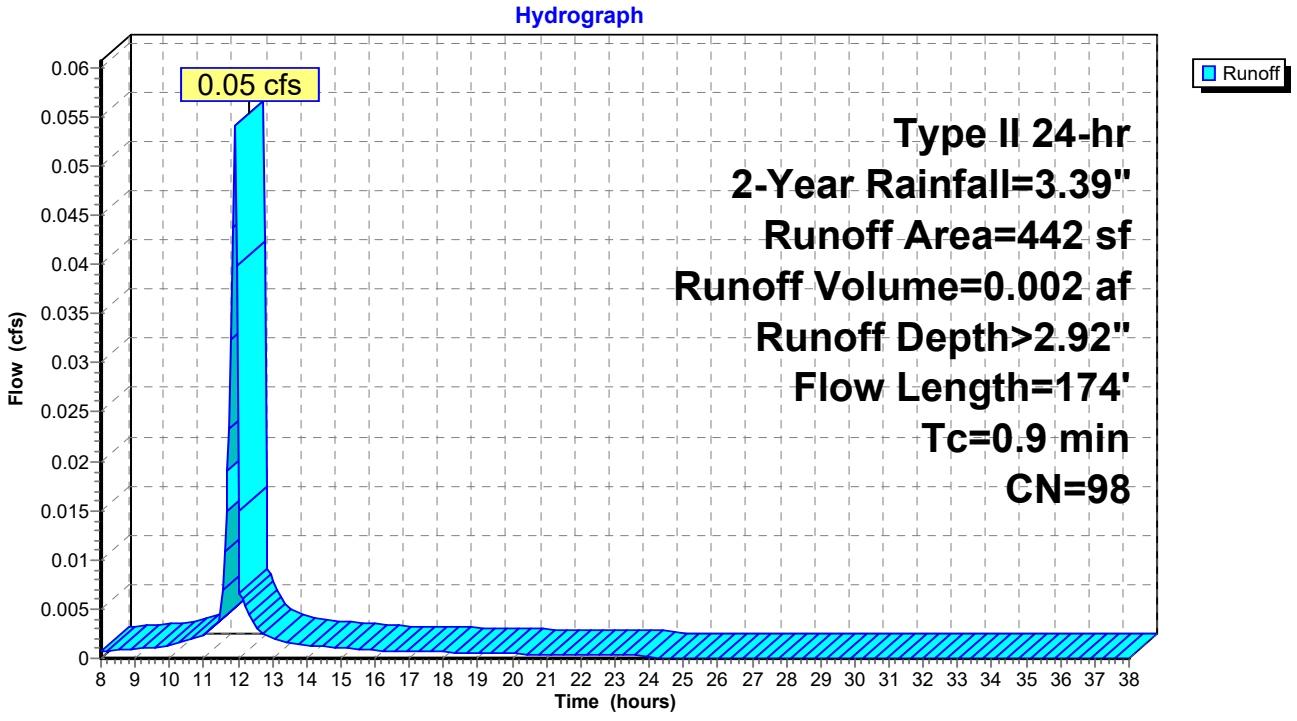
Runoff = 0.05 cfs @ 11.90 hrs, Volume= 0.002 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

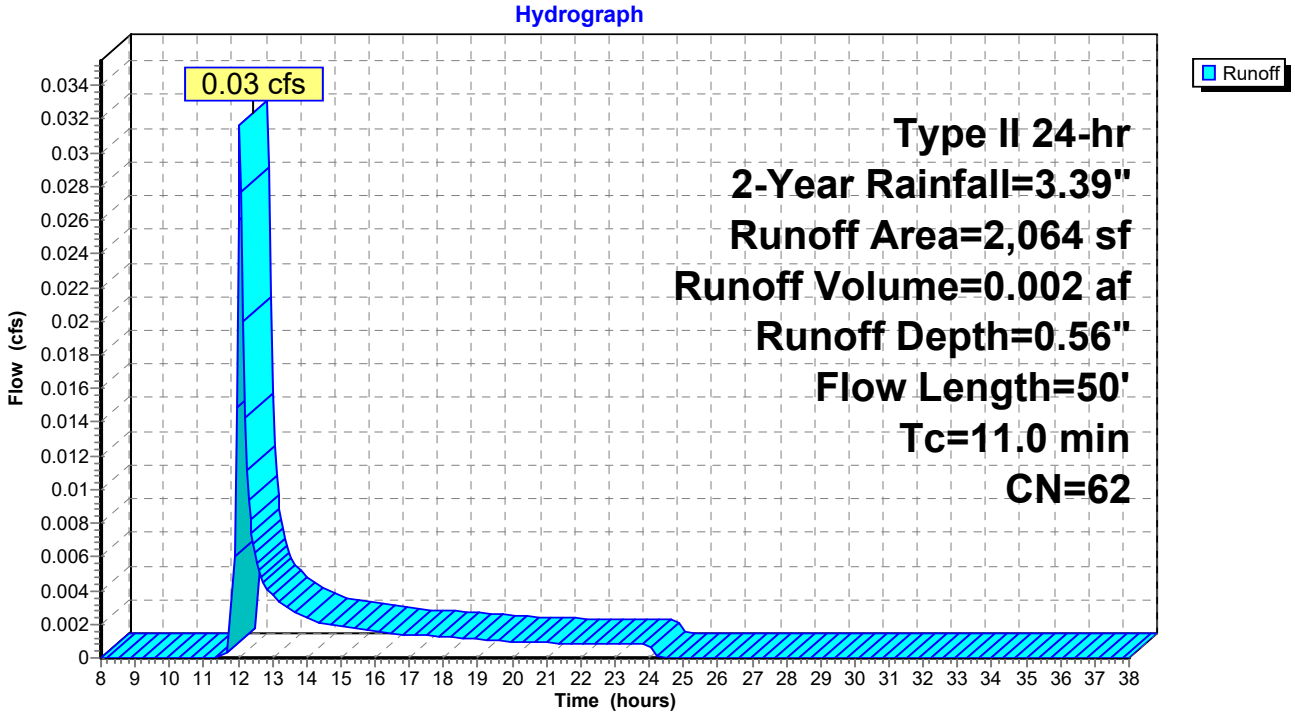
Runoff = 0.03 cfs @ 12.05 hrs, Volume= 0.002 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

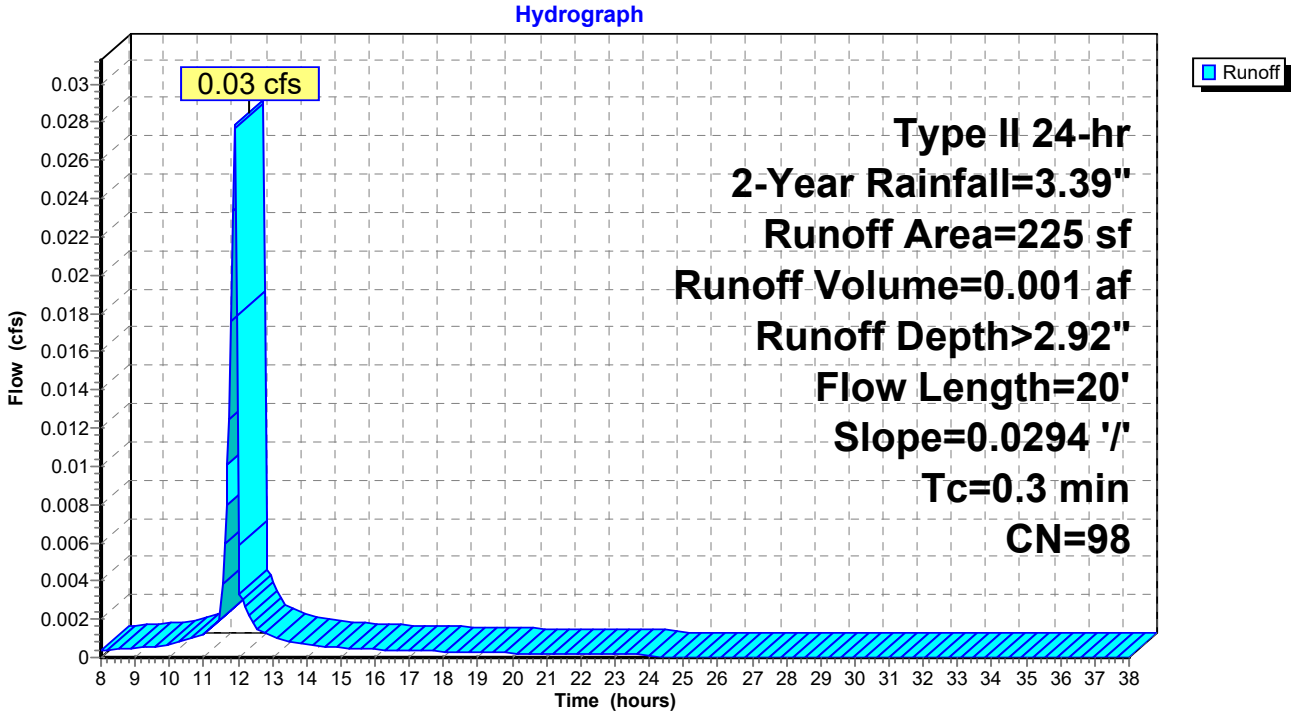
Runoff = 0.03 cfs @ 11.89 hrs, Volume= 0.001 af, Depth> 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=0.16"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.01 cfs 0.005 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.00 cfs 0.001 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>3.83"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.41 cfs 0.022 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=0.13"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.01 cfs 0.008 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>4.31"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.08 cfs 0.004 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=1.41"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.09 cfs 0.006 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>4.31"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.04 cfs 0.002 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.046 af Average Runoff Depth = 0.26"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

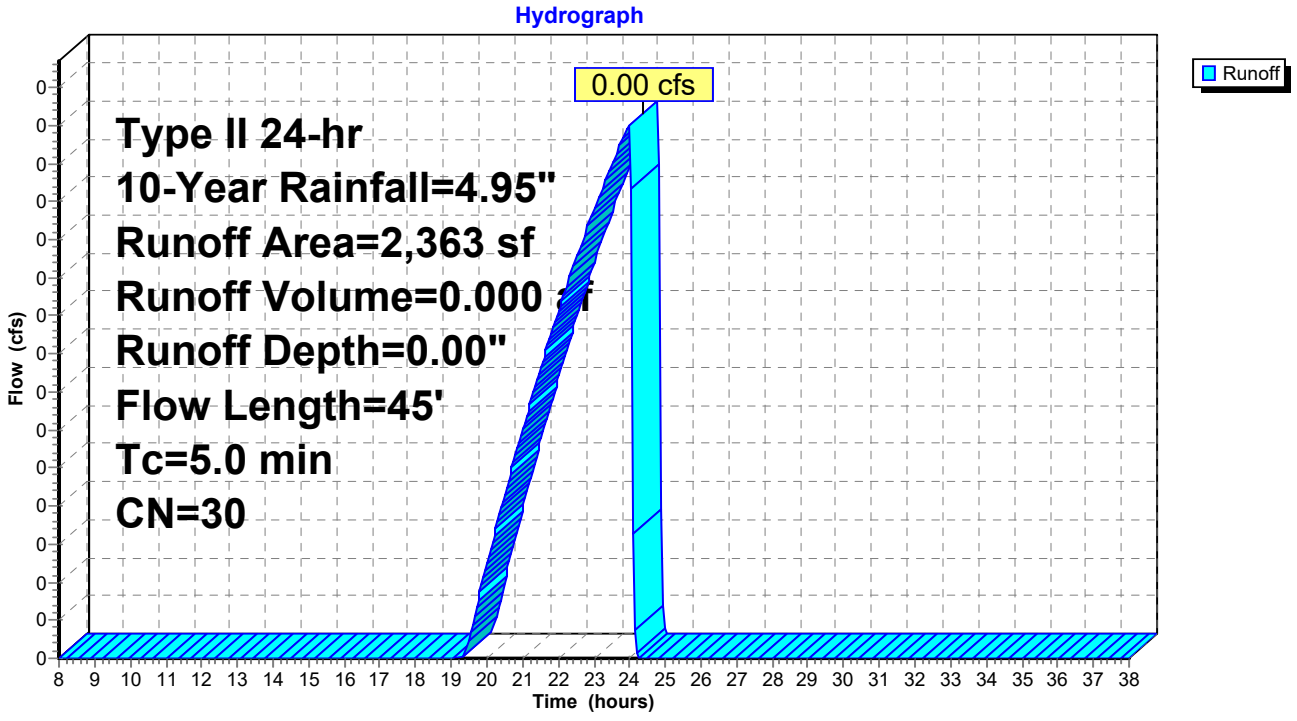
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

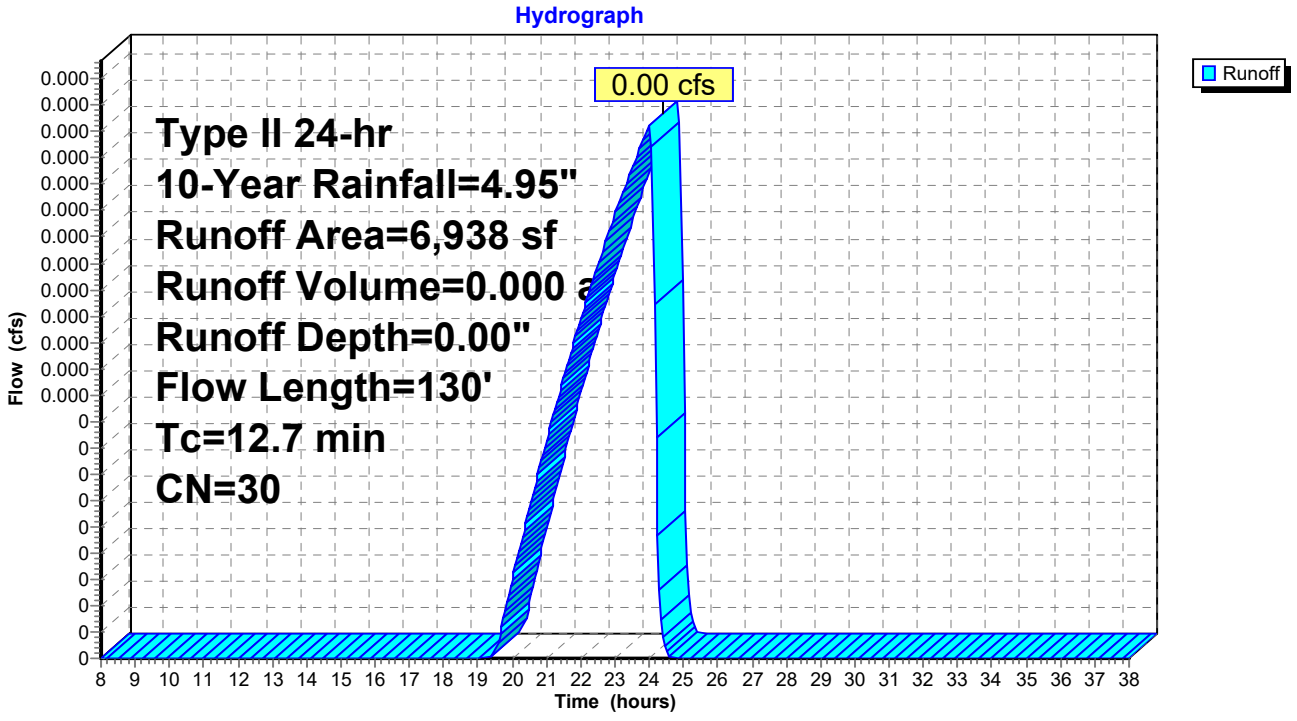
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

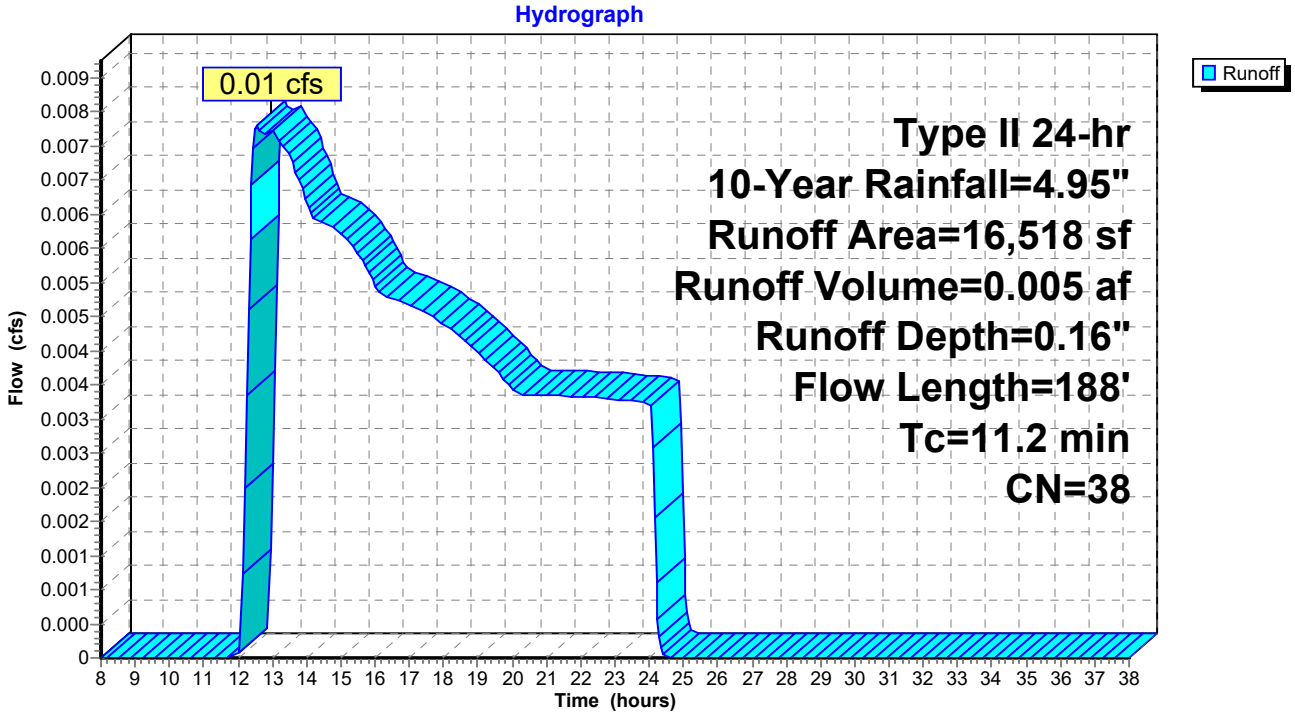
Runoff = 0.01 cfs @ 12.54 hrs, Volume= 0.005 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

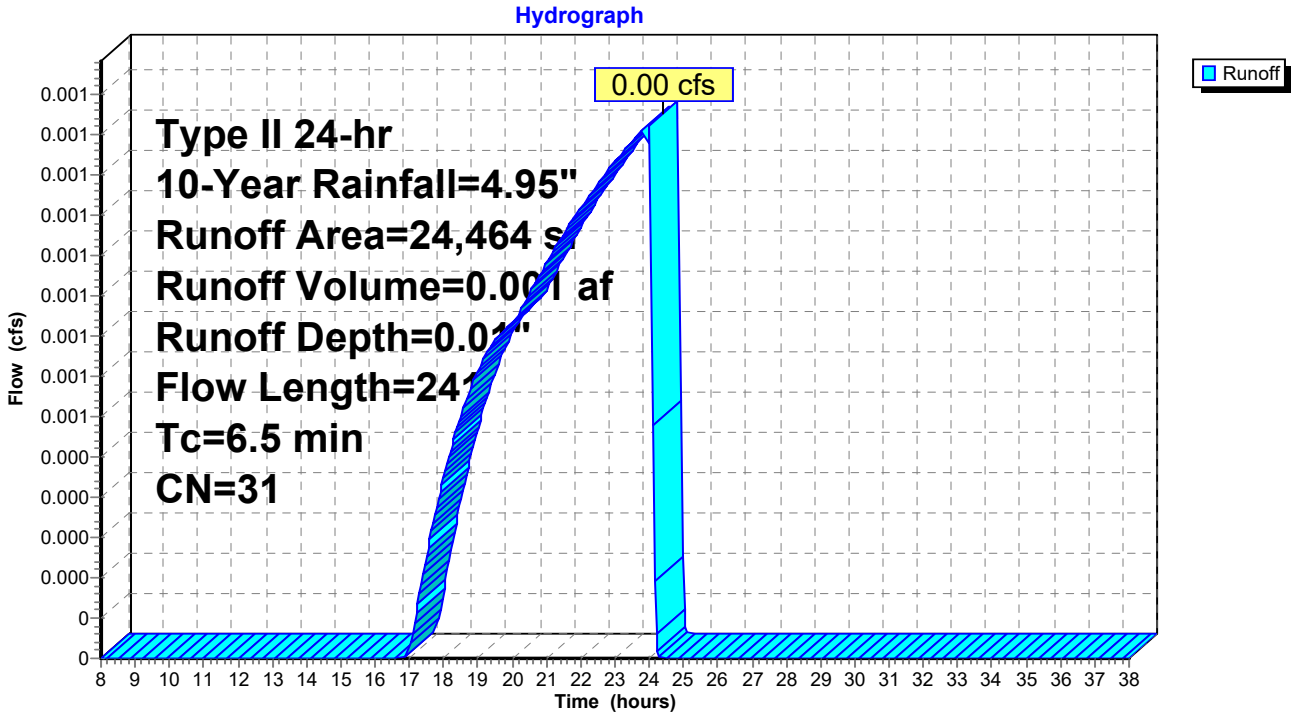
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

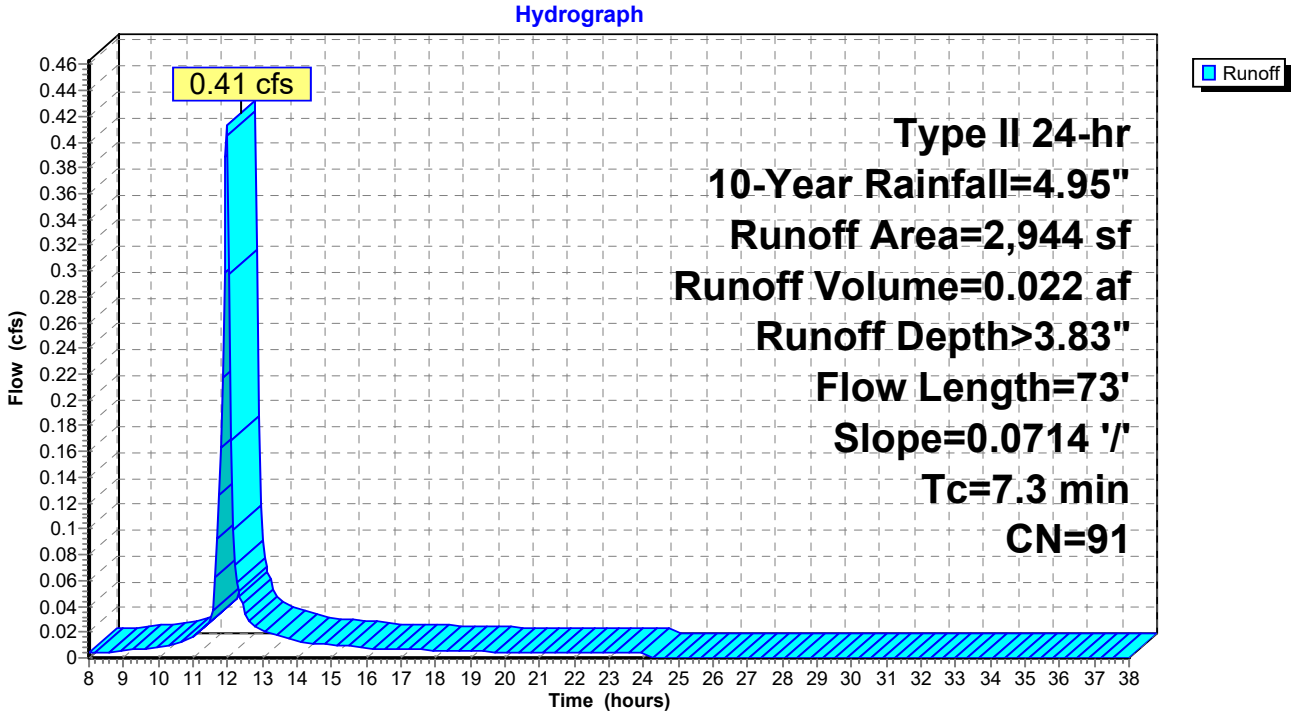
Runoff = 0.41 cfs @ 11.98 hrs, Volume= 0.022 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

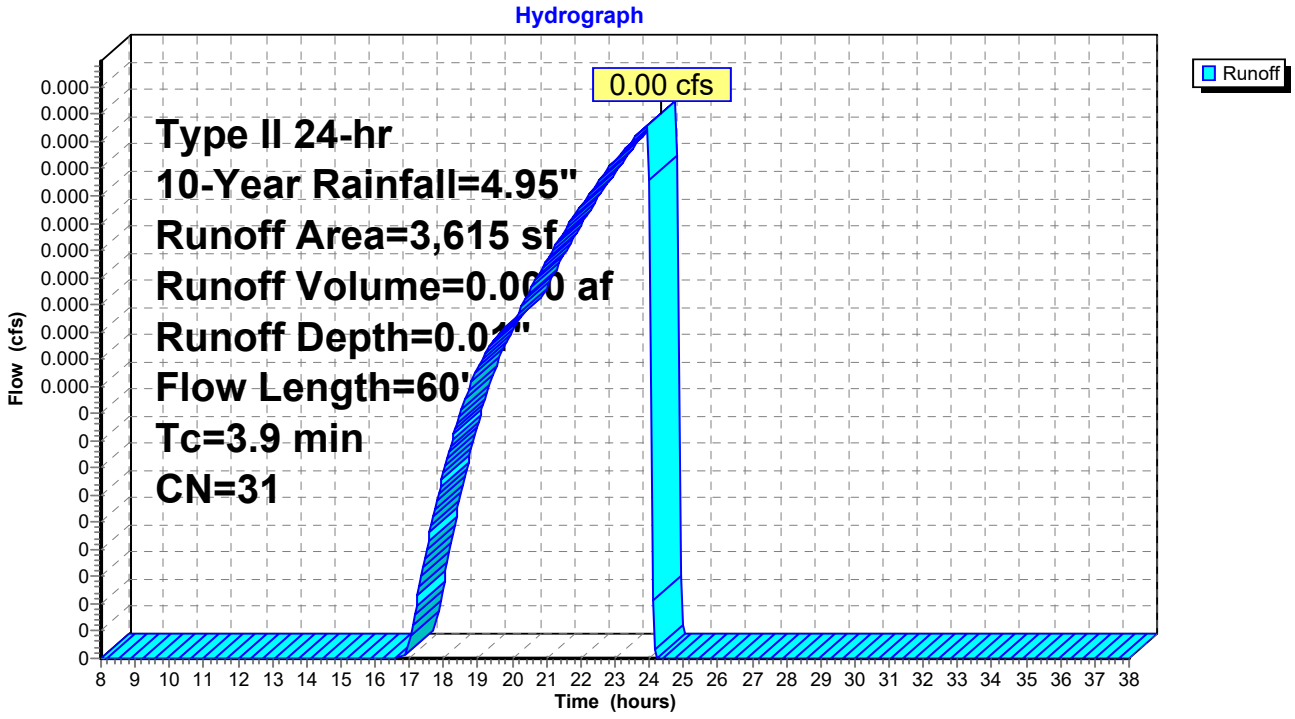
Runoff = 0.00 cfs @ 23.95 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

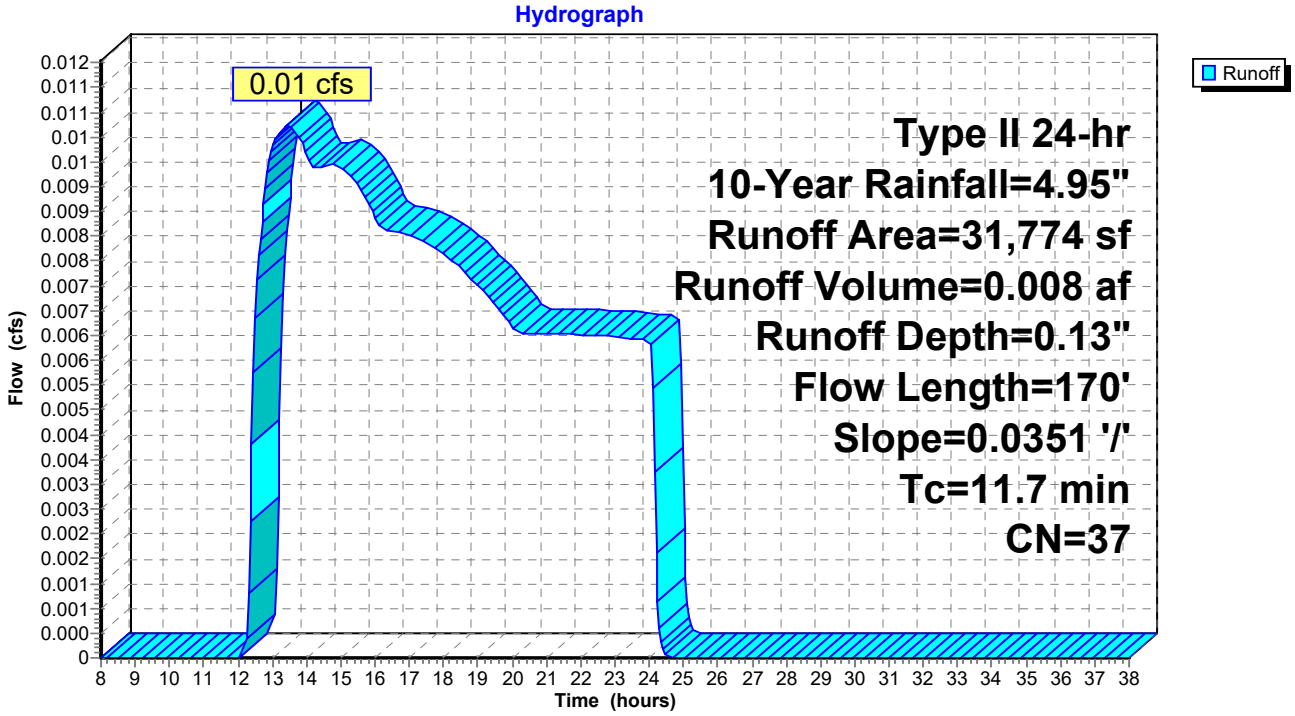
Runoff = 0.01 cfs @ 13.44 hrs, Volume= 0.008 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

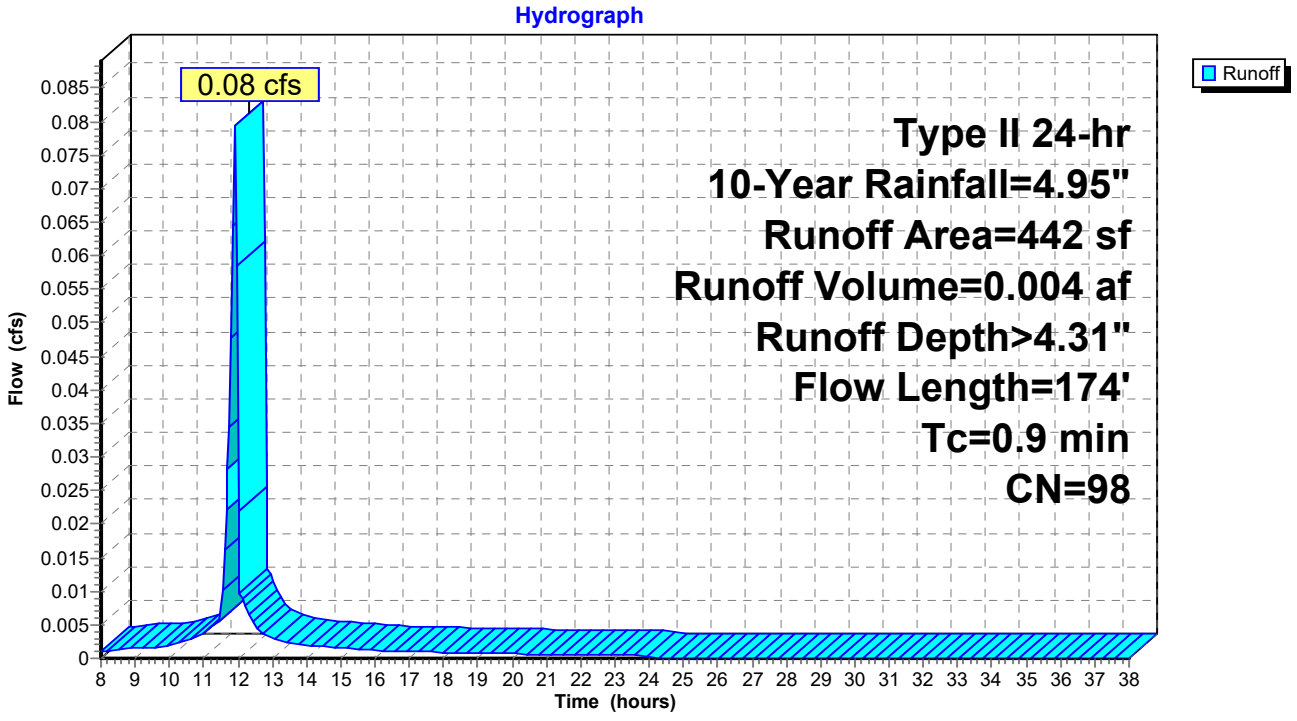
Runoff = 0.08 cfs @ 11.90 hrs, Volume= 0.004 af, Depth> 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

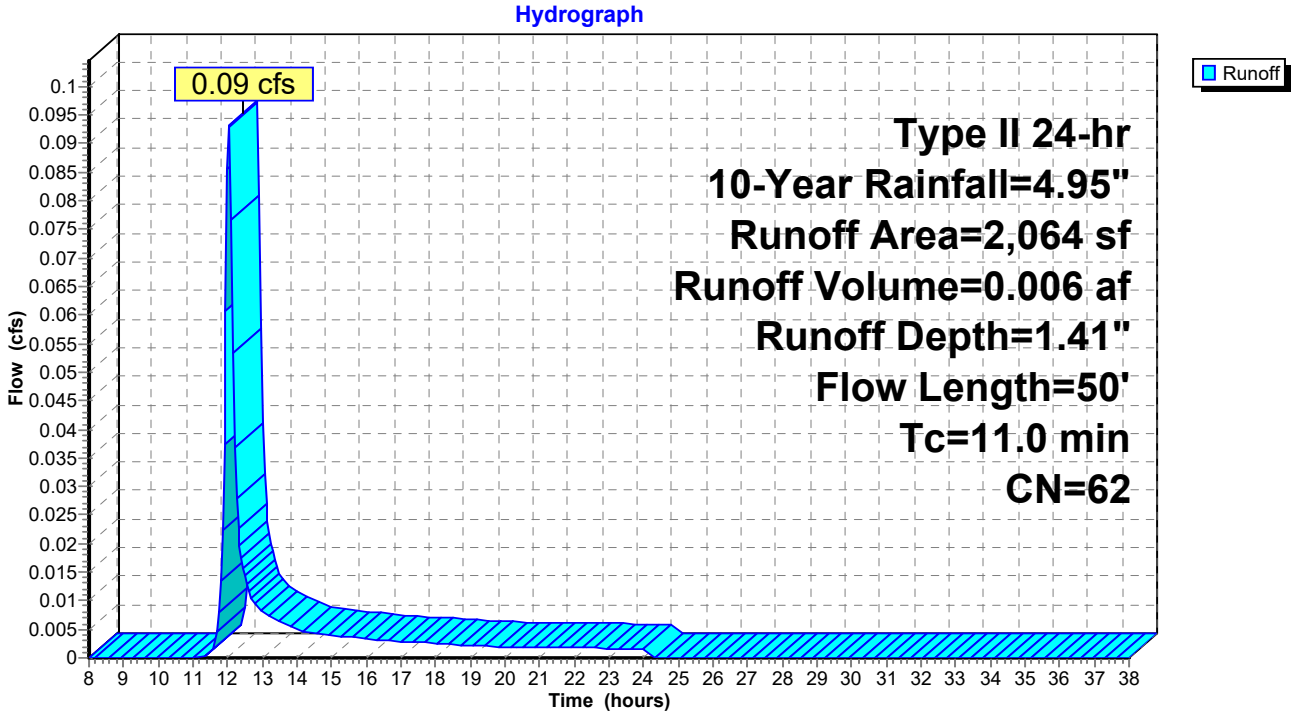
Runoff = 0.09 cfs @ 12.04 hrs, Volume= 0.006 af, Depth= 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

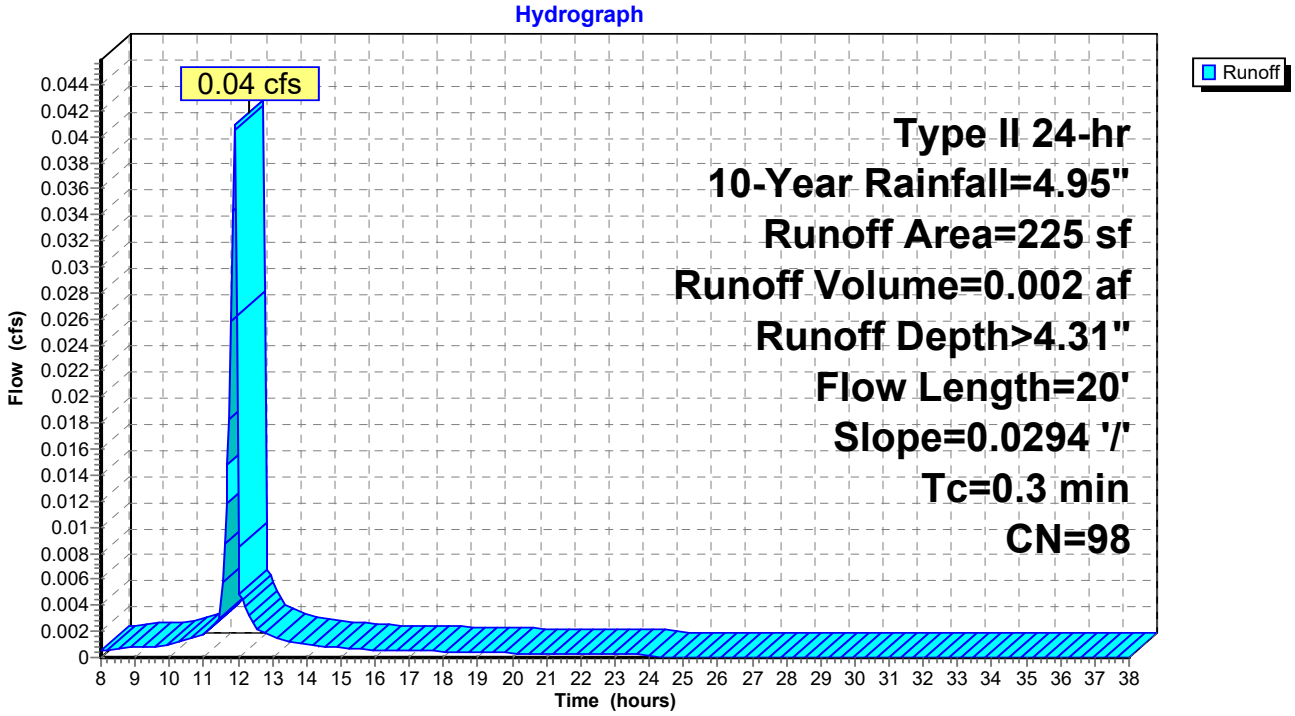
Runoff = 0.04 cfs @ 11.89 hrs, Volume= 0.002 af, Depth> 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.06"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.06"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=0.37"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.06 cfs 0.012 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.09"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.01 cfs 0.004 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>4.71"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.51 cfs 0.027 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.09"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.00 cfs 0.001 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.07 cfs 0.020 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>5.17"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.10 cfs 0.004 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=2.04"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.14 cfs 0.008 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>5.17"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.05 cfs 0.002 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.079 af Average Runoff Depth = 0.45"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

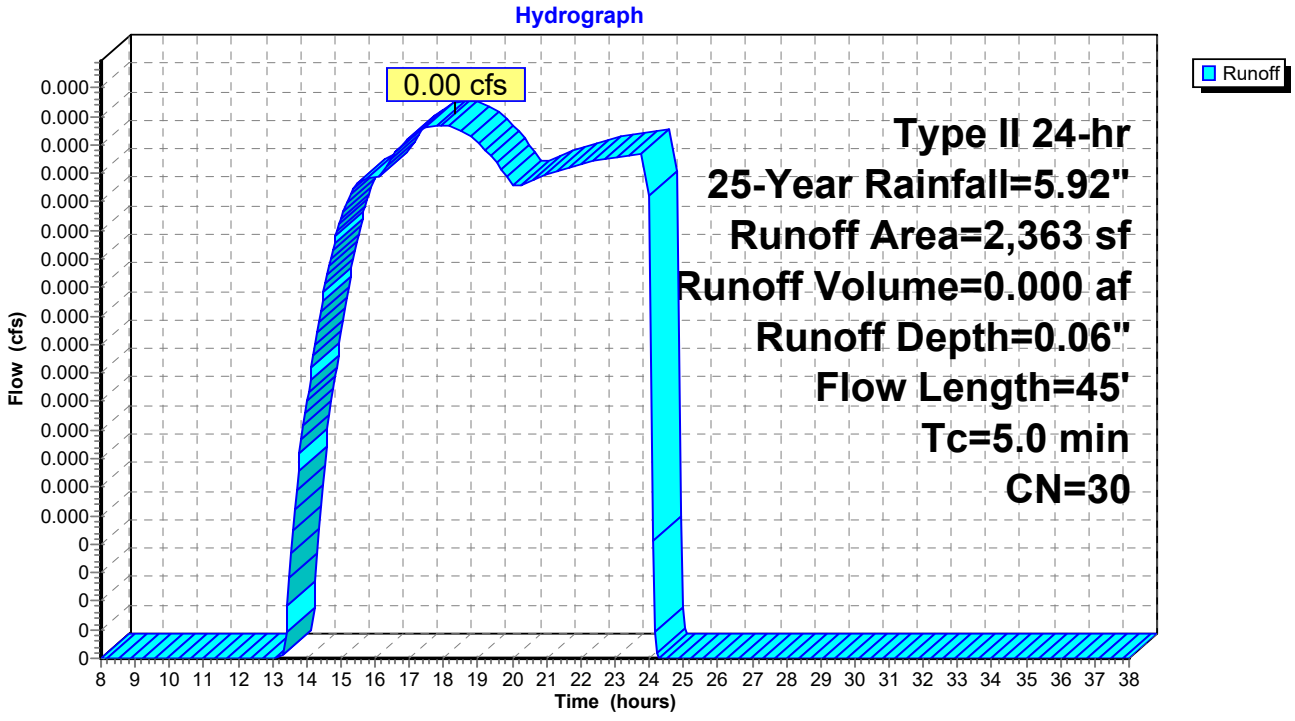
Runoff = 0.00 cfs @ 17.95 hrs, Volume= 0.000 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

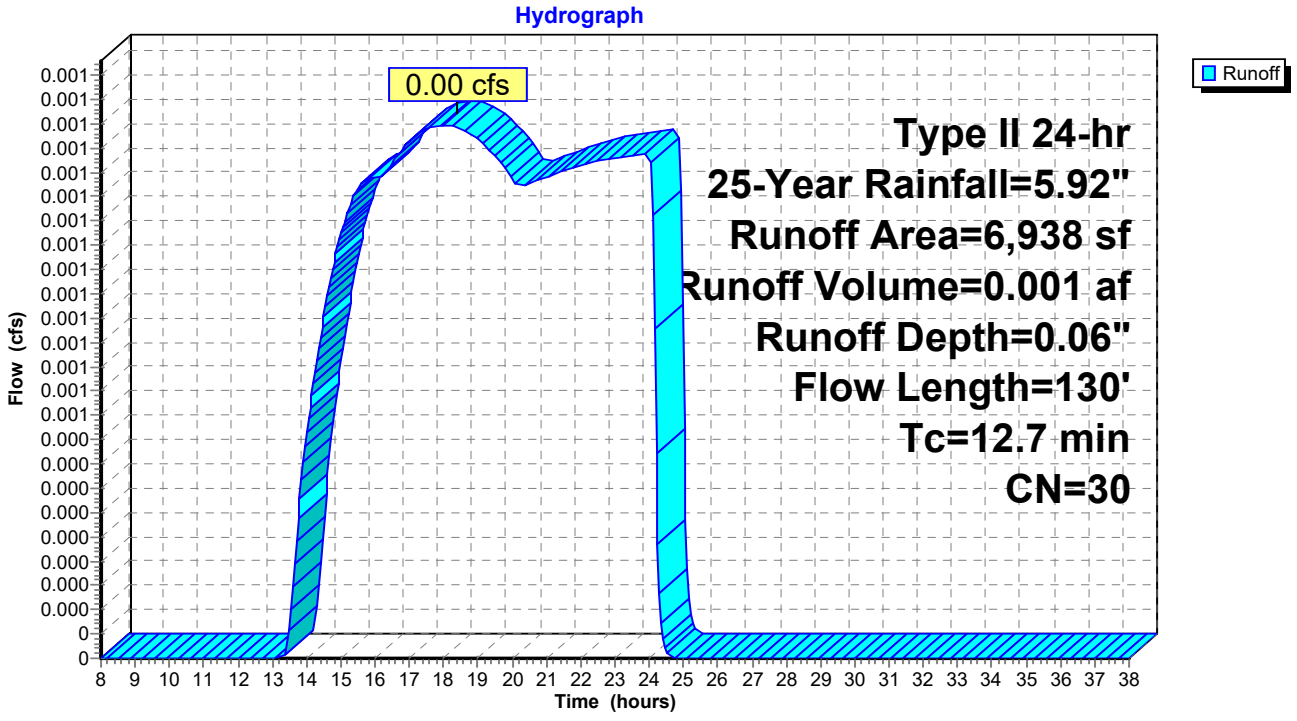
Runoff = 0.00 cfs @ 18.00 hrs, Volume= 0.001 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

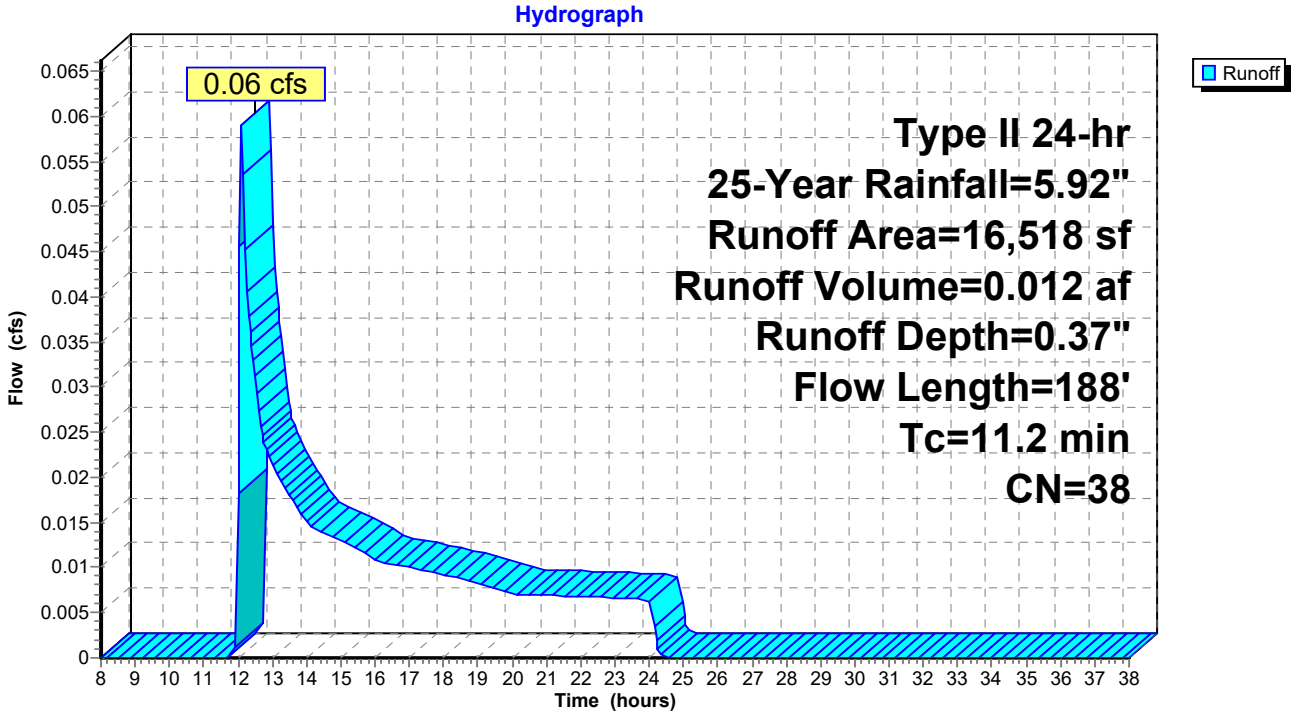
Runoff = 0.06 cfs @ 12.11 hrs, Volume= 0.012 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

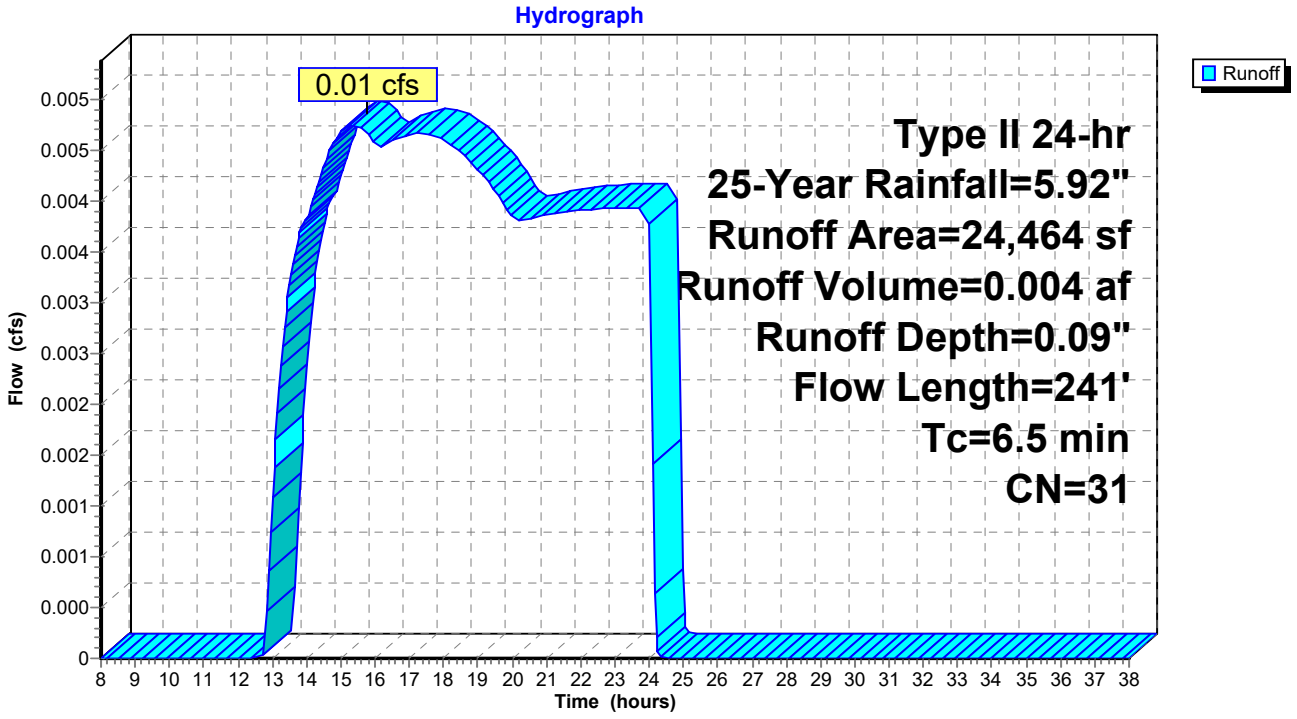
Runoff = 0.01 cfs @ 15.36 hrs, Volume= 0.004 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

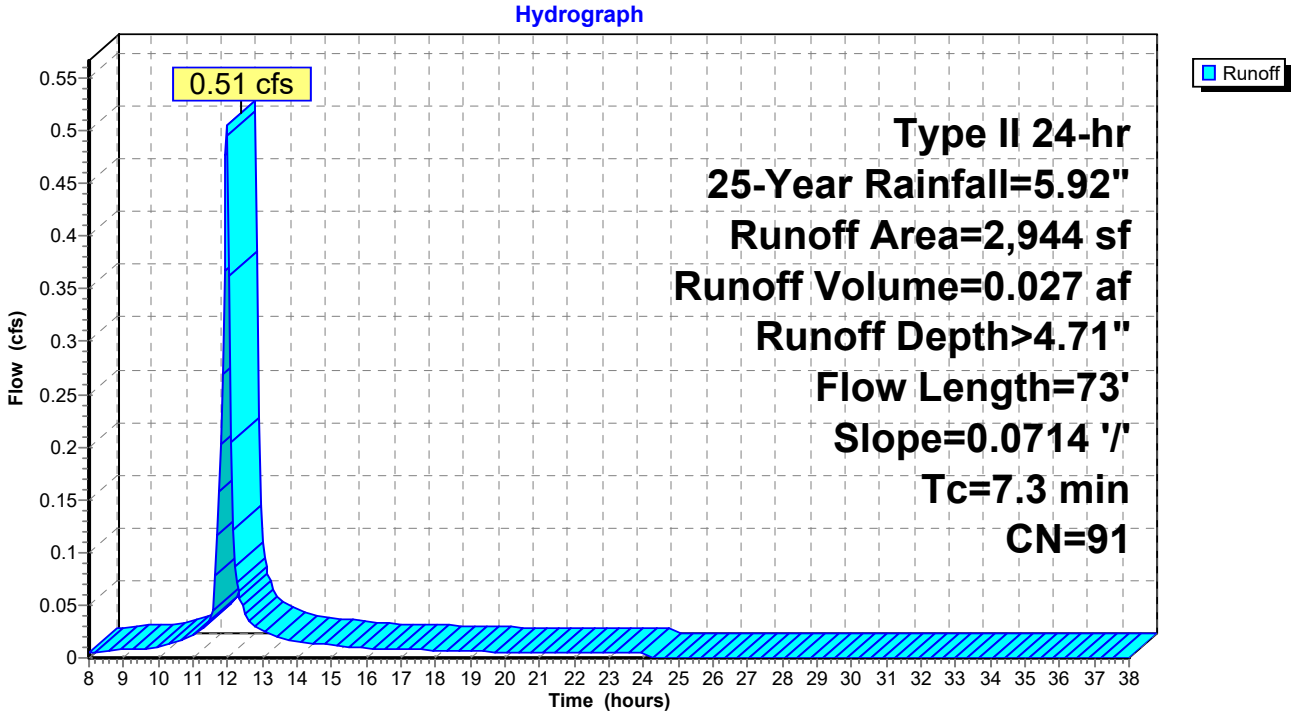
Runoff = 0.51 cfs @ 11.98 hrs, Volume= 0.027 af, Depth> 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

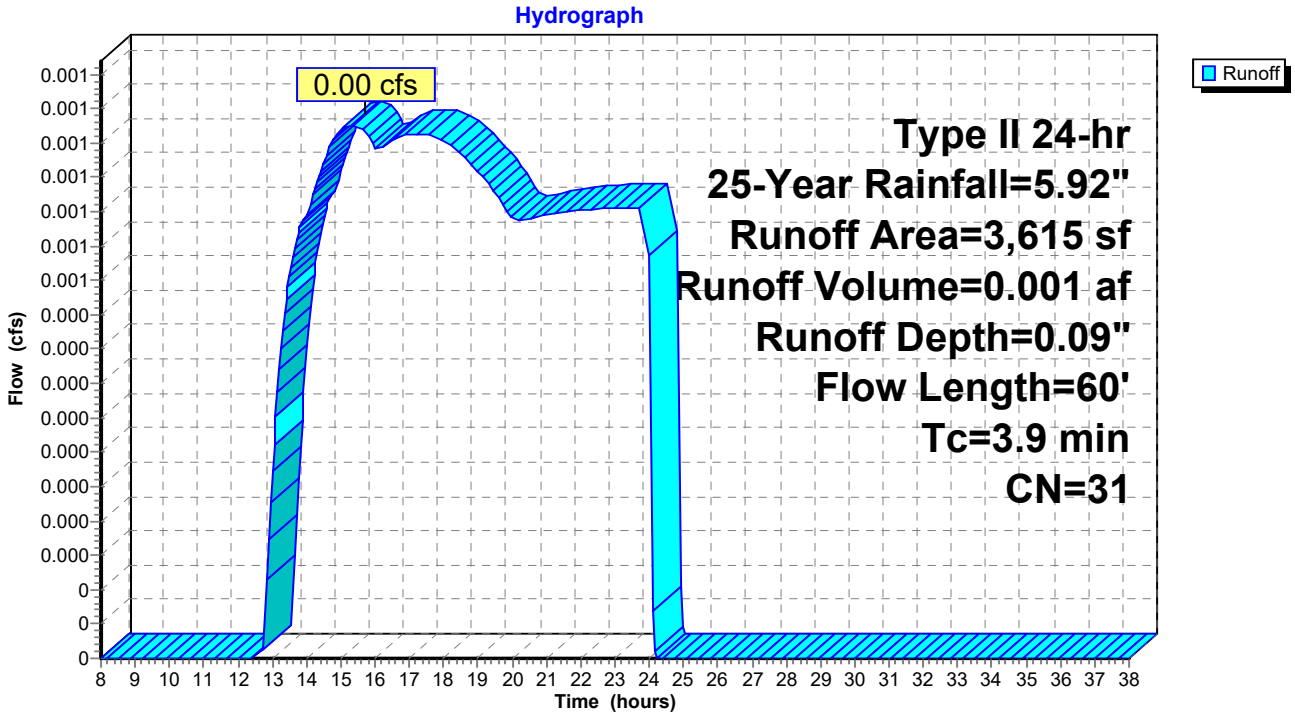
Runoff = 0.00 cfs @ 15.32 hrs, Volume= 0.001 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

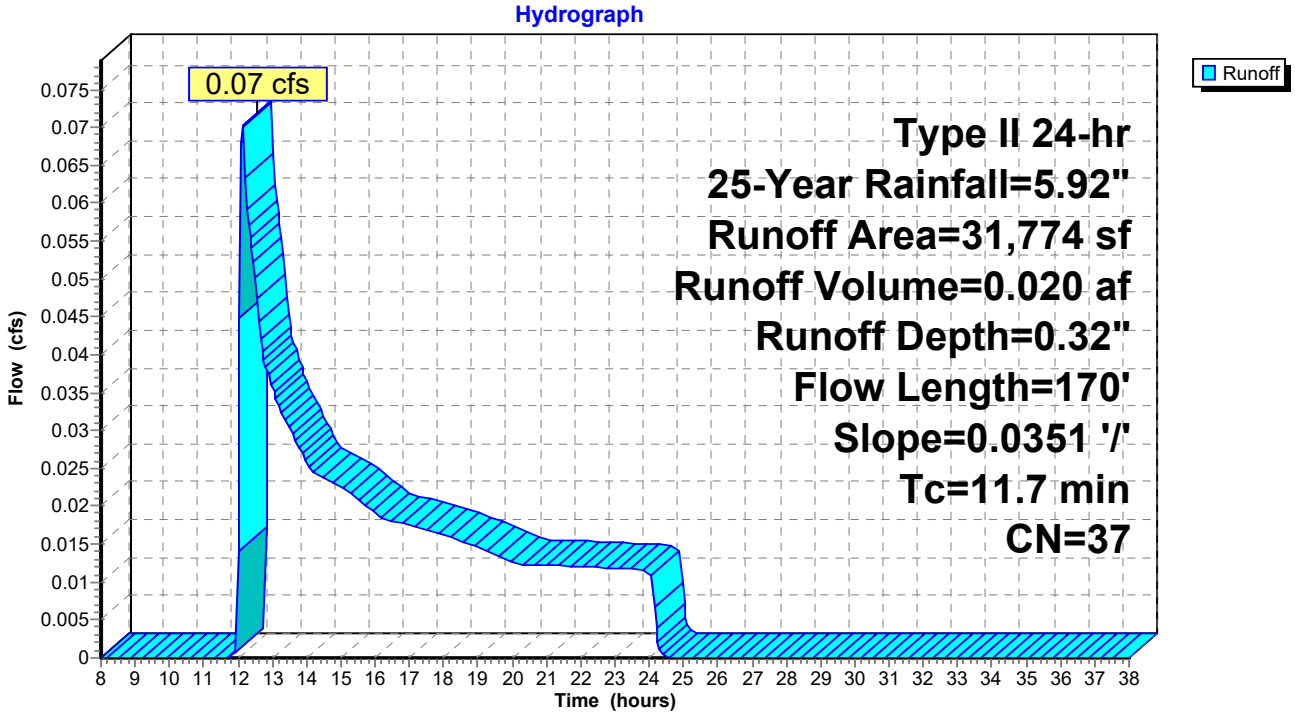
Runoff = 0.07 cfs @ 12.14 hrs, Volume= 0.020 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

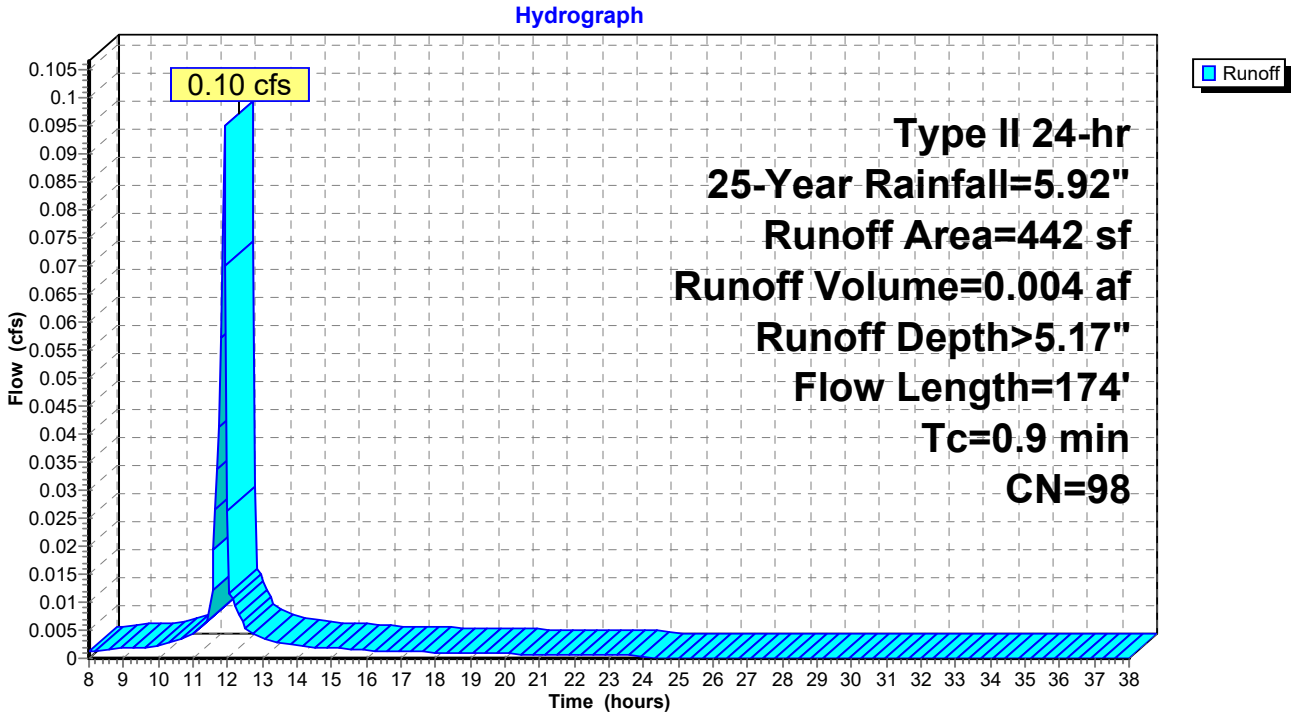
Runoff = 0.10 cfs @ 11.90 hrs, Volume= 0.004 af, Depth> 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

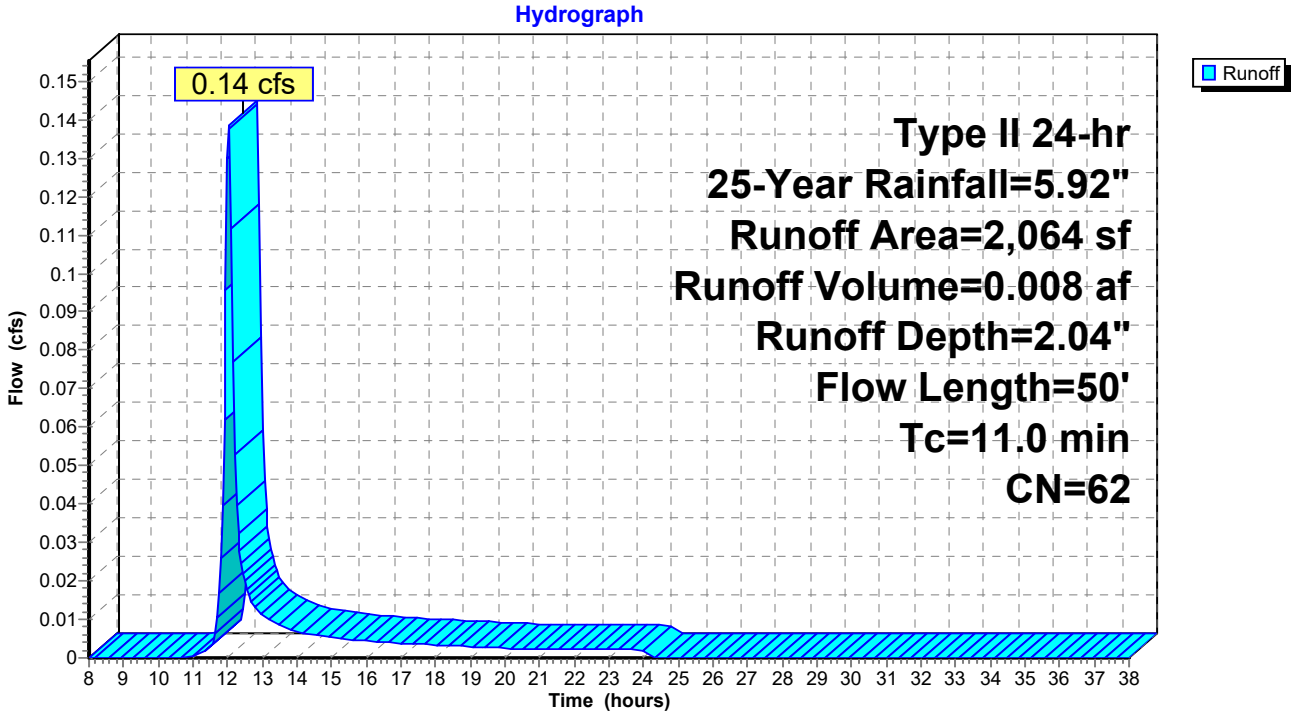
Runoff = 0.14 cfs @ 12.04 hrs, Volume= 0.008 af, Depth= 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

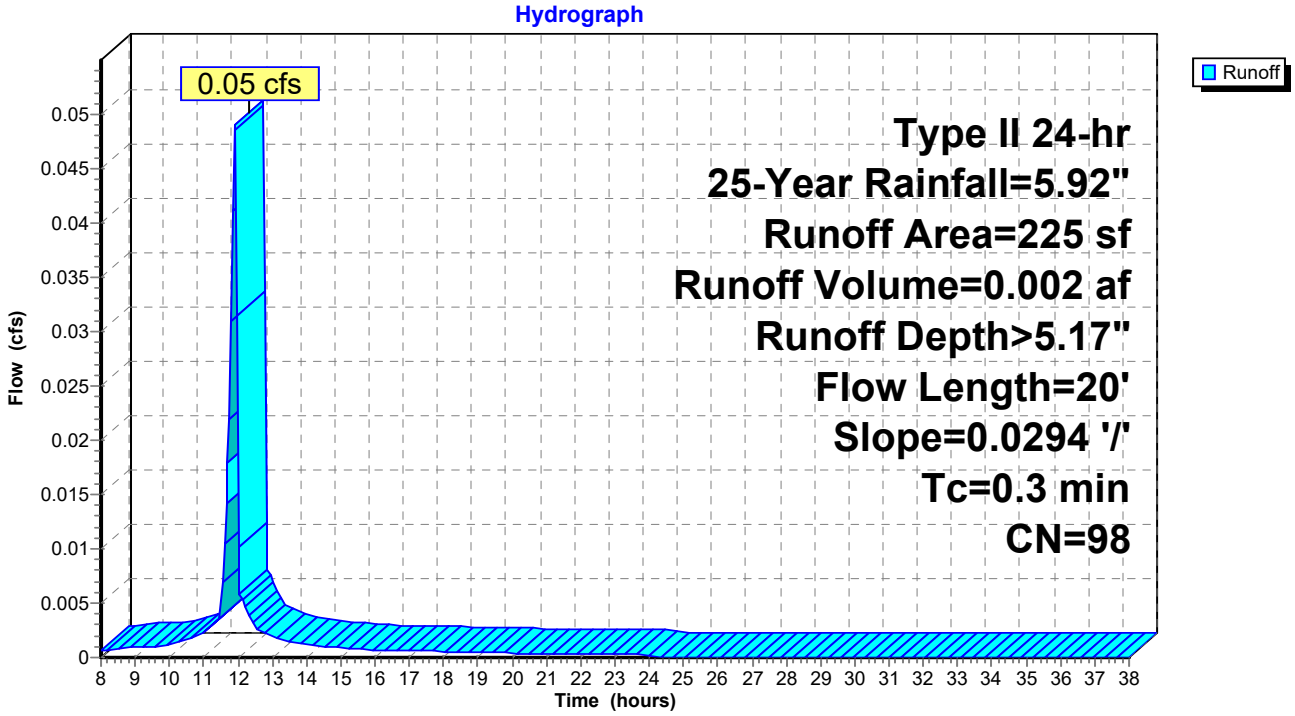
Runoff = 0.05 cfs @ 11.89 hrs, Volume= 0.002 af, Depth> 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.29"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.29"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.01 cfs 0.004 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=0.84"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.29 cfs 0.027 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.35"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.05 cfs 0.016 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>6.07"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.65 cfs 0.034 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.35"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.01 cfs 0.002 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.44 cfs 0.046 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>6.49"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.12 cfs 0.005 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=3.11"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.21 cfs 0.012 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>6.49"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.06 cfs 0.003 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.151 af Average Runoff Depth = 0.87"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

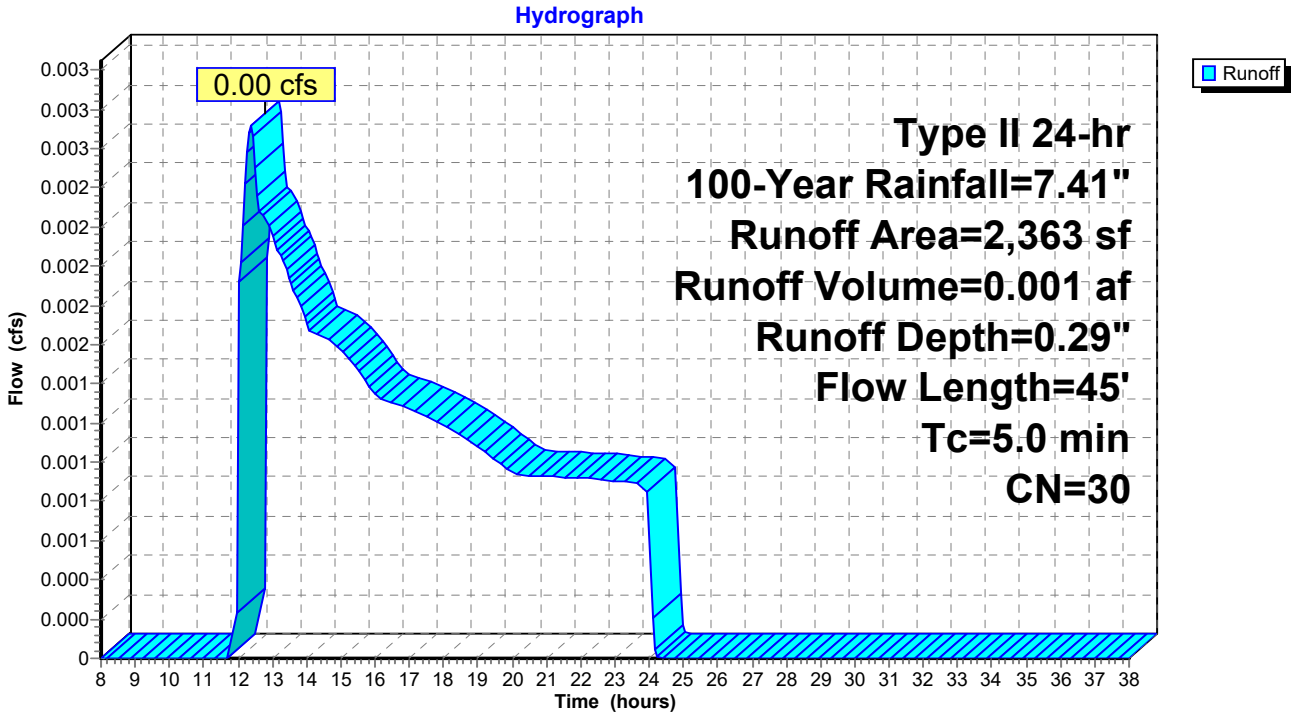
Runoff = 0.00 cfs @ 12.36 hrs, Volume= 0.001 af, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

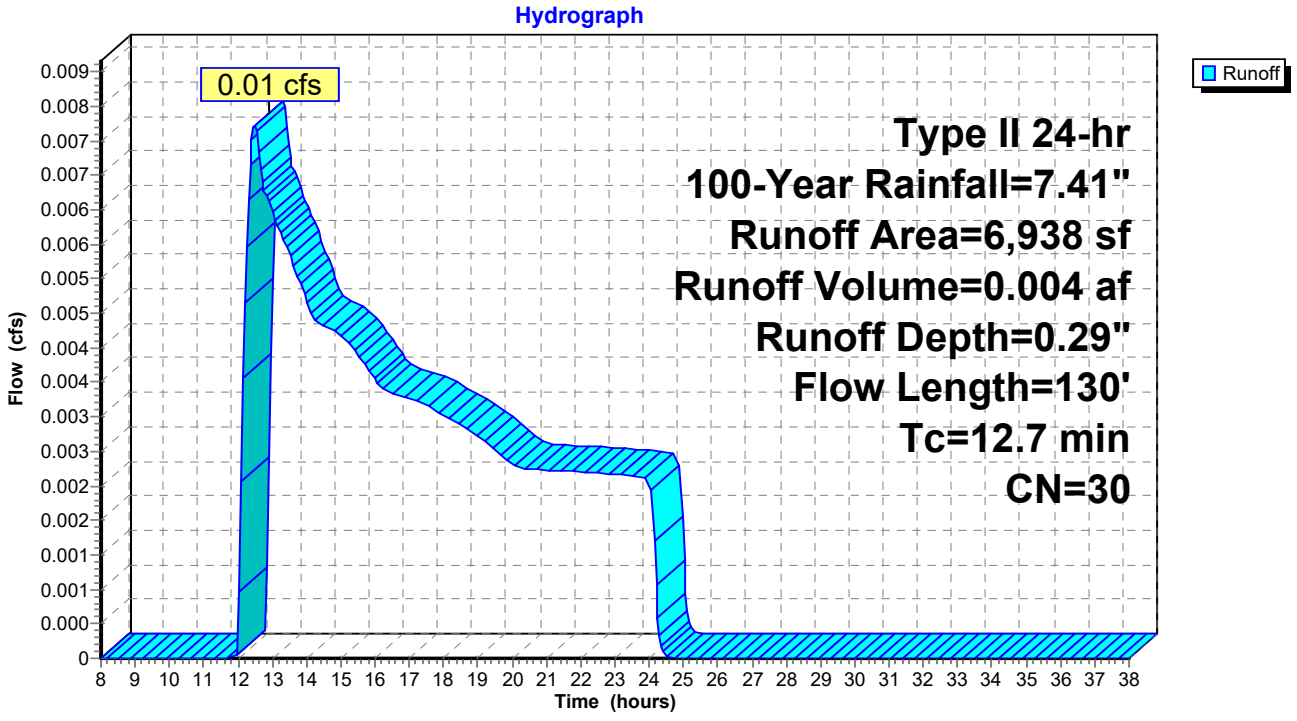
Runoff = 0.01 cfs @ 12.48 hrs, Volume= 0.004 af, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

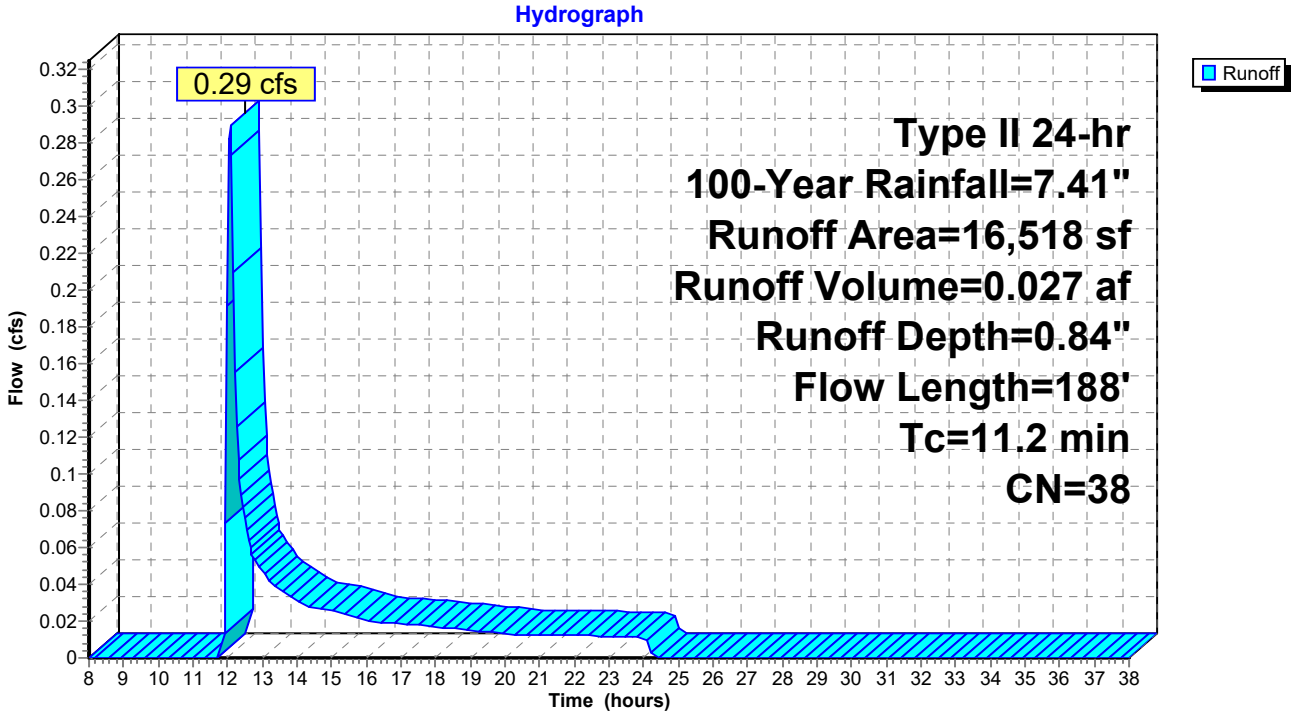
Runoff = 0.29 cfs @ 12.07 hrs, Volume= 0.027 af, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

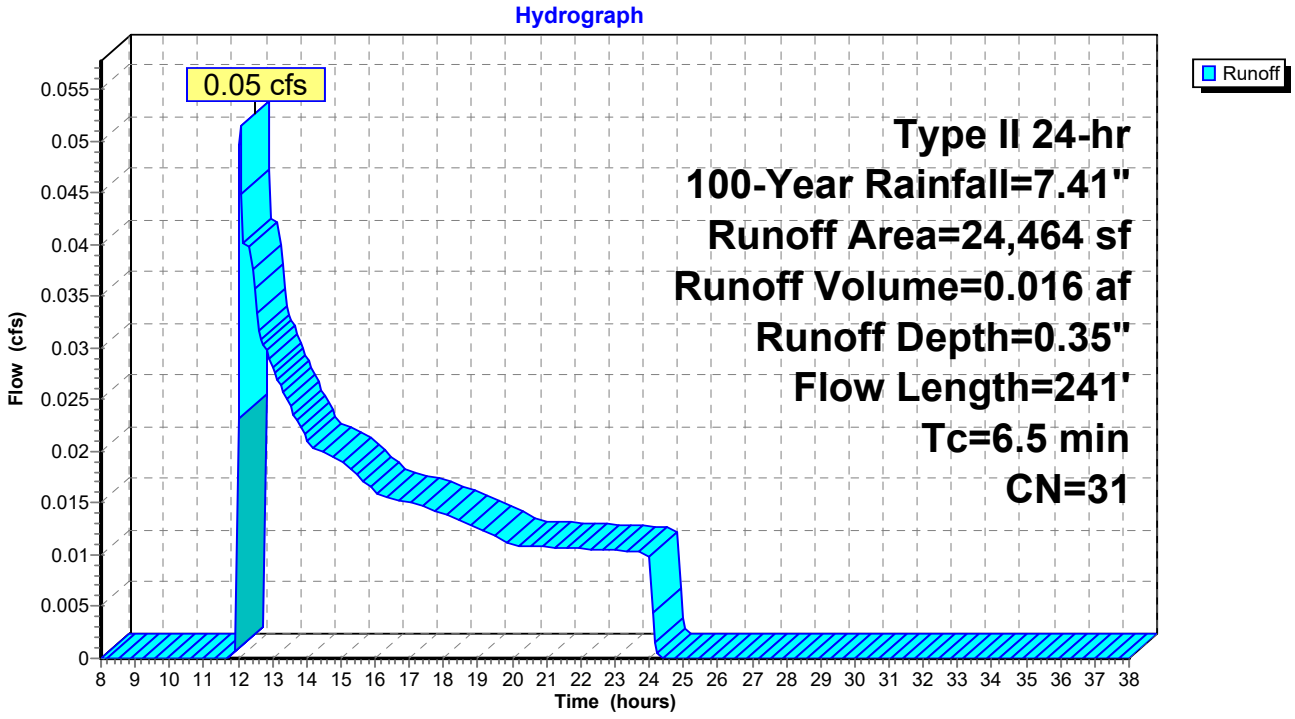
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.016 af, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

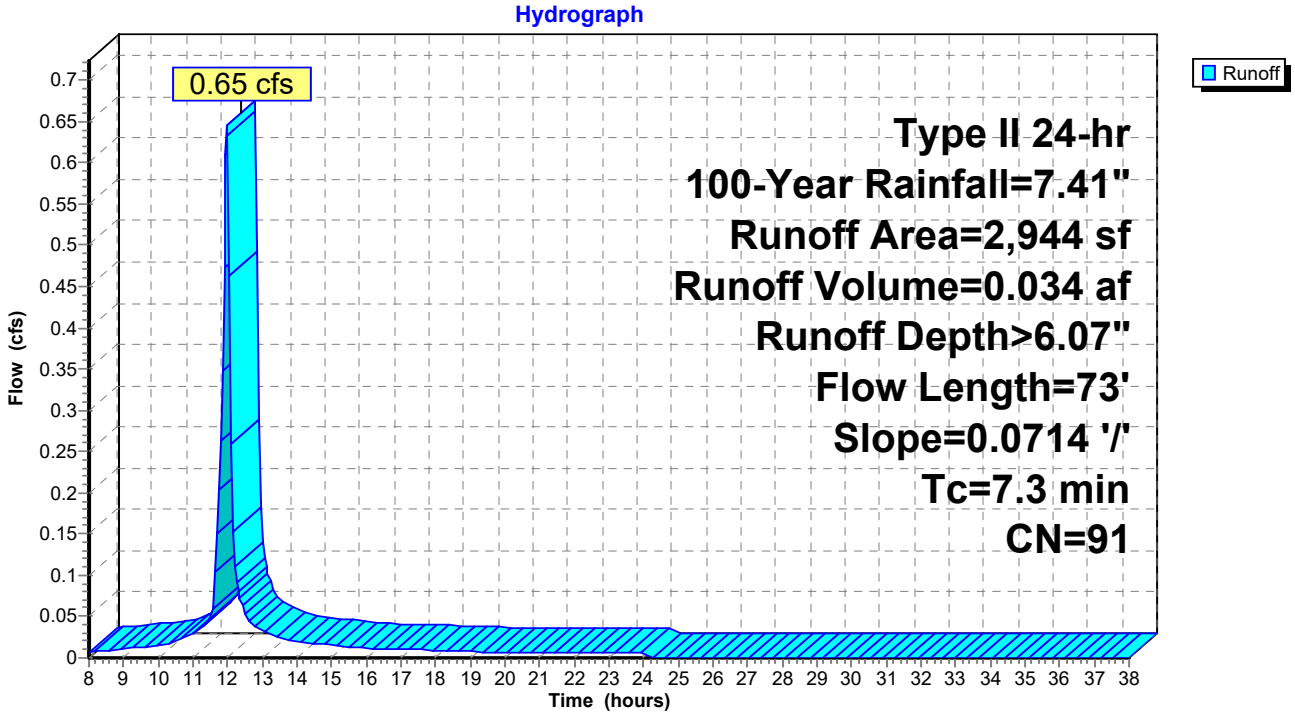
Runoff = 0.65 cfs @ 11.98 hrs, Volume= 0.034 af, Depth> 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

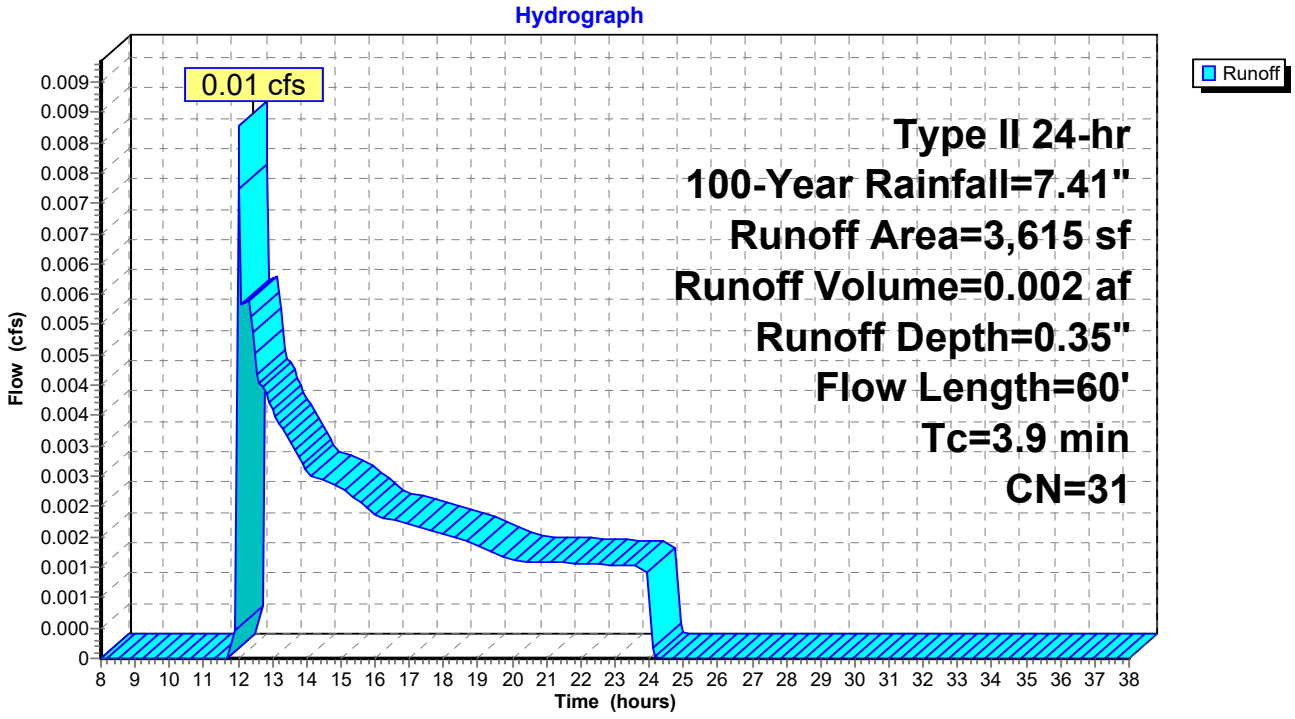
Runoff = 0.01 cfs @ 12.02 hrs, Volume= 0.002 af, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

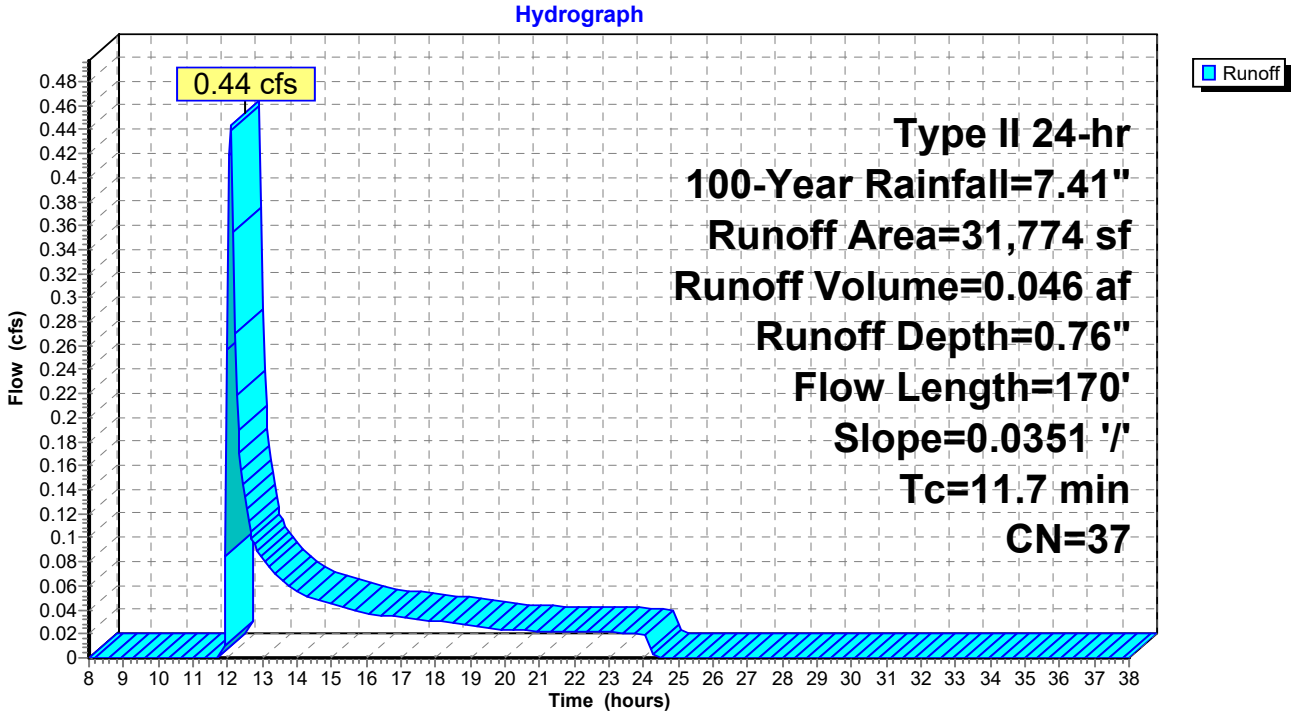
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.046 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

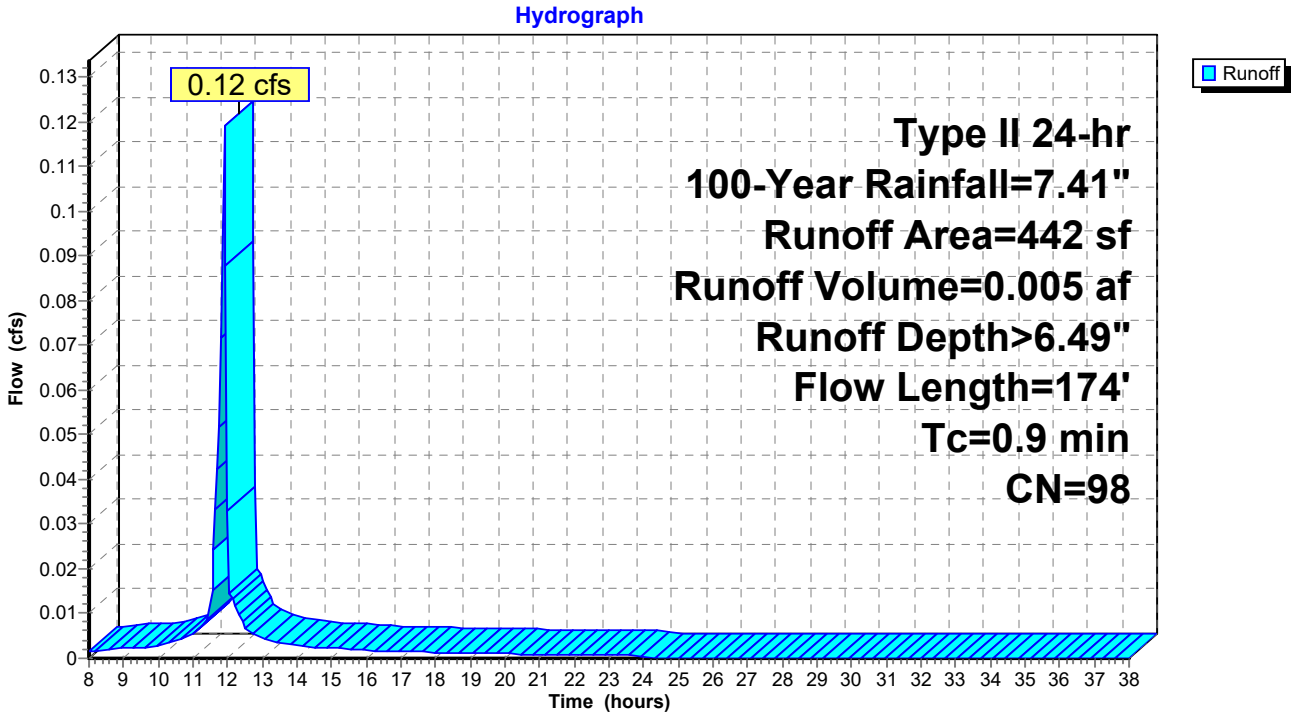
Runoff = 0.12 cfs @ 11.90 hrs, Volume= 0.005 af, Depth> 6.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

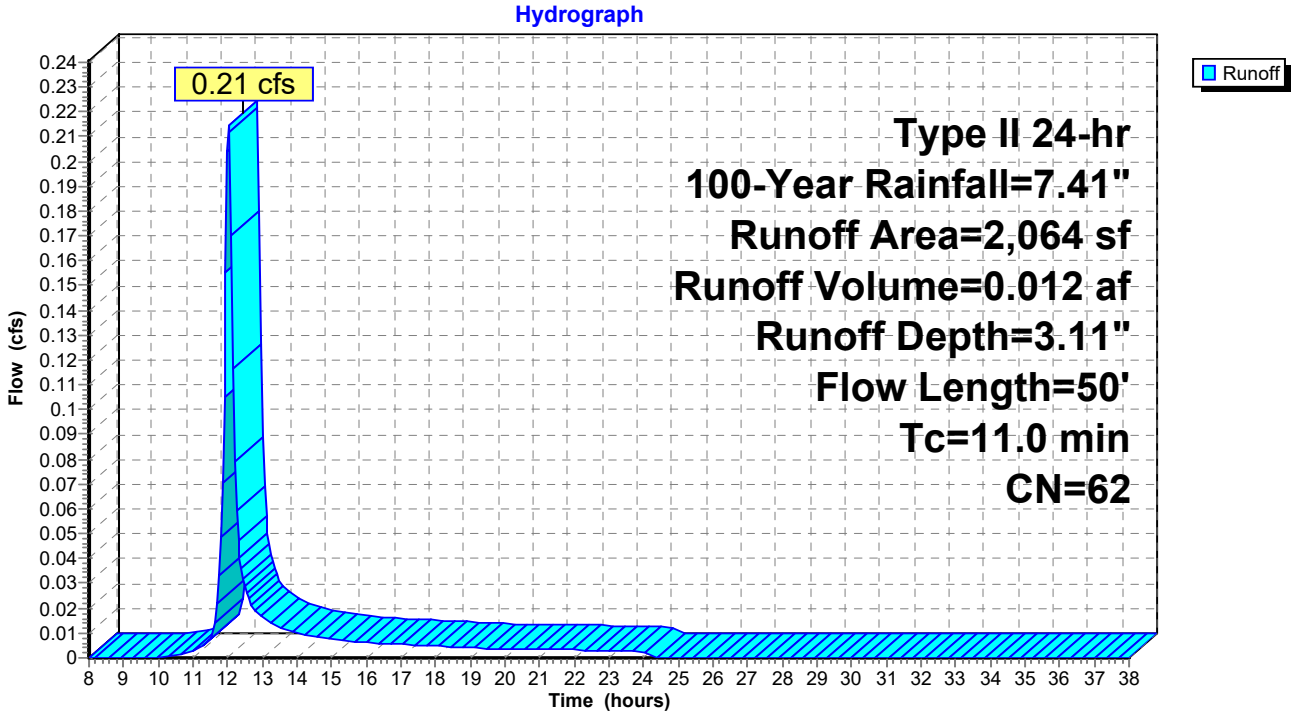
Runoff = 0.21 cfs @ 12.03 hrs, Volume= 0.012 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

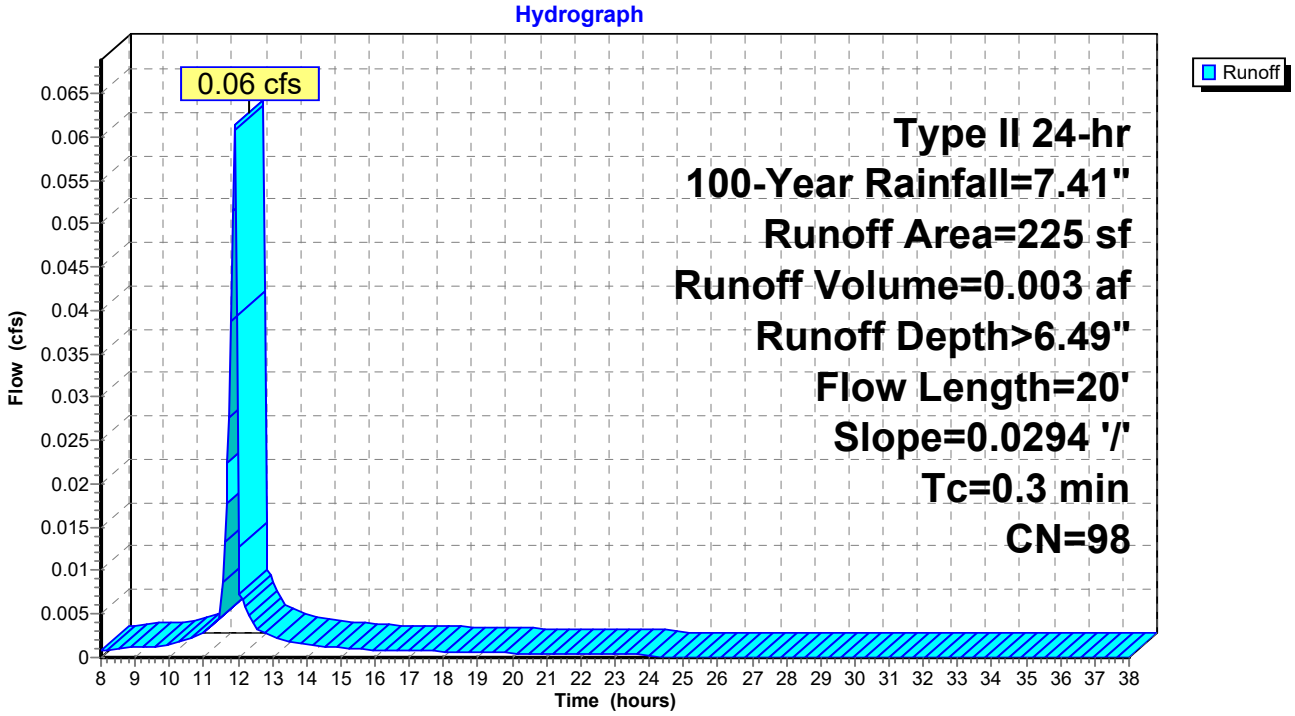
Runoff = 0.06 cfs @ 11.89 hrs, Volume= 0.003 af, Depth> 6.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Time span=8.00-38.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site, Onsite Flow Runoff Area=2,363 sf 0.00% Impervious Runoff Depth=0.59"
Flow Length=45' Tc=5.0 min CN=30 Runoff=0.02 cfs 0.003 af

Subcatchment 1.2: WTP Site, Onsite Flow Runoff Area=6,938 sf 0.00% Impervious Runoff Depth=0.59"
Flow Length=130' Tc=12.7 min CN=30 Runoff=0.04 cfs 0.008 af

Subcatchment 1.3: WTP Site, Onsite Flow Runoff Area=16,518 sf 11.10% Impervious Runoff Depth=1.36"
Flow Length=188' Tc=11.2 min CN=38 Runoff=0.58 cfs 0.043 af

Subcatchment 1.4: WTP Site, Onsite Flow Runoff Area=24,464 sf 0.00% Impervious Runoff Depth=0.68"
Flow Length=241' Tc=6.5 min CN=31 Runoff=0.29 cfs 0.032 af

Subcatchment 2.1: WTP Site, Offsite Flow Runoff Area=2,944 sf 87.77% Impervious Runoff Depth>7.24"
Flow Length=73' Slope=0.0714 '/' Tc=7.3 min CN=91 Runoff=0.77 cfs 0.041 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=3,615 sf 0.00% Impervious Runoff Depth=0.68"
Flow Length=60' Tc=3.9 min CN=31 Runoff=0.05 cfs 0.005 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=31,774 sf 0.00% Impervious Runoff Depth=1.26"
Flow Length=170' Slope=0.0351 '/' Tc=11.7 min CN=37 Runoff=0.97 cfs 0.076 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth>7.63"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.14 cfs 0.006 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=4.11"
Flow Length=50' Tc=11.0 min CN=62 Runoff=0.29 cfs 0.016 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth>7.63"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.07 cfs 0.003 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.233 af Average Runoff Depth = 1.33"
93.73% Pervious = 1.965 ac 6.27% Impervious = 0.132 ac

Summary for Subcatchment 1.1: WTP Site, Onsite Flow

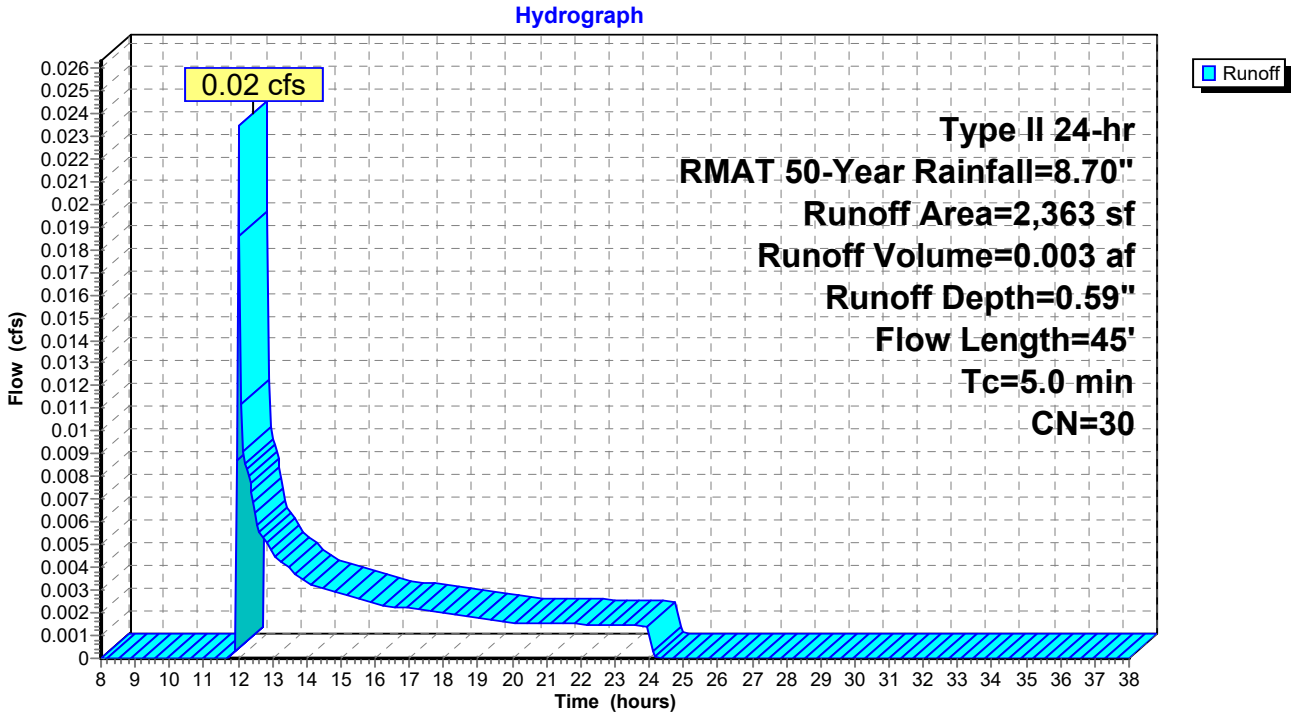
Runoff = 0.02 cfs @ 12.01 hrs, Volume= 0.003 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
2,363	30	Woods, Good, HSG A
2,363		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	30	0.0667	0.10		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	15	0.2000	2.24		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
5.0	45	Total			

Subcatchment 1.1: WTP Site, Onsite Flow



Summary for Subcatchment 1.2: WTP Site, Onsite Flow

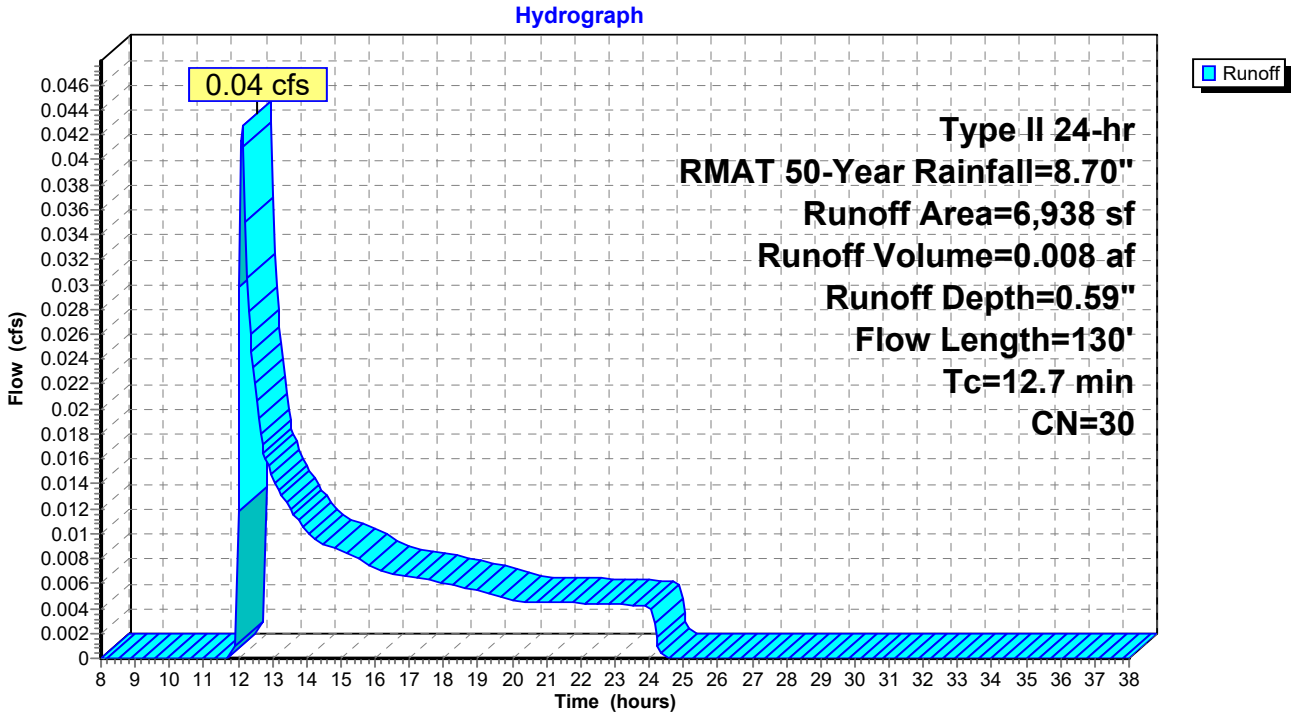
Runoff = 0.04 cfs @ 12.12 hrs, Volume= 0.008 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
6,938	30	Woods, Good, HSG A
6,938		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.7	50	0.0213	0.07		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.0	80	0.0656	1.28		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
12.7	130	Total			

Subcatchment 1.2: WTP Site, Onsite Flow



Summary for Subcatchment 1.3: WTP Site, Onsite Flow

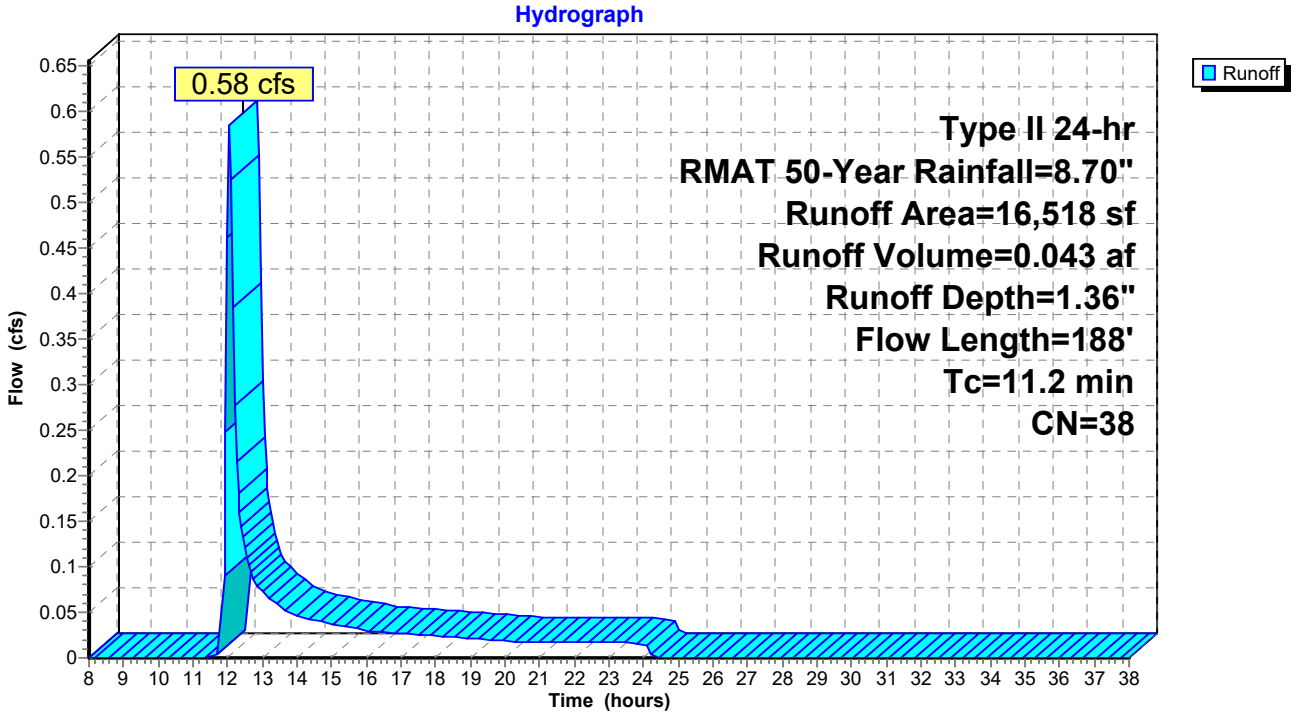
Runoff = 0.58 cfs @ 12.06 hrs, Volume= 0.043 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
14,685	30	Woods, Good, HSG A
1,833	98	Paved parking, HSG A
16,518	38	Weighted Average
14,685		88.90% Pervious Area
1,833		11.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0364	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.8	138	0.0625	1.25		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
11.2	188	Total			

Subcatchment 1.3: WTP Site, Onsite Flow



Summary for Subcatchment 1.4: WTP Site, Onsite Flow

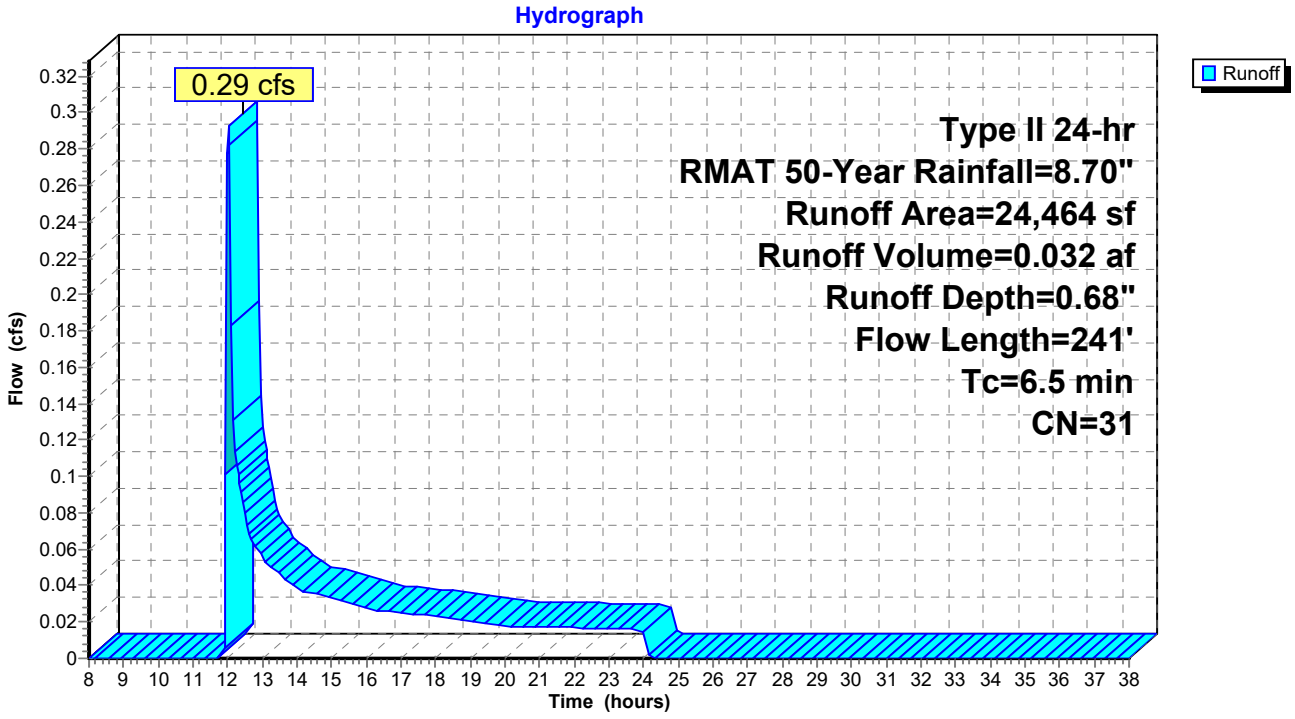
Runoff = 0.29 cfs @ 12.03 hrs, Volume= 0.032 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
23,637	30	Woods, Good, HSG A
827	49	50-75% Grass cover, Fair, HSG A
24,464	31	Weighted Average
24,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.1250	0.13		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.7	211	0.0667	1.29		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
6.5	241	Total			

Subcatchment 1.4: WTP Site, Onsite Flow



Summary for Subcatchment 2.1: WTP Site, Offsite Flow to the West

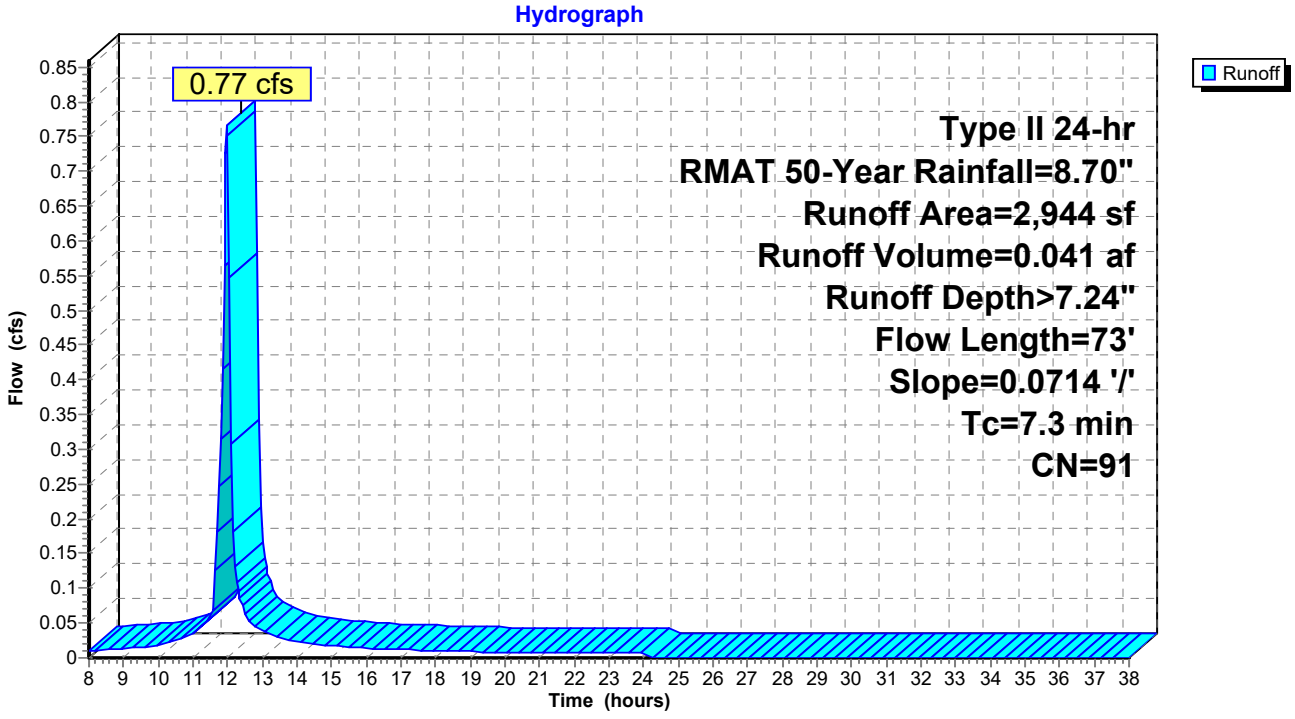
Runoff = 0.77 cfs @ 11.98 hrs, Volume= 0.041 af, Depth> 7.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
2,584	98	Paved parking, HSG A
360	39	>75% Grass cover, Good, HSG A
2,944	91	Weighted Average
360		12.23% Pervious Area
2,584		87.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0714	0.12		**Sheet Flow, Access Road** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	23	0.0714	5.42		**Shallow Concentrated Flow, Acess Road** Paved Kv= 20.3 fps
7.3	73	Total			

Subcatchment 2.1: WTP Site, Offsite Flow to the West



Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

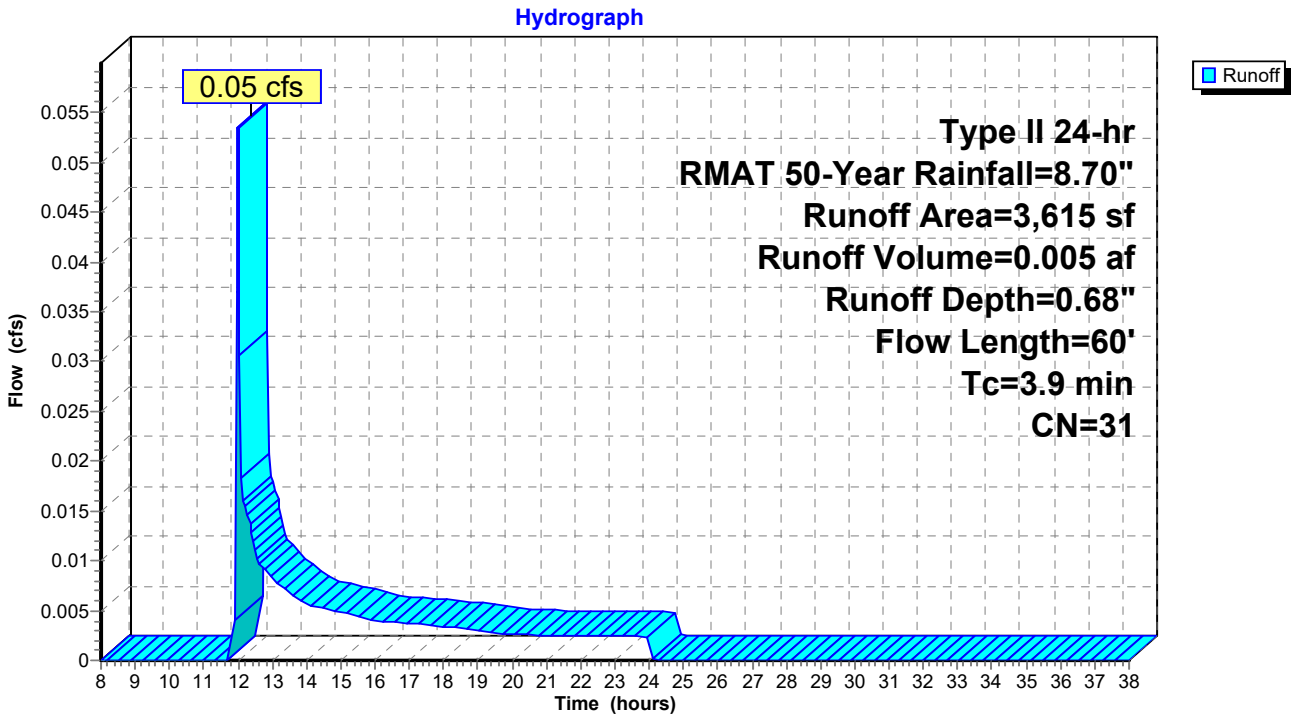
Runoff = 0.05 cfs @ 12.00 hrs, Volume= 0.005 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
3,447	30	Woods, Good, HSG A
168	49	50-75% Grass cover, Fair, HSG A
3,615	31	Weighted Average
3,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 3.1: WTP Site, Offsite Flow to the East



Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

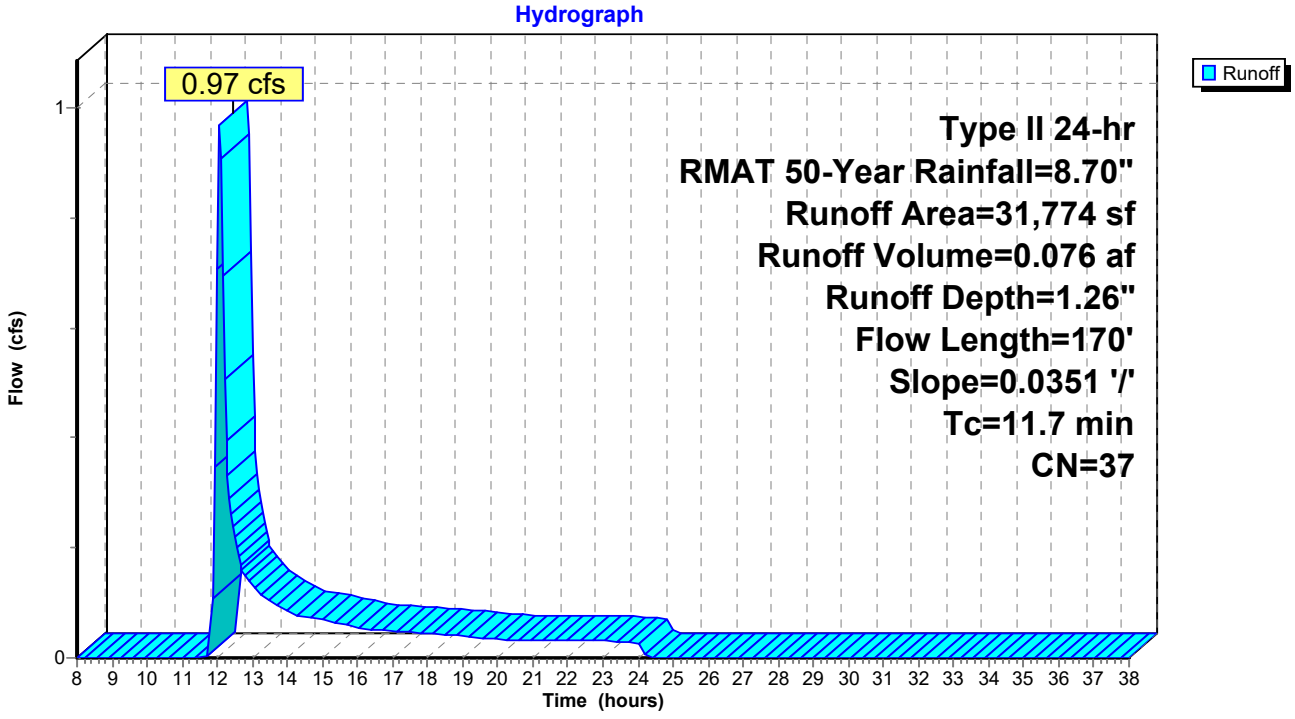
Runoff = 0.97 cfs @ 12.07 hrs, Volume= 0.076 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
18,343	30	Woods, Good, HSG A
12,149	45	Woods, Poor, HSG A
1,282	49	50-75% Grass cover, Fair, HSG A
31,774	37	Weighted Average
31,774		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0351	0.09		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
2.1	120	0.0351	0.94		**Shallow Concentrated Flow, Forest** Woodland Kv= 5.0 fps
11.7	170	Total			

Subcatchment 4.1: WTP Site, Offsite Flow to the South



Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

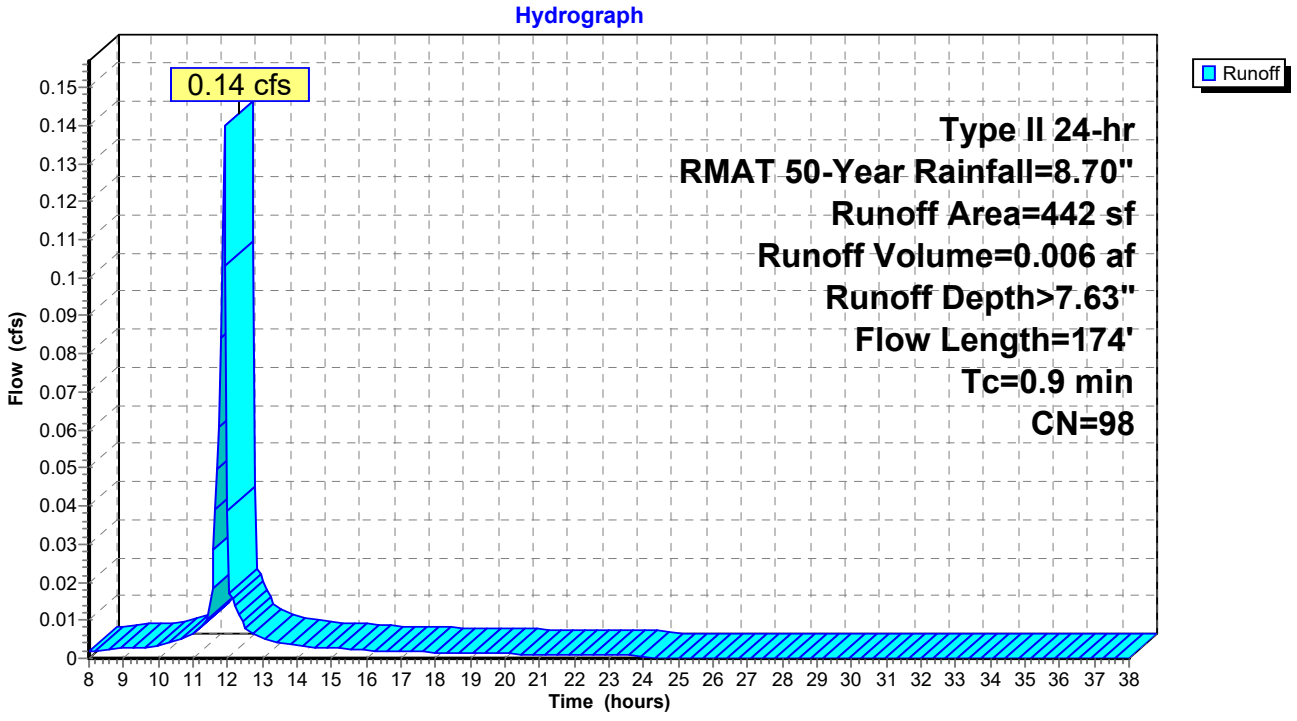
Runoff = 0.14 cfs @ 11.90 hrs, Volume= 0.006 af, Depth> 7.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Subcatchment 5.1: WTP Site, Offsite Flow to the North



Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

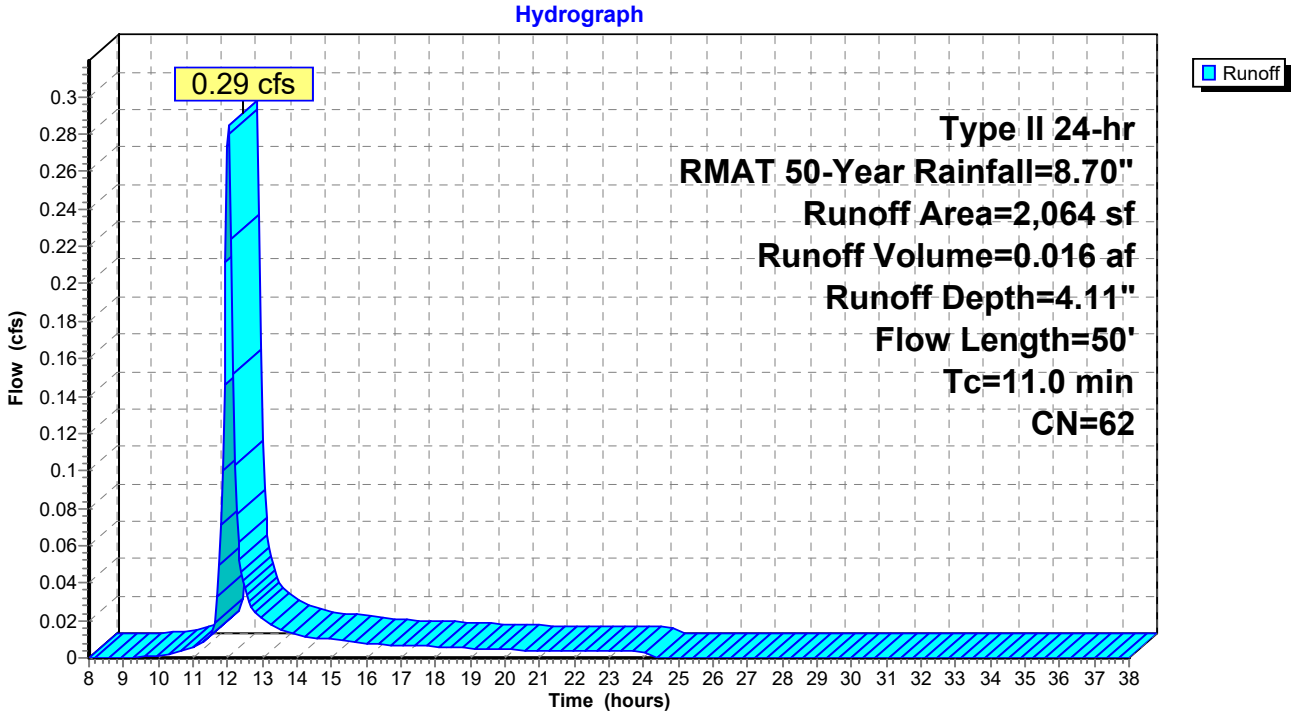
Runoff = 0.29 cfs @ 12.03 hrs, Volume= 0.016 af, Depth= 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
1,417	45	Woods, Poor, HSG A
647	98	Paved parking, HSG A
2,064	62	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Subcatchment 5.2: Well 4, Offsite Flow to the North



Summary for Subcatchment 6.1: End of Access Road

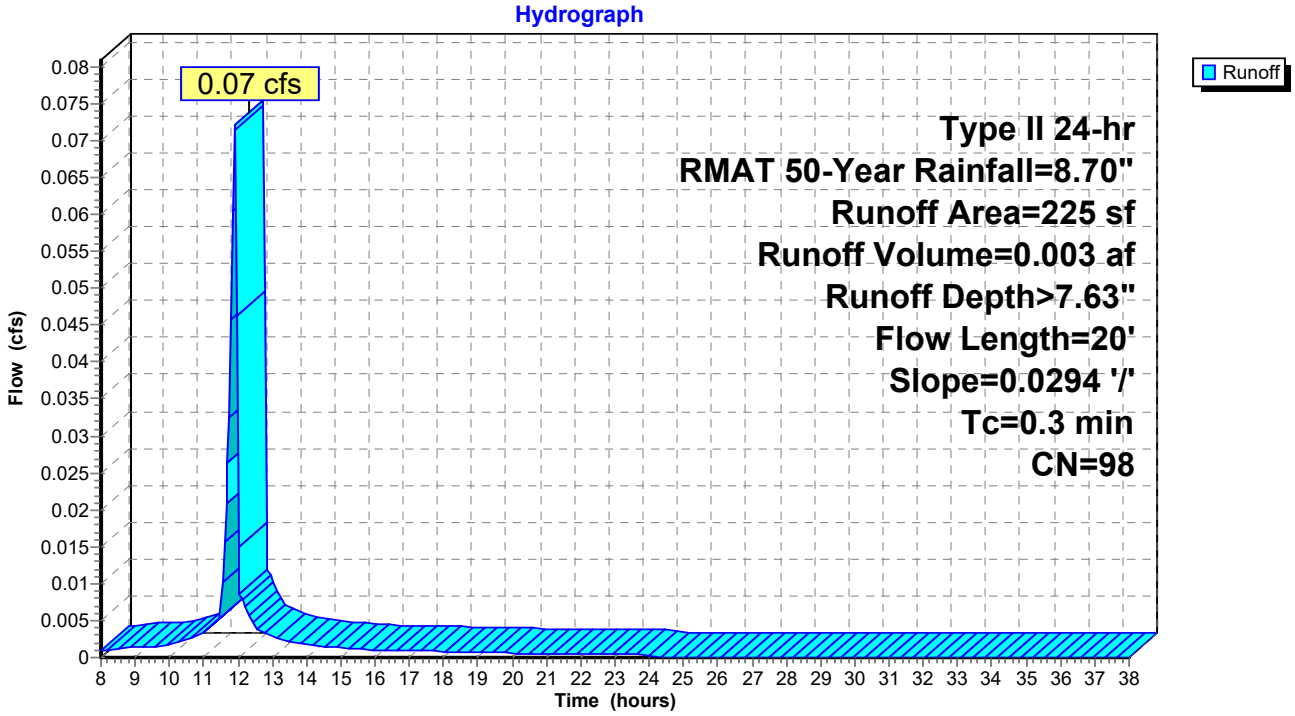
Runoff = 0.07 cfs @ 11.89 hrs, Volume= 0.003 af, Depth> 7.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 8.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Subcatchment 6.1: End of Access Road



Appendix H – Proposed Conditions HydroCAD Model Results



Subcat Reach Pond Link

Routing Diagram for BFD_Proposed
Prepared by H2Olson Engineering, Inc, Printed 6/9/2026
HydroCAD® 10.20-9a s/n 14216 © 2026 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type II 24-hr		Default	24.00	1	3.39	2
2	10-Year	Type II 24-hr		Default	24.00	1	4.95	2
3	25-Year	Type II 24-hr		Default	24.00	1	5.92	2
4	100-Year	Type II 24-hr		Default	24.00	1	7.41	2
5	RMAT 50-Year	Type II 24-hr		Default	24.00	1	8.70	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.500	39	>75% Grass cover, Good, HSG A (1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 3.1, 4.1, 4.2, 5.2)
0.285	30	Brush, Good, HSG A (1.1, 1.2, 1.3, 1.9, 3.1, 4.1, 4.2)
0.220	98	Paved parking, HSG A (1.3, 1.7, 1.8, 1.9, 5.1, 5.2, 6.1)
0.093	98	Roofs, HSG A (1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.7, 1.8)
2.097	**47**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
2.097	HSG A	1.1, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 3.1, 4.1, 4.2, 5.1, 5.2, 6.1
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.097		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
1.500	0.000	0.000	0.000	0.000	1.500	>75% Grass cover, Good	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 3.1, 4.1, 4.2, 5.2
0.285	0.000	0.000	0.000	0.000	0.285	Brush, Good	1.1, 1.2, 1.3, 1.9, 3.1, 4.1, 4.2
0.220	0.000	0.000	0.000	0.000	0.220	Paved parking	1.3, 1.7, 1.8, 1.9, 5.1, 5.2, 6.1
0.093	0.000	0.000	0.000	0.000	0.093	Roofs	1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 1.7, 1.8
2.097	**0.000**	**0.000**	**0.000**	**0.000**	**2.097**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	1.10	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
2	1.10	0.00	0.00	17.0	1.0000	0.025	6.0	6.0	0.0	
3	1.10	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
4	1.11	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
5	1.11	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
6	1.11	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
7	1.12	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
8	1.12	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
9	1.12	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
10	1.13	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
11	1.13	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
12	1.13	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
13	1.14	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
14	1.14	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
15	1.14	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
16	1.15	0.00	0.00	20.0	0.0005	0.025	10.0	3.5	0.0	
17	1.15	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
18	1.15	0.00	0.00	30.0	0.0005	0.025	0.0	4.0	0.0	
19	1.7	0.00	0.00	17.0	0.0005	0.025	10.0	3.5	0.0	
20	1.7	0.00	0.00	17.0	1.0000	0.025	6.0	6.0	0.0	
21	1.7	0.00	0.00	22.0	0.1060	0.013	0.0	6.0	0.0	
22	1.8	0.00	0.00	17.0	0.0005	0.025	10.0	3.5	0.0	
23	1.8	0.00	0.00	23.0	1.0000	0.025	6.0	6.0	0.0	
24	1.8	0.00	0.00	31.0	0.0750	0.025	0.0	6.0	0.0	
25	1P	65.10	60.46	12.0	0.3867	0.013	0.0	12.0	0.0	
26	2P	65.10	60.46	43.0	0.1079	0.013	0.0	12.0	0.0	
27	3P	59.21	57.80	184.0	0.0077	0.013	0.0	8.0	0.0	
28	4P	59.75	59.54	130.0	0.0016	0.013	0.0	12.0	0.0	
29	4P	60.22	57.65	221.0	0.0116	0.013	0.0	6.0	0.0	
30	5P	59.15	57.65	86.0	0.0174	0.013	0.0	12.0	0.0	
31	7P	57.20	57.09	6.5	0.0169	0.011	24.0	6.0	0.0	
32	8P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
33	9P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
34	10P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
35	11P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
36	12P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	
37	13P	70.10	69.60	1.0	0.5000	0.025	6.0	6.0	0.0	

Notes Listing (all nodes)

Line#	Node Number	Notes
1	1.4	Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.
2	1.5	Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.00 cfs 0.000 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.00 cfs 0.000 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=0.25"
Flow Length=165' Tc=0.9 min CN=53 Runoff=0.06 cfs 0.005 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.24 cfs 0.011 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.24 cfs 0.012 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=0.31"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=0.05 cfs 0.005 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=0.38"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.02 cfs 0.001 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.03 cfs 0.001 af

Pond 1P: Catch Basin Peak Elev=65.31' Storage=188 cf Inflow=0.24 cfs 0.011 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.23 cfs 0.007 af

Pond 2P: Catch Basin Peak Elev=65.31' Storage=188 cf Inflow=0.24 cfs 0.012 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.24 cfs 0.008 af

Pond 3P: Rain Garden Peak Elev=59.33' Storage=13 cf Inflow=0.05 cfs 0.005 af
Outflow=0.04 cfs 0.005 af

Pond 4P: Flow Splitter Peak Elev=60.24' Storage=3 cf Inflow=0.48 cfs 0.015 af
Primary=0.47 cfs 0.015 af Secondary=0.00 cfs 0.000 af Outflow=0.48 cfs 0.015 af

Pond 5P: Oil/Grit Separator Peak Elev=59.24' Storage=302 cf Inflow=0.47 cfs 0.015 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=0.05 cfs 0.008 af

Pond 6P: Sediment Forebay Peak Elev=57.35' Storage=246 cf Inflow=0.08 cfs 0.013 af
Outflow=0.02 cfs 0.008 af

Pond 7P: Infiltration Basin Peak Elev=56.00' Storage=4 cf Inflow=0.02 cfs 0.008 af
Discarded=0.02 cfs 0.008 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.008 af

Pond 8P: Dry Well 1 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 9P: Dry Well 2 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 10P: Dry Well 3 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 11P: Dry Well 4 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 12P: Dry Well 5 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 13P: Dry Well 6 Peak Elev=64.68' Storage=36 cf Inflow=0.06 cfs 0.003 af
Discarded=0.02 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.003 af

Pond 14P: Infiltration Trench 1 Peak Elev=50.07' Storage=7 cf Inflow=0.06 cfs 0.005 af
Discarded=0.05 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.005 af

Pond 15P: Infiltration Trench 2 Peak Elev=63.00' Storage=0 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.057 af Average Runoff Depth = 0.33"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af, Depth= 3.16"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 0.06 cfs @ 11.95 hrs, Volume= 0.005 af, Depth= 0.25"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.00 cfs @ 24.04 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.24 cfs @ 11.91 hrs, Volume= 0.011 af, Depth= 3.16"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.24 cfs @ 11.91 hrs, Volume= 0.012 af, Depth= 3.16"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.005 af, Depth= 0.31"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.06 cfs @ 11.91 hrs, Volume= 0.003 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.02 cfs @ 12.07 hrs, Volume= 0.001 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.03 cfs @ 11.90 hrs, Volume= 0.001 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=3.39"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.24 cfs @ 11.91 hrs, Volume= 0.011 af
Outflow = 0.23 cfs @ 11.91 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.3 min
Primary = 0.23 cfs @ 11.91 hrs, Volume= 0.007 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.31' @ 11.91 hrs Surf.Area= 40 sf Storage= 188 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 196.9 min calculated for 0.007 af (64% of inflow)
Center-of-Mass det. time= 92.1 min (838.7 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.22 cfs @ 11.91 hrs HW=65.31' (Free Discharge)
1=Culvert (Inlet Controls 0.22 cfs @ 1.93 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.24 cfs @ 11.91 hrs, Volume= 0.012 af
Outflow = 0.24 cfs @ 11.91 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.2 min
Primary = 0.24 cfs @ 11.91 hrs, Volume= 0.008 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.31' @ 11.91 hrs Surf.Area= 40 sf Storage= 188 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 193.6 min calculated for 0.007 af (64% of inflow)
Center-of-Mass det. time= 90.3 min (836.9 - 746.6)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.23 cfs @ 11.91 hrs HW=65.31' (Free Discharge)
1=Culvert (Inlet Controls 0.23 cfs @ 1.94 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 0.31" for 2-Year event
Inflow = 0.05 cfs @ 12.08 hrs, Volume= 0.005 af
Outflow = 0.04 cfs @ 12.13 hrs, Volume= 0.005 af, Atten= 15%, Lag= 3.2 min
Primary = 0.04 cfs @ 12.13 hrs, Volume= 0.005 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.33' @ 12.13 hrs Surf.Area= 200 sf Storage= 13 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 20.7 min calculated for 0.005 af (99% of inflow)
Center-of-Mass det. time= 13.9 min (963.0 - 949.2)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 12.13 hrs HW=59.33' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.04 cfs @ 1.44 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 2.02" for 2-Year event
Inflow = 0.48 cfs @ 11.91 hrs, Volume= 0.015 af
Outflow = 0.48 cfs @ 11.91 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min
Primary = 0.47 cfs @ 11.91 hrs, Volume= 0.015 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.00 cfs @ 11.91 hrs, Volume= 0.000 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.24' @ 11.91 hrs Surf.Area= 3 sf Storage= 3 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 2.3 min calculated for 0.015 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (838.4 - 837.8)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.47 cfs @ 11.91 hrs HW=60.24' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.47 cfs @ 1.79 fps)

Secondary OutFlow Max=0.00 cfs @ 11.91 hrs HW=60.24' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.00 cfs @ 0.53 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 2.02" for 2-Year event
Inflow = 0.47 cfs @ 11.91 hrs, Volume= 0.015 af
Outflow = 0.05 cfs @ 12.22 hrs, Volume= 0.008 af, Atten= 90%, Lag= 18.5 min
Primary = 0.05 cfs @ 12.22 hrs, Volume= 0.008 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.24' @ 12.22 hrs Surf.Area= 71 sf Storage= 302 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 231.3 min calculated for 0.008 af (54% of inflow)
Center-of-Mass det. time= 110.4 min (948.8 - 838.4)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.04 cfs @ 12.22 hrs HW=59.24' (Free Discharge)
1=Culvert (Barrel Controls 0.04 cfs @ 1.82 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 0.45" for 2-Year event
Inflow = 0.08 cfs @ 12.20 hrs, Volume= 0.013 af
Outflow = 0.02 cfs @ 14.25 hrs, Volume= 0.008 af, Atten= 79%, Lag= 122.9 min
Primary = 0.02 cfs @ 14.25 hrs, Volume= 0.008 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.35' @ 14.25 hrs Surf.Area= 306 sf Storage= 246 cf

Plug-Flow detention time= 292.5 min calculated for 0.008 af (58% of inflow)
Center-of-Mass det. time= 138.7 min (1,093.3 - 954.6)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=0.01 cfs @ 14.25 hrs HW=57.35' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 0.01 cfs @ 0.31 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 0.20" for 2-Year event
Inflow = 0.02 cfs @ 14.25 hrs, Volume= 0.008 af
Outflow = 0.02 cfs @ 14.40 hrs, Volume= 0.008 af, Atten= 2%, Lag= 8.9 min
Discarded = 0.02 cfs @ 14.40 hrs, Volume= 0.008 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 56.00' @ 14.40 hrs Surf.Area= 600 sf Storage= 4 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 3.9 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (1,097.6 - 1,093.7)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.11 cfs @ 14.40 hrs HW=56.00' (Free Discharge)
1=Exfiltration (Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=56.00' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 3.16" for 2-Year event
Inflow = 0.06 cfs @ 11.93 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af, Atten= 70%, Lag= 6.0 min
Discarded = 0.02 cfs @ 12.03 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 64.68' @ 12.03 hrs Surf.Area= 25 sf Storage= 36 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= 14.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 14.5 min (763.1 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.02 cfs @ 12.03 hrs HW=64.68' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 0.25" for 2-Year event
Inflow = 0.06 cfs @ 11.95 hrs, Volume= 0.005 af
Outflow = 0.05 cfs @ 11.98 hrs, Volume= 0.005 af, Atten= 28%, Lag= 2.1 min
Discarded = 0.05 cfs @ 11.98 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 50.07' @ 11.98 hrs Surf.Area= 234 sf Storage= 7 cf

Plug-Flow detention time= 2.2 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 2.1 min (959.2 - 957.1)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.05 cfs @ 11.98 hrs HW=50.07' (Free Discharge)
1=Exfiltration (Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=50.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 24.04 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.06 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.9 min
Discarded = 0.00 cfs @ 24.06 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 63.00' @ 24.06 hrs Surf.Area= 135 sf Storage= 0 cf

Plug-Flow detention time= 1.4 min calculated for 0.000 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (1,331.0 - 1,329.6)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 24.06 hrs HW=63.00' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=0.16"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.00 cfs 0.001 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=0.16"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.00 cfs 0.001 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=0.84"
Flow Length=165' Tc=0.9 min CN=53 Runoff=0.38 cfs 0.016 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.01 cfs 0.004 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.01 cfs 0.005 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.00 cfs 0.002 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.35 cfs 0.017 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.35 cfs 0.017 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=0.96"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=0.25 cfs 0.017 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=0.10"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.00 cfs 0.001 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=0.13"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.01 cfs 0.004 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=0.13"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.00 cfs 0.001 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.08 cfs 0.004 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=1.08"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.07 cfs 0.004 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=4.71"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.04 cfs 0.002 af

Pond 1P: Catch Basin Peak Elev=65.36' Storage=190 cf Inflow=0.35 cfs 0.017 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.34 cfs 0.013 af

Pond 2P: Catch Basin Peak Elev=65.36' Storage=190 cf Inflow=0.35 cfs 0.017 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.35 cfs 0.013 af

Pond 3P: Rain Garden Peak Elev=59.51' Storage=29 cf Inflow=0.25 cfs 0.017 af
Outflow=0.25 cfs 0.017 af

Pond 4P: Flow Splitter Peak Elev=60.33' Storage=3 cf Inflow=0.70 cfs 0.026 af
Primary=0.66 cfs 0.026 af Secondary=0.04 cfs 0.000 af Outflow=0.70 cfs 0.026 af

Pond 5P: Oil/Grit Separator Peak Elev=59.51' Storage=322 cf Inflow=0.66 cfs 0.026 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=0.65 cfs 0.019 af

Pond 6P: Sediment Forebay Peak Elev=57.44' Storage=276 cf Inflow=0.73 cfs 0.036 af
Outflow=0.43 cfs 0.031 af

Pond 7P: Infiltration Basin Peak Elev=56.24' Storage=187 cf Inflow=0.43 cfs 0.032 af
Discarded=0.13 cfs 0.032 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.032 af

Pond 8P: Dry Well 1 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 9P: Dry Well 2 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 10P: Dry Well 3 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 11P: Dry Well 4 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 12P: Dry Well 5 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 13P: Dry Well 6 Peak Elev=66.66' Storage=56 cf Inflow=0.09 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 14P: Infiltration Trench 1 Peak Elev=51.49' Storage=139 cf Inflow=0.38 cfs 0.016 af
Discarded=0.07 cfs 0.016 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.016 af

Pond 15P: Infiltration Trench 2 Peak Elev=63.01' Storage=0 cf Inflow=0.00 cfs 0.002 af
Discarded=0.00 cfs 0.002 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.002 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.124 af Average Runoff Depth = 0.71"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.00 cfs @ 12.44 hrs, Volume= 0.001 af, Depth= 0.16"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 4.71"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.00 cfs @ 12.45 hrs, Volume= 0.001 af, Depth= 0.16"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 0.38 cfs @ 11.92 hrs, Volume= 0.016 af, Depth= 0.84"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.01 cfs @ 12.44 hrs, Volume= 0.004 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.01 cfs @ 12.45 hrs, Volume= 0.005 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.00 cfs @ 12.65 hrs, Volume= 0.002 af, Depth= 0.19"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.35 cfs @ 11.91 hrs, Volume= 0.017 af, Depth= 4.71"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.35 cfs @ 11.91 hrs, Volume= 0.017 af, Depth= 4.71"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 0.25 cfs @ 12.05 hrs, Volume= 0.017 af, Depth= 0.96"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.00 cfs @ 15.06 hrs, Volume= 0.001 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.01 cfs @ 13.43 hrs, Volume= 0.004 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.00 cfs @ 13.80 hrs, Volume= 0.001 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.08 cfs @ 11.91 hrs, Volume= 0.004 af, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.07 cfs @ 12.04 hrs, Volume= 0.004 af, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.04 cfs @ 11.90 hrs, Volume= 0.002 af, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.35 cfs @ 11.91 hrs, Volume= 0.017 af
Outflow = 0.34 cfs @ 11.91 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.3 min
Primary = 0.34 cfs @ 11.91 hrs, Volume= 0.013 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.36' @ 11.91 hrs Surf.Area= 40 sf Storage= 190 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 164.0 min calculated for 0.013 af (76% of inflow)
Center-of-Mass det. time= 75.0 min (814.4 - 739.4)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.34 cfs @ 11.91 hrs HW=65.35' (Free Discharge)
1=Culvert (Inlet Controls 0.34 cfs @ 2.14 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.35 cfs @ 11.91 hrs, Volume= 0.017 af
Outflow = 0.35 cfs @ 11.91 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.2 min
Primary = 0.35 cfs @ 11.91 hrs, Volume= 0.013 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.36' @ 11.91 hrs Surf.Area= 40 sf Storage= 190 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 161.8 min calculated for 0.013 af (76% of inflow)
Center-of-Mass det. time= 73.9 min (813.4 - 739.5)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.35 cfs @ 11.91 hrs HW=65.36' (Free Discharge)
1=Culvert (Inlet Controls 0.35 cfs @ 2.16 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 0.96" for 10-Year event
Inflow = 0.25 cfs @ 12.05 hrs, Volume= 0.017 af
Outflow = 0.25 cfs @ 12.07 hrs, Volume= 0.017 af, Atten= 1%, Lag= 1.0 min
Primary = 0.25 cfs @ 12.07 hrs, Volume= 0.017 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.51' @ 12.07 hrs Surf.Area= 200 sf Storage= 29 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 9.0 min calculated for 0.017 af (100% of inflow)
Center-of-Mass det. time= 6.6 min (902.5 - 896.0)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.25 cfs @ 12.07 hrs HW=59.50' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.25 cfs @ 2.44 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 3.58" for 10-Year event
Inflow = 0.70 cfs @ 11.91 hrs, Volume= 0.026 af
Outflow = 0.70 cfs @ 11.91 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min
Primary = 0.66 cfs @ 11.91 hrs, Volume= 0.026 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.04 cfs @ 11.91 hrs, Volume= 0.000 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.33' @ 11.91 hrs Surf.Area= 3 sf Storage= 3 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 1.5 min calculated for 0.026 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (814.3 - 813.9)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.65 cfs @ 11.91 hrs HW=60.33' (Free Discharge)
1=Culvert (Barrel Controls 0.65 cfs @ 1.98 fps)

Secondary OutFlow Max=0.04 cfs @ 11.91 hrs HW=60.33' (Free Discharge)
2=Culvert (Barrel Controls 0.04 cfs @ 1.67 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 3.54" for 10-Year event
Inflow = 0.66 cfs @ 11.91 hrs, Volume= 0.026 af
Outflow = 0.65 cfs @ 11.92 hrs, Volume= 0.019 af, Atten= 1%, Lag= 0.2 min
Primary = 0.65 cfs @ 11.92 hrs, Volume= 0.019 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.51' @ 11.92 hrs Surf.Area= 71 sf Storage= 322 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 134.1 min calculated for 0.019 af (73% of inflow)
Center-of-Mass det. time= 42.8 min (857.9 - 815.1)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.64 cfs @ 11.92 hrs HW=59.51' (Free Discharge)
1=Culvert (Inlet Controls 0.64 cfs @ 2.55 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 1.24" for 10-Year event
Inflow = 0.73 cfs @ 11.92 hrs, Volume= 0.036 af
Outflow = 0.43 cfs @ 12.02 hrs, Volume= 0.031 af, Atten= 41%, Lag= 5.7 min
Primary = 0.43 cfs @ 12.02 hrs, Volume= 0.031 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.44' @ 12.02 hrs Surf.Area= 327 sf Storage= 276 cf

Plug-Flow detention time= 105.1 min calculated for 0.031 af (85% of inflow)
Center-of-Mass det. time= 32.4 min (913.3 - 880.9)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=0.42 cfs @ 12.02 hrs HW=57.44' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 0.42 cfs @ 1.01 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 0.85" for 10-Year event
Inflow = 0.43 cfs @ 12.02 hrs, Volume= 0.032 af
Outflow = 0.13 cfs @ 12.35 hrs, Volume= 0.032 af, Atten= 69%, Lag= 20.4 min
Discarded = 0.13 cfs @ 12.35 hrs, Volume= 0.032 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 56.24' @ 12.35 hrs Surf.Area= 690 sf Storage= 187 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 9.0 min calculated for 0.032 af (100% of inflow)
Center-of-Mass det. time= 9.0 min (927.4 - 918.4)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.13 cfs @ 12.35 hrs HW=56.24' (Free Discharge)
1=Exfiltration (Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=56.00' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
Inflow = 0.09 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af, Atten= 70%, Lag= 6.1 min
Discarded = 0.03 cfs @ 12.04 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 66.66' @ 12.04 hrs Surf.Area= 25 sf Storage= 56 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= 17.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.0 min (758.4 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.04 hrs HW=66.66' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 0.84" for 10-Year event
Inflow = 0.38 cfs @ 11.92 hrs, Volume= 0.016 af
Outflow = 0.07 cfs @ 12.03 hrs, Volume= 0.016 af, Atten= 83%, Lag= 6.6 min
Discarded = 0.07 cfs @ 12.03 hrs, Volume= 0.016 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 51.49' @ 12.03 hrs Surf.Area= 234 sf Storage= 139 cf

Plug-Flow detention time= 13.0 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 13.0 min (908.0 - 895.0)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.07 cfs @ 12.03 hrs HW=51.49' (Free Discharge)
1=Exfiltration (Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=50.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 0.15" for 10-Year event
Inflow = 0.00 cfs @ 12.65 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 12.67 hrs, Volume= 0.002 af, Atten= 0%, Lag= 1.3 min
Discarded = 0.00 cfs @ 12.67 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 63.01' @ 12.67 hrs Surf.Area= 135 sf Storage= 0 cf

Plug-Flow detention time= 1.4 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (1,036.2 - 1,034.8)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 12.67 hrs HW=63.01' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=0.37"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.02 cfs 0.003 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.11 cfs 0.005 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=0.37"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.01 cfs 0.002 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=1.32"
Flow Length=165' Tc=0.9 min CN=53 Runoff=0.63 cfs 0.026 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=0.42"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.06 cfs 0.008 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=0.42"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.07 cfs 0.010 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=0.42"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.02 cfs 0.005 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.41 cfs 0.020 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.42 cfs 0.021 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=1.47"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=0.42 cfs 0.026 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=0.28"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.01 cfs 0.003 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.04 cfs 0.010 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.01 cfs 0.003 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.10 cfs 0.005 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=1.63"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.11 cfs 0.006 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=5.68"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.05 cfs 0.002 af

Pond 1P: Catch Basin Peak Elev=65.38' Storage=191 cf Inflow=0.41 cfs 0.020 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.41 cfs 0.016 af

Pond 2P: Catch Basin Peak Elev=65.38' Storage=191 cf Inflow=0.42 cfs 0.021 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.42 cfs 0.017 af

Pond 3P: Rain Garden Peak Elev=59.60' Storage=37 cf Inflow=0.42 cfs 0.026 af
Outflow=0.42 cfs 0.026 af

Pond 4P: Flow Splitter Peak Elev=60.38' Storage=3 cf Inflow=0.84 cfs 0.033 af
Primary=0.76 cfs 0.033 af Secondary=0.08 cfs 0.001 af Outflow=0.84 cfs 0.033 af

Pond 5P: Oil/Grit Separator Peak Elev=59.54' Storage=324 cf Inflow=0.76 cfs 0.033 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=0.75 cfs 0.026 af

Pond 6P: Sediment Forebay Peak Elev=57.51' Storage=300 cf Inflow=0.97 cfs 0.054 af
Outflow=0.94 cfs 0.048 af

Pond 7P: Infiltration Basin Peak Elev=56.68' Storage=540 cf Inflow=0.95 cfs 0.051 af
Discarded=0.17 cfs 0.051 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.051 af

Pond 8P: Dry Well 1 Peak Elev=67.67' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 9P: Dry Well 2 Peak Elev=67.67' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 10P: Dry Well 3 Peak Elev=67.65' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 11P: Dry Well 4 Peak Elev=67.62' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 12P: Dry Well 5 Peak Elev=67.73' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 13P: Dry Well 6 Peak Elev=67.70' Storage=68 cf Inflow=0.11 cfs 0.005 af
Discarded=0.03 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.005 af

Pond 14P: Infiltration Trench 1 Peak Elev=53.05' Storage=285 cf Inflow=0.63 cfs 0.026 af
Discarded=0.09 cfs 0.026 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.026 af

Pond 15P: Infiltration Trench 2 Peak Elev=63.03' Storage=2 cf Inflow=0.02 cfs 0.005 af
Discarded=0.02 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.005 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.184 af Average Runoff Depth = 1.05"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.02 cfs @ 12.02 hrs, Volume= 0.003 af, Depth= 0.37"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af, Depth= 5.68"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.01 cfs @ 12.03 hrs, Volume= 0.002 af, Depth= 0.37"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 0.63 cfs @ 11.92 hrs, Volume= 0.026 af, Depth= 1.32"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.06 cfs @ 12.08 hrs, Volume= 0.008 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.07 cfs @ 12.08 hrs, Volume= 0.010 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.02 cfs @ 12.28 hrs, Volume= 0.005 af, Depth= 0.42"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.41 cfs @ 11.91 hrs, Volume= 0.020 af, Depth= 5.68"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.42 cfs @ 11.91 hrs, Volume= 0.021 af, Depth= 5.68"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 0.42 cfs @ 12.04 hrs, Volume= 0.026 af, Depth= 1.47"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.01 cfs @ 12.39 hrs, Volume= 0.003 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.04 cfs @ 12.12 hrs, Volume= 0.010 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.01 cfs @ 12.55 hrs, Volume= 0.003 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.10 cfs @ 11.91 hrs, Volume= 0.005 af, Depth= 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.11 cfs @ 12.04 hrs, Volume= 0.006 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.05 cfs @ 11.90 hrs, Volume= 0.002 af, Depth= 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=5.92"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.41 cfs @ 11.91 hrs, Volume= 0.020 af
Outflow = 0.41 cfs @ 11.91 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.2 min
Primary = 0.41 cfs @ 11.91 hrs, Volume= 0.016 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.38' @ 11.91 hrs Surf.Area= 40 sf Storage= 191 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 151.5 min calculated for 0.016 af (80% of inflow)
Center-of-Mass det. time= 69.6 min (806.1 - 736.5)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.40 cfs @ 11.91 hrs HW=65.38' (Free Discharge)
1=Culvert (Inlet Controls 0.40 cfs @ 2.25 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.42 cfs @ 11.91 hrs, Volume= 0.021 af
Outflow = 0.42 cfs @ 11.91 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.1 min
Primary = 0.42 cfs @ 11.91 hrs, Volume= 0.017 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.38' @ 11.91 hrs Surf.Area= 40 sf Storage= 191 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 149.5 min calculated for 0.017 af (80% of inflow)
Center-of-Mass det. time= 68.6 min (805.2 - 736.6)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.41 cfs @ 11.91 hrs HW=65.38' (Free Discharge)
1=Culvert (Inlet Controls 0.41 cfs @ 2.26 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 1.47" for 25-Year event
Inflow = 0.42 cfs @ 12.04 hrs, Volume= 0.026 af
Outflow = 0.42 cfs @ 12.06 hrs, Volume= 0.026 af, Atten= 1%, Lag= 0.7 min
Primary = 0.42 cfs @ 12.06 hrs, Volume= 0.026 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.60' @ 12.06 hrs Surf.Area= 200 sf Storage= 37 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 6.7 min calculated for 0.026 af (100% of inflow)
Center-of-Mass det. time= 5.1 min (885.0 - 879.9)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.42 cfs @ 12.06 hrs HW=59.60' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.42 cfs @ 2.81 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 4.55" for 25-Year event
Inflow = 0.84 cfs @ 11.91 hrs, Volume= 0.033 af
Outflow = 0.84 cfs @ 11.91 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 11.91 hrs, Volume= 0.033 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.08 cfs @ 11.91 hrs, Volume= 0.001 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.38' @ 11.91 hrs Surf.Area= 3 sf Storage= 3 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 0.9 min calculated for 0.033 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (805.9 - 805.6)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.75 cfs @ 11.91 hrs HW=60.38' (Free Discharge)
1=Culvert (Barrel Controls 0.75 cfs @ 2.07 fps)

Secondary OutFlow Max=0.07 cfs @ 11.91 hrs HW=60.38' (Free Discharge)
2=Culvert (Barrel Controls 0.07 cfs @ 2.06 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 4.47" for 25-Year event
Inflow = 0.76 cfs @ 11.91 hrs, Volume= 0.033 af
Outflow = 0.75 cfs @ 11.91 hrs, Volume= 0.026 af, Atten= 1%, Lag= 0.2 min
Primary = 0.75 cfs @ 11.91 hrs, Volume= 0.026 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.54' @ 11.91 hrs Surf.Area= 71 sf Storage= 324 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 112.9 min calculated for 0.026 af (79% of inflow)
Center-of-Mass det. time= 32.6 min (840.0 - 807.4)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.75 cfs @ 11.91 hrs HW=59.54' (Free Discharge)
1=Culvert (Inlet Controls 0.75 cfs @ 2.65 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 1.83" for 25-Year event
Inflow = 0.97 cfs @ 11.92 hrs, Volume= 0.054 af
Outflow = 0.94 cfs @ 11.95 hrs, Volume= 0.048 af, Atten= 3%, Lag= 1.5 min
Primary = 0.94 cfs @ 11.95 hrs, Volume= 0.048 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.51' @ 11.95 hrs Surf.Area= 342 sf Storage= 300 cf

Plug-Flow detention time= 73.1 min calculated for 0.048 af (90% of inflow)
Center-of-Mass det. time= 20.0 min (884.5 - 864.6)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=0.92 cfs @ 11.95 hrs HW=57.51' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 0.92 cfs @ 1.30 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 1.35" for 25-Year event
Inflow = 0.95 cfs @ 11.95 hrs, Volume= 0.051 af
Outflow = 0.17 cfs @ 12.41 hrs, Volume= 0.051 af, Atten= 82%, Lag= 27.7 min
Discarded = 0.17 cfs @ 12.41 hrs, Volume= 0.051 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 56.68' @ 12.41 hrs Surf.Area= 864 sf Storage= 540 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 23.6 min calculated for 0.051 af (100% of inflow)
Center-of-Mass det. time= 23.6 min (913.7 - 890.1)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.17 cfs @ 12.41 hrs HW=56.68' (Free Discharge)
1=Exfiltration (Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=56.00' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 68%, Lag= 5.9 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.67' @ 12.03 hrs Surf.Area= 35 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 18.0 min (756.5 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.67' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 68%, Lag= 5.9 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.67' @ 12.03 hrs Surf.Area= 35 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 18.0 min (756.5 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.67' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 68%, Lag= 5.8 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.65' @ 12.03 hrs Surf.Area= 37 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.9 min (756.4 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.65' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 67%, Lag= 5.8 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.62' @ 12.03 hrs Surf.Area= 42 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= 17.9 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 17.9 min (756.4 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.61' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 69%, Lag= 6.0 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.73' @ 12.03 hrs Surf.Area= 30 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 18.0 min (756.5 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.72' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 5.68" for 25-Year event
Inflow = 0.11 cfs @ 11.93 hrs, Volume= 0.005 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af, Atten= 69%, Lag= 5.9 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 67.70' @ 12.03 hrs Surf.Area= 32 sf Storage= 68 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= 18.0 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 18.0 min (756.5 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=67.69' (Free Discharge)
└**1=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 1.32" for 25-Year event
Inflow = 0.63 cfs @ 11.92 hrs, Volume= 0.026 af
Outflow = 0.09 cfs @ 12.14 hrs, Volume= 0.026 af, Atten= 86%, Lag= 13.5 min
Discarded = 0.09 cfs @ 12.14 hrs, Volume= 0.026 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 53.05' @ 12.14 hrs Surf.Area= 234 sf Storage= 285 cf

Plug-Flow detention time= 24.6 min calculated for 0.026 af (100% of inflow)
Center-of-Mass det. time= 24.6 min (901.7 - 877.1)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.09 cfs @ 12.14 hrs HW=53.05' (Free Discharge)
1=Exfiltration (Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=50.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 0.34" for 25-Year event
Inflow = 0.02 cfs @ 12.28 hrs, Volume= 0.005 af
Outflow = 0.02 cfs @ 12.30 hrs, Volume= 0.005 af, Atten= 1%, Lag= 1.5 min
Discarded = 0.02 cfs @ 12.30 hrs, Volume= 0.005 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 63.03' @ 12.30 hrs Surf.Area= 135 sf Storage= 2 cf

Plug-Flow detention time= 1.4 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (980.6 - 979.2)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 12.30 hrs HW=63.03' (Free Discharge)
1=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=0.84"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.11 cfs 0.007 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.13 cfs 0.007 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=0.84"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.06 cfs 0.004 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=2.19"
Flow Length=165' Tc=0.9 min CN=53 Runoff=1.08 cfs 0.042 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.23 cfs 0.018 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.28 cfs 0.023 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=0.92"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.08 cfs 0.011 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.52 cfs 0.026 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.53 cfs 0.026 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=2.39"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=0.72 cfs 0.042 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=0.69"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.05 cfs 0.006 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.24 cfs 0.024 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.04 cfs 0.008 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.12 cfs 0.006 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=2.59"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.18 cfs 0.010 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=7.17"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.06 cfs 0.003 af

Pond 1P: Catch Basin Peak Elev=65.42' Storage=193 cf Inflow=0.52 cfs 0.026 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.52 cfs 0.022 af

Pond 2P: Catch Basin Peak Elev=65.42' Storage=193 cf Inflow=0.53 cfs 0.026 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.53 cfs 0.022 af

Pond 3P: Rain Garden Peak Elev=59.75' Storage=49 cf Inflow=0.72 cfs 0.042 af
Outflow=0.71 cfs 0.042 af

Pond 4P: Flow Splitter Peak Elev=60.44' Storage=4 cf Inflow=1.05 cfs 0.044 af
Primary=0.91 cfs 0.043 af Secondary=0.15 cfs 0.001 af Outflow=1.05 cfs 0.044 af

Pond 5P: Oil/Grit Separator Peak Elev=59.58' Storage=326 cf Inflow=0.91 cfs 0.043 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=0.90 cfs 0.036 af

Pond 6P: Sediment Forebay Peak Elev=57.56' Storage=316 cf Inflow=1.38 cfs 0.083 af
Outflow=1.36 cfs 0.077 af

Pond 7P: Infiltration Basin Peak Elev=57.27' Storage=1,123 cf Inflow=1.43 cfs 0.084 af
Discarded=0.22 cfs 0.081 af Primary=0.15 cfs 0.004 af Outflow=0.38 cfs 0.084 af

Pond 8P: Dry Well 1 Peak Elev=70.18' Storage=75 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.05 cfs 0.000 af Outflow=0.09 cfs 0.007 af

Pond 9P: Dry Well 2 Peak Elev=70.18' Storage=75 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.05 cfs 0.000 af Outflow=0.09 cfs 0.007 af

Pond 10P: Dry Well 3 Peak Elev=69.81' Storage=76 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.007 af

Pond 11P: Dry Well 4 Peak Elev=70.24' Storage=78 cf Inflow=0.13 cfs 0.007 af
Discarded=0.05 cfs 0.007 af Primary=0.11 cfs 0.000 af Outflow=0.16 cfs 0.007 af

Pond 12P: Dry Well 5 Peak Elev=70.28' Storage=73 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.17 cfs 0.001 af Outflow=0.20 cfs 0.007 af

Pond 13P: Dry Well 6 Peak Elev=70.24' Storage=74 cf Inflow=0.13 cfs 0.007 af
Discarded=0.04 cfs 0.007 af Primary=0.12 cfs 0.000 af Outflow=0.16 cfs 0.007 af

Pond 14P: Infiltration Trench 1 Peak Elev=55.63' Storage=527 cf Inflow=1.08 cfs 0.042 af
Discarded=0.13 cfs 0.041 af Primary=0.45 cfs 0.002 af Outflow=0.58 cfs 0.042 af

Pond 15P: Infiltration Trench 2 Peak Elev=64.15' Storage=62 cf Inflow=0.11 cfs 0.011 af
Discarded=0.04 cfs 0.011 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.011 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.297 af Average Runoff Depth = 1.70"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.11 cfs @ 11.99 hrs, Volume= 0.007 af, Depth= 0.84"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af, Depth= 7.17"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.06 cfs @ 12.00 hrs, Volume= 0.004 af, Depth= 0.84"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 1.08 cfs @ 11.92 hrs, Volume= 0.042 af, Depth= 2.19"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.23 cfs @ 12.05 hrs, Volume= 0.018 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.28 cfs @ 12.05 hrs, Volume= 0.023 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.08 cfs @ 12.22 hrs, Volume= 0.011 af, Depth= 0.92"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.52 cfs @ 11.91 hrs, Volume= 0.026 af, Depth= 7.17"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.53 cfs @ 11.91 hrs, Volume= 0.026 af, Depth= 7.17"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 0.72 cfs @ 12.04 hrs, Volume= 0.042 af, Depth= 2.39"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.05 cfs @ 12.11 hrs, Volume= 0.006 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.24 cfs @ 12.07 hrs, Volume= 0.024 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.04 cfs @ 12.39 hrs, Volume= 0.008 af, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.12 cfs @ 11.91 hrs, Volume= 0.006 af, Depth= 7.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.18 cfs @ 12.04 hrs, Volume= 0.010 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.06 cfs @ 11.90 hrs, Volume= 0.003 af, Depth= 7.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.52 cfs @ 11.91 hrs, Volume= 0.026 af
Outflow = 0.52 cfs @ 11.91 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.2 min
Primary = 0.52 cfs @ 11.91 hrs, Volume= 0.022 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.42' @ 11.91 hrs Surf.Area= 40 sf Storage= 193 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 135.1 min calculated for 0.022 af (84% of inflow)
Center-of-Mass det. time= 63.0 min (796.3 - 733.2)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.50 cfs @ 11.91 hrs HW=65.41' (Free Discharge)
1=Culvert (Inlet Controls 0.50 cfs @ 2.38 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.53 cfs @ 11.91 hrs, Volume= 0.026 af
Outflow = 0.53 cfs @ 11.91 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.1 min
Primary = 0.53 cfs @ 11.91 hrs, Volume= 0.022 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.42' @ 11.91 hrs Surf.Area= 40 sf Storage= 193 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 133.1 min calculated for 0.022 af (84% of inflow)
Center-of-Mass det. time= 62.1 min (795.5 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.52 cfs @ 11.91 hrs HW=65.42' (Free Discharge)
1=Culvert (Inlet Controls 0.52 cfs @ 2.40 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 2.39" for 100-Year event
Inflow = 0.72 cfs @ 12.04 hrs, Volume= 0.042 af
Outflow = 0.71 cfs @ 12.05 hrs, Volume= 0.042 af, Atten= 1%, Lag= 0.7 min
Primary = 0.71 cfs @ 12.05 hrs, Volume= 0.042 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.75' @ 12.05 hrs Surf.Area= 200 sf Storage= 49 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 4.9 min calculated for 0.042 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (867.9 - 863.9)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.71 cfs @ 12.05 hrs HW=59.75' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.71 cfs @ 3.19 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 6.03" for 100-Year event
Inflow = 1.05 cfs @ 11.91 hrs, Volume= 0.044 af
Outflow = 1.05 cfs @ 11.91 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min
Primary = 0.91 cfs @ 11.91 hrs, Volume= 0.043 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.15 cfs @ 11.91 hrs, Volume= 0.001 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.44' @ 11.91 hrs Surf.Area= 3 sf Storage= 4 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 1.0 min calculated for 0.044 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (796.2 - 795.9)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=0.89 cfs @ 11.91 hrs HW=60.44' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.89 cfs @ 2.18 fps)

Secondary OutFlow Max=0.14 cfs @ 11.91 hrs HW=60.44' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.14 cfs @ 2.48 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 5.86" for 100-Year event
Inflow = 0.91 cfs @ 11.91 hrs, Volume= 0.043 af
Outflow = 0.90 cfs @ 11.91 hrs, Volume= 0.036 af, Atten= 1%, Lag= 0.2 min
Primary = 0.90 cfs @ 11.91 hrs, Volume= 0.036 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.58' @ 11.91 hrs Surf.Area= 71 sf Storage= 326 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 95.9 min calculated for 0.036 af (84% of inflow)
Center-of-Mass det. time= 27.1 min (825.7 - 798.5)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.88 cfs @ 11.91 hrs HW=59.58' (Free Discharge)
1=Culvert (Inlet Controls 0.88 cfs @ 2.78 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 2.81" for 100-Year event
Inflow = 1.38 cfs @ 11.92 hrs, Volume= 0.083 af
Outflow = 1.36 cfs @ 11.94 hrs, Volume= 0.077 af, Atten= 1%, Lag= 0.8 min
Primary = 1.36 cfs @ 11.94 hrs, Volume= 0.077 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.56' @ 11.94 hrs Surf.Area= 353 sf Storage= 316 cf

Plug-Flow detention time= 49.3 min calculated for 0.077 af (93% of inflow)
Center-of-Mass det. time= 12.4 min (862.5 - 850.1)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=1.35 cfs @ 11.94 hrs HW=57.56' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 1.35 cfs @ 1.47 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 2.22" for 100-Year event
Inflow = 1.43 cfs @ 11.94 hrs, Volume= 0.084 af
Outflow = 0.38 cfs @ 12.26 hrs, Volume= 0.084 af, Atten= 74%, Lag= 19.1 min
Discarded = 0.22 cfs @ 12.26 hrs, Volume= 0.081 af
Primary = 0.15 cfs @ 12.26 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.27' @ 12.26 hrs Surf.Area= 1,113 sf Storage= 1,123 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 40.8 min calculated for 0.084 af (100% of inflow)
Center-of-Mass det. time= 40.8 min (908.8 - 868.0)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.22 cfs @ 12.26 hrs HW=57.27' (Free Discharge)
1=Exfiltration (Controls 0.22 cfs)

Primary OutFlow Max=0.15 cfs @ 12.26 hrs HW=57.27' (Free Discharge)
2=Culvert (Inlet Controls 0.15 cfs @ 1.07 fps)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.09 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 30%, Lag= 1.9 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.05 cfs @ 11.96 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.18' @ 11.96 hrs Surf.Area= 25 sf Storage= 75 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 29.5 min calculated for 0.007 af (98% of inflow)
Center-of-Mass det. time= 18.0 min (753.3 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.18' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.17' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.04 cfs @ 1.07 fps)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.09 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 30%, Lag= 1.9 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.05 cfs @ 11.96 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.18' @ 11.96 hrs Surf.Area= 25 sf Storage= 75 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 29.5 min calculated for 0.007 af (98% of inflow)
Center-of-Mass det. time= 18.0 min (753.3 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.18' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.17' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.04 cfs @ 1.07 fps)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af, Atten= 68%, Lag= 1.5 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 69.81' @ 11.97 hrs Surf.Area= 25 sf Storage= 76 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 40.5 min calculated for 0.007 af (97% of inflow)
Center-of-Mass det. time= 18.7 min (754.0 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=69.63' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.10' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.16 cfs @ 11.99 hrs, Volume= 0.007 af, Atten= 0%, Lag= 3.1 min
Discarded = 0.05 cfs @ 11.98 hrs, Volume= 0.007 af
Primary = 0.11 cfs @ 11.99 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.24' @ 11.98 hrs Surf.Area= 25 sf Storage= 78 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 17.0 min (752.3 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.05 cfs @ 11.98 hrs HW=70.24' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.09 cfs @ 11.99 hrs HW=70.23' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.09 cfs @ 1.44 fps)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.20 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 0%, Lag= 2.0 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.17 cfs @ 11.97 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.28' @ 11.96 hrs Surf.Area= 25 sf Storage= 73 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 15.7 min (751.0 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.28' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.14 cfs @ 11.97 hrs HW=70.27' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.14 cfs @ 1.65 fps)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 7.17" for 100-Year event
Inflow = 0.13 cfs @ 11.93 hrs, Volume= 0.007 af
Outflow = 0.16 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 0%, Lag= 2.0 min
Discarded = 0.04 cfs @ 11.96 hrs, Volume= 0.007 af
Primary = 0.12 cfs @ 11.97 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.24' @ 11.96 hrs Surf.Area= 25 sf Storage= 74 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 16.5 min (751.8 - 735.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.96 hrs HW=70.24' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.10 cfs @ 11.97 hrs HW=70.23' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.10 cfs @ 1.47 fps)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 2.19" for 100-Year event
Inflow = 1.08 cfs @ 11.92 hrs, Volume= 0.042 af
Outflow = 0.58 cfs @ 11.98 hrs, Volume= 0.042 af, Atten= 46%, Lag= 4.1 min
Discarded = 0.13 cfs @ 11.99 hrs, Volume= 0.041 af
Primary = 0.45 cfs @ 11.98 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 55.63' @ 11.99 hrs Surf.Area= 234 sf Storage= 527 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 35.4 min (895.1 - 859.7)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.13 cfs @ 11.99 hrs HW=55.59' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.13 cfs)

Primary OutFlow Max=0.39 cfs @ 11.98 hrs HW=55.60' (Free Discharge)
↑—**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.39 cfs @ 1.01 fps)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 0.76" for 100-Year event
Inflow = 0.11 cfs @ 11.97 hrs, Volume= 0.011 af
Outflow = 0.04 cfs @ 12.61 hrs, Volume= 0.011 af, Atten= 67%, Lag= 38.9 min
Discarded = 0.04 cfs @ 12.61 hrs, Volume= 0.011 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 64.15' @ 12.61 hrs Surf.Area= 135 sf Storage= 62 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 9.8 min (940.3 - 930.5)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.04 cfs @ 12.61 hrs HW=64.15' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
↑—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-38.00 hrs, dt=0.02 hrs, 1901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: WTP Site Lawn Runoff Area=4,464 sf 0.00% Impervious Runoff Depth=1.36"
Flow Length=54' Tc=5.2 min CN=38 Runoff=0.22 cfs 0.012 af

Subcatchment 1.10: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=89' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.11: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.12: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.13: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.14: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.15: WTP Roof Runoff Area=505 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=95' Tc=3.1 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 1.2: WTP Site Lawn Runoff Area=2,421 sf 0.00% Impervious Runoff Depth=1.36"
Flow Length=56' Slope=0.0769 '/' Tc=6.1 min CN=38 Runoff=0.11 cfs 0.006 af

Subcatchment 1.3: WTP Site, Offsite Flow Runoff Area=10,116 sf 26.34% Impervious Runoff Depth=3.04"
Flow Length=165' Tc=0.9 min CN=53 Runoff=1.51 cfs 0.059 af

Subcatchment 1.4: WTP Residuals Runoff Area=10,165 sf 0.00% Impervious Runoff Depth=1.46"
Flow Length=54' Tc=10.0 min CN=39 Runoff=0.43 cfs 0.028 af

Subcatchment 1.5: WTP Residuals Runoff Area=12,807 sf 0.00% Impervious Runoff Depth=1.46"
Flow Length=101' Tc=10.3 min CN=39 Runoff=0.54 cfs 0.036 af

Subcatchment 1.6: WTP Site Lawn Runoff Area=6,123 sf 0.00% Impervious Runoff Depth=1.46"
Flow Length=90' Slope=0.0050 '/' Tc=22.2 min CN=39 Runoff=0.16 cfs 0.017 af

Subcatchment 1.7: WTP Driveway/Roof Runoff Area=1,878 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=78' Tc=0.9 min CN=98 Runoff=0.61 cfs 0.030 af

Subcatchment 1.8: WTP Driveway/Roof Runoff Area=1,927 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=93' Tc=1.0 min CN=98 Runoff=0.62 cfs 0.031 af

Subcatchment 1.9: WTP Access Road Runoff Area=9,108 sf 30.92% Impervious Runoff Depth=3.27"
Flow Length=200' Slope=0.0303 '/' Tc=11.2 min CN=55 Runoff=1.00 cfs 0.057 af

Subcatchment 3.1: WTP Site, Offsite Flow to Runoff Area=4,934 sf 0.00% Impervious Runoff Depth=1.15"
Flow Length=100' Tc=13.2 min CN=36 Runoff=0.12 cfs 0.011 af

Subcatchment 4.1: WTP Site, Offsite Flow Runoff Area=16,243 sf 0.00% Impervious Runoff Depth=1.26"
Flow Length=186' Tc=11.0 min CN=37 Runoff=0.52 cfs 0.039 af

Subcatchment 4.2: WTP Site, Offsite Flow to Runoff Area=5,400 sf 0.00% Impervious Runoff Depth=1.26"
Flow Length=196' Tc=31.6 min CN=37 Runoff=0.08 cfs 0.013 af

Subcatchment 5.1: WTP Site, Offsite Flow to Runoff Area=442 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=174' Tc=0.9 min CN=98 Runoff=0.14 cfs 0.007 af

Subcatchment 5.2: Well 4, Offsite Flow to Runoff Area=2,064 sf 31.35% Impervious Runoff Depth=3.51"
Flow Length=50' Tc=11.0 min CN=57 Runoff=0.25 cfs 0.014 af

Subcatchment 6.1: End of Access Road Runoff Area=225 sf 100.00% Impervious Runoff Depth=8.46"
Flow Length=20' Slope=0.0294 '/' Tc=0.3 min CN=98 Runoff=0.07 cfs 0.004 af

Pond 1P: Catch Basin Peak Elev=65.45' Storage=194 cf Inflow=0.61 cfs 0.030 af
12.0" Round Culvert n=0.013 L=12.0' S=0.3867 '/' Outflow=0.61 cfs 0.026 af

Pond 2P: Catch Basin Peak Elev=65.45' Storage=194 cf Inflow=0.62 cfs 0.031 af
12.0" Round Culvert n=0.013 L=43.0' S=0.1079 '/' Outflow=0.62 cfs 0.027 af

Pond 3P: Rain Garden Peak Elev=59.90' Storage=61 cf Inflow=1.00 cfs 0.057 af
Outflow=0.99 cfs 0.057 af

Pond 4P: Flow Splitter Peak Elev=60.49' Storage=4 cf Inflow=1.23 cfs 0.053 af
Primary=1.02 cfs 0.051 af Secondary=0.21 cfs 0.002 af Outflow=1.23 cfs 0.053 af

Pond 5P: Oil/Grit Separator Peak Elev=59.61' Storage=329 cf Inflow=1.02 cfs 0.051 af
12.0" Round Culvert n=0.013 L=86.0' S=0.0174 '/' Outflow=1.01 cfs 0.045 af

Pond 6P: Sediment Forebay Peak Elev=57.60' Storage=330 cf Inflow=1.77 cfs 0.110 af
Outflow=1.75 cfs 0.104 af

Pond 7P: Infiltration Basin Peak Elev=57.43' Storage=1,314 cf Inflow=1.92 cfs 0.116 af
Discarded=0.24 cfs 0.095 af Primary=0.87 cfs 0.021 af Outflow=1.11 cfs 0.116 af

Pond 8P: Dry Well 1 Peak Elev=70.15' Storage=75 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.007 af Primary=0.03 cfs 0.000 af Outflow=0.07 cfs 0.008 af

Pond 9P: Dry Well 2 Peak Elev=70.15' Storage=75 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.007 af Primary=0.03 cfs 0.000 af Outflow=0.07 cfs 0.008 af

Pond 10P: Dry Well 3 Peak Elev=70.21' Storage=76 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.008 af Primary=0.08 cfs 0.000 af Outflow=0.13 cfs 0.008 af

Pond 11P: Dry Well 4 Peak Elev=70.31' Storage=78 cf Inflow=0.16 cfs 0.008 af
Discarded=0.05 cfs 0.008 af Primary=0.21 cfs 0.001 af Outflow=0.26 cfs 0.009 af

Pond 12P: Dry Well 5 Peak Elev=70.22' Storage=73 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.007 af Primary=0.09 cfs 0.001 af Outflow=0.12 cfs 0.008 af

Pond 13P: Dry Well 6 Peak Elev=70.17' Storage=74 cf Inflow=0.16 cfs 0.008 af
Discarded=0.04 cfs 0.007 af Primary=0.04 cfs 0.000 af Outflow=0.08 cfs 0.008 af

Pond 14P: Infiltration Trench 1 Peak Elev=55.72' Storage=536 cf Inflow=1.51 cfs 0.059 af
Discarded=0.13 cfs 0.049 af Primary=1.47 cfs 0.009 af Outflow=1.60 cfs 0.058 af

Pond 15P: Infiltration Trench 2 Peak Elev=66.00' Storage=162 cf Inflow=0.16 cfs 0.018 af
Discarded=0.05 cfs 0.018 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.018 af

Total Runoff Area = 2.097 ac Runoff Volume = 0.413 af Average Runoff Depth = 2.37"
85.08% Pervious = 1.784 ac 14.92% Impervious = 0.313 ac

Summary for Subcatchment 1.1: WTP Site Lawn

Runoff = 0.22 cfs @ 11.98 hrs, Volume= 0.012 af, Depth= 1.36"
Routed to Pond 7P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
3,862	39	>75% Grass cover, Good, HSG A
602	30	Brush, Good, HSG A
4,464	38	Weighted Average
4,464		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	40	0.1111	0.13		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	14	0.1429	3.78		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
5.2	54	Total			

Summary for Subcatchment 1.10: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 8P : Dry Well 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	89	Total			

Summary for Subcatchment 1.11: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 9P : Dry Well 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.12: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 10P : Dry Well 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08'

n= 0.025 Corrugated metal

3.1	95	Total

Summary for Subcatchment 1.13: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 11P : Dry Well 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.14: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 12P : Dry Well 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.15: WTP Roof

Runoff = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af, Depth= 8.46"
Routed to Pond 13P : Dry Well 6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
505		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
1.1	20	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
2.0	30	0.0005	0.25	0.02	**Pipe Channel, Drain Pipe** 4.0" Round Area= 0.1 sf Perim= 1.0' r= 0.08' n= 0.025 Corrugated metal
3.1	95	Total			

Summary for Subcatchment 1.2: WTP Site Lawn

Runoff = 0.11 cfs @ 11.99 hrs, Volume= 0.006 af, Depth= 1.36"
Routed to Pond 6P : Sediment Forebay

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
2,133	39	>75% Grass cover, Good, HSG A
288	30	Brush, Good, HSG A
2,421	38	Weighted Average
2,421		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0769	0.11		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.1	16	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
6.1	56	Total			

Summary for Subcatchment 1.3: WTP Site, Offsite Flow to the West

Runoff = 1.51 cfs @ 11.91 hrs, Volume= 0.059 af, Depth= 3.04"
Routed to Pond 14P : Infiltration Trench 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
5,406	39	>75% Grass cover, Good, HSG A
2,665	98	Paved parking, HSG A
2,045	30	Brush, Good, HSG A
10,116	53	Weighted Average
7,451		73.66% Pervious Area
2,665		26.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	115	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	165	Total			

Summary for Subcatchment 1.4: WTP Residuals Treatment

Subcatchment 1.4 includes two infiltration basins for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each infiltration basin was designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 9,124 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of these infiltration basins were excluded.

Runoff = 0.43 cfs @ 12.04 hrs, Volume= 0.028 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
10,165	39	>75% Grass cover, Good, HSG A
10,165		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.0	4	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.0	54	Total			

Summary for Subcatchment 1.5: WTP Residuals Treatment

Subcatchment 1.5 includes two sand filters for residuals treatment from the Barnstable Wells 3&4 Water Treatment Plant. Each sand filter is designed to hold 55,000 gallons (a total of 110,000 gallons of storage), a much greater volume than the 11,731 gallons of runoff produced by this subcatchment during the RMAT 24-hour 50-year storm. As the water treatment residuals design is not within the scope of this stromwater management report, and the volume of the structure is sufficient to contain the runoff, the intricacies of this subcatchment were excluded. Instead, the whole area within this subcatchment was modeled as grass.

Runoff = 0.54 cfs @ 12.04 hrs, Volume= 0.036 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
12,807	39	>75% Grass cover, Good, HSG A
12,807		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.3	51	0.0714	2.67		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
10.3	101	Total			

Summary for Subcatchment 1.6: WTP Site Lawn

Runoff = 0.16 cfs @ 12.20 hrs, Volume= 0.017 af, Depth= 1.46"
Routed to Pond 15P : Infiltration Trench 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
6,123	39	>75% Grass cover, Good, HSG A
6,123		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.9	40	0.0050	0.71		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
22.2	90	Total			

Summary for Subcatchment 1.7: WTP Driveway/Roof

Runoff = 0.61 cfs @ 11.91 hrs, Volume= 0.030 af, Depth= 8.46"
Routed to Pond 1P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,373	98	Paved parking, HSG A
1,878	98	Weighted Average
1,878		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	17	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.0	22	0.1060	9.30	1.83	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.013
0.9	78	Total			

Summary for Subcatchment 1.8: WTP Driveway/Roof

Runoff = 0.62 cfs @ 11.91 hrs, Volume= 0.031 af, Depth= 8.46"
Routed to Pond 2P : Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
505	98	Roofs, HSG A
1,422	98	Paved parking, HSG A
1,927	98	Weighted Average
1,927		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	22	0.5000	14.35		**Shallow Concentrated Flow, Roof** Paved Kv= 20.3 fps
0.9	17	0.0005	0.30	0.07	**Pipe Channel, Roof** 10.0" x 3.5" Box Area= 0.2 sf Perim= 2.3' r= 0.11' n= 0.025 Corrugated metal
0.0	23	1.0000	14.86	3.71	**Pipe Channel, Down Spout** 6.0" x 6.0" Box Area= 0.3 sf Perim= 2.0' r= 0.13' n= 0.025 Corrugated metal
0.1	31	0.0750	4.07	0.80	**Pipe Channel, Drain Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.025 Corrugated metal
1.0	93	Total			

Summary for Subcatchment 1.9: WTP Access Road

Runoff = 1.00 cfs @ 12.04 hrs, Volume= 0.057 af, Depth= 3.27"
Routed to Pond 3P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
2,816	98	Paved parking, HSG A
3,649	39	>75% Grass cover, Good, HSG A
2,643	30	Brush, Good, HSG A
9,108	55	Weighted Average
6,292		69.08% Pervious Area
2,816		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	50	0.0303	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	30	0.0303	2.80		**Shallow Concentrated Flow, Lawn** Unpaved Kv= 16.1 fps
0.6	120	0.0303	3.53		**Shallow Concentrated Flow, Pavement** Paved Kv= 20.3 fps
11.2	200	Total			

Summary for Subcatchment 3.1: WTP Site, Offsite Flow to the East

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 0.011 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
4,934	36	Weighted Average
4,934		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0175	0.06		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
0.2	40	0.0769	2.77		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
0.1	10	0.0769	1.94		**Shallow Concentrated Flow, Brush** Short Grass Pasture Kv= 7.0 fps
13.2	100	Total			

Summary for Subcatchment 4.1: WTP Site, Offsite Flow to the South

Runoff = 0.52 cfs @ 12.06 hrs, Volume= 0.039 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
11,815	39	>75% Grass cover, Good, HSG A
4,428	30	Brush, Good, HSG A
16,243	37	Weighted Average
16,243		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0333	0.08		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.0	136	0.0500	2.24		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
11.0	186	Total			

Summary for Subcatchment 4.2: WTP Site, Offsite Flow to the South

Runoff = 0.08 cfs @ 12.34 hrs, Volume= 0.013 af, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
4,444	39	>75% Grass cover, Good, HSG A
956	30	Brush, Good, HSG A
5,400	37	Weighted Average
5,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	50	0.0050	0.04		**Sheet Flow, Lawn** Grass: Bermuda n= 0.410 P2= 3.39"
1.2	37	0.0050	0.49		**Shallow Concentrated Flow, Lawn** Short Grass Pasture Kv= 7.0 fps
9.1	109	0.0004	0.20		**Shallow Concentrated Flow, Lawn** Nearly Bare & Untilled Kv= 10.0 fps
31.6	196	Total			

Summary for Subcatchment 5.1: WTP Site, Offsite Flow to the North

Runoff = 0.14 cfs @ 11.91 hrs, Volume= 0.007 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
442	98	Paved parking, HSG A
442		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0345	1.53		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"
0.4	124	0.0571	4.85		**Shallow Concentrated Flow, Access Road** Paved Kv= 20.3 fps
0.9	174	Total			

Summary for Subcatchment 5.2: Well 4, Offsite Flow to the North

Runoff = 0.25 cfs @ 12.03 hrs, Volume= 0.014 af, Depth= 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
1,417	39	>75% Grass cover, Good, HSG A
647	98	Paved parking, HSG A
2,064	57	Weighted Average
1,417		68.65% Pervious Area
647		31.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	30	0.0120	0.05		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
1.2	20	0.0008	0.28		**Sheet Flow, Pavement** Smooth surfaces n= 0.011 P2= 3.39"
11.0	50	Total			

Summary for Subcatchment 6.1: End of Access Road

Runoff = 0.07 cfs @ 11.90 hrs, Volume= 0.004 af, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Type II 24-hr RMAT 50-Year Rainfall=8.70"

Area (sf)	CN	Description
225	98	Paved parking, HSG A
225		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0294	1.20		**Sheet Flow, Access Road** Smooth surfaces n= 0.011 P2= 3.39"

Summary for Pond 1P: Catch Basin

Inflow Area = 0.043 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.61 cfs @ 11.91 hrs, Volume= 0.030 af
Outflow = 0.61 cfs @ 11.91 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.2 min
Primary = 0.61 cfs @ 11.91 hrs, Volume= 0.026 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.45' @ 11.91 hrs Surf.Area= 40 sf Storage= 194 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 123.8 min calculated for 0.026 af (86% of inflow)
Center-of-Mass det. time= 58.2 min (789.4 - 731.2)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 12.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.3867 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.60 cfs @ 11.91 hrs HW=65.44' (Free Discharge)
1=Culvert (Inlet Controls 0.60 cfs @ 2.50 fps)

Summary for Pond 2P: Catch Basin

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.62 cfs @ 11.91 hrs, Volume= 0.031 af
Outflow = 0.62 cfs @ 11.91 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.1 min
Primary = 0.62 cfs @ 11.91 hrs, Volume= 0.027 af
Routed to Pond 4P : Flow Splitter

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 65.45' @ 11.91 hrs Surf.Area= 40 sf Storage= 194 cf
Flood Elev= 69.00' Surf.Area= 40 sf Storage= 336 cf

Plug-Flow detention time= 121.7 min calculated for 0.027 af (87% of inflow)
Center-of-Mass det. time= 57.2 min (788.6 - 731.3)

Volume	Invert	Avail.Storage	Storage Description
#1	60.60'	340 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.60	40	0	0
69.10	40	340	340

Device	Routing	Invert	Outlet Devices
#1	Primary	65.10'	**12.0" Round Culvert** L= 43.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 65.10' / 60.46' S= 0.1079 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.61 cfs @ 11.91 hrs HW=65.45' (Free Discharge)
1=Culvert (Inlet Controls 0.61 cfs @ 2.51 fps)

Summary for Pond 3P: Rain Garden

Inflow Area = 0.209 ac, 30.92% Impervious, Inflow Depth = 3.27" for RMAT 50-Year event
Inflow = 1.00 cfs @ 12.04 hrs, Volume= 0.057 af
Outflow = 0.99 cfs @ 12.05 hrs, Volume= 0.057 af, Atten= 1%, Lag= 0.8 min
Primary = 0.99 cfs @ 12.05 hrs, Volume= 0.057 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 59.90' @ 12.05 hrs Surf.Area= 400 sf Storage= 61 cf
Flood Elev= 62.67' Surf.Area= 800 sf Storage= 363 cf

Plug-Flow detention time= 4.1 min calculated for 0.057 af (100% of inflow)
Center-of-Mass det. time= 3.4 min (857.6 - 854.3)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	134 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2	61.83'	14 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 34 cf Overall x 40.0% Voids
#3	59.83'	160 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 400 cf Overall x 40.0% Voids
#4	59.17'	51 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 132 cf Overall - 5 cf Embedded = 127 cf x 40.0% Voids
#5	59.21'	3 cf	**4.0" Round Pipe Storage** x 8 Inside #4 L= 4.0' S= 0.0020 '/' 3 cf Overall - 0.2" Wall Thickness = 3 cf
#6	59.21'	2 cf	**4.0" Round Pipe Storage** x 2 Inside #4 L= 9.0' S= 0.0020 '/' 2 cf Overall - 0.2" Wall Thickness = 2 cf
		363 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	200	0	0
62.67	200	134	134

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
61.83	200	0	0
62.00	200	34	34

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.83	200	0	0
61.83	200	400	400

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.17	200	0	0
59.83	200	132	132

Device	Routing	Invert	Outlet Devices
#1	Primary	59.21'	**8.0" Round Culvert** L= 184.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.21' / 57.80' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Primary	62.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.98 cfs @ 12.05 hrs HW=59.90' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.98 cfs @ 3.39 fps)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 4P: Flow Splitter

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 7.32" for RMAT 50-Year event
Inflow = 1.23 cfs @ 11.91 hrs, Volume= 0.053 af
Outflow = 1.23 cfs @ 11.91 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min
Primary = 1.02 cfs @ 11.91 hrs, Volume= 0.051 af
Routed to Pond 5P : Oil/Grit Separator
Secondary = 0.21 cfs @ 11.91 hrs, Volume= 0.002 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 60.49' @ 11.91 hrs Surf.Area= 3 sf Storage= 4 cf
Flood Elev= 65.17' Surf.Area= 3 sf Storage= 17 cf

Plug-Flow detention time= 0.8 min calculated for 0.053 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (789.3 - 789.0)

Volume	Invert	Avail.Storage	Storage Description
#1	59.25'	17 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
59.25	3	0	0
65.00	3	17	17

Device	Routing	Invert	Outlet Devices
#1	Primary	59.75'	**12.0" Round Culvert** L= 130.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.75' / 59.54' S= 0.0016 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Secondary	60.22'	**6.0" Round Culvert** L= 221.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 60.22' / 57.65' S= 0.0116 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Primary OutFlow Max=1.01 cfs @ 11.91 hrs HW=60.49' (Free Discharge)
1=Culvert (Barrel Controls 1.01 cfs @ 2.26 fps)

Secondary OutFlow Max=0.20 cfs @ 11.91 hrs HW=60.49' (Free Discharge)
2=Culvert (Barrel Controls 0.20 cfs @ 2.74 fps)

Summary for Pond 5P: Oil/Grit Separator

Inflow Area = 0.087 ac,100.00% Impervious, Inflow Depth = 7.05" for RMAT 50-Year event
Inflow = 1.02 cfs @ 11.91 hrs, Volume= 0.051 af
Outflow = 1.01 cfs @ 11.91 hrs, Volume= 0.045 af, Atten= 1%, Lag= 0.2 min
Primary = 1.01 cfs @ 11.91 hrs, Volume= 0.045 af
Routed to Pond 6P : Sediment Forebay

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2

Peak Elev= 59.61' @ 11.91 hrs Surf.Area= 71 sf Storage= 329 cf
Flood Elev= 60.65' Surf.Area= 71 sf Storage= 403 cf

Plug-Flow detention time= 87.3 min calculated for 0.045 af (87% of inflow)
Center-of-Mass det. time= 26.0 min (818.1 - 792.1)

Volume	Invert	Avail.Storage	Storage Description
#1	54.98'	476 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.98	71	0	0
61.69	71	476	476

Device	Routing	Invert	Outlet Devices
#1	Primary	59.15'	**12.0" Round Culvert** L= 86.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 59.15' / 57.65' S= 0.0174 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.00 cfs @ 11.91 hrs HW=59.61' (Free Discharge)
1=Culvert (Inlet Controls 1.00 cfs @ 2.87 fps)

Summary for Pond 6P: Sediment Forebay

Inflow Area = 0.352 ac, 43.18% Impervious, Inflow Depth = 3.74" for RMAT 50-Year event
Inflow = 1.77 cfs @ 11.93 hrs, Volume= 0.110 af
Outflow = 1.75 cfs @ 11.94 hrs, Volume= 0.104 af, Atten= 1%, Lag= 0.7 min
Primary = 1.75 cfs @ 11.94 hrs, Volume= 0.104 af
Routed to Pond 7P : Infiltration Basin

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.60' @ 11.94 hrs Surf.Area= 362 sf Storage= 330 cf

Plug-Flow detention time= 38.3 min calculated for 0.104 af (95% of inflow)
Center-of-Mass det. time= 9.6 min (851.4 - 841.8)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	492 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	78	0	0
57.00	228	153	153
58.00	450	339	492

Device	Routing	Invert	Outlet Devices
#1	Primary	57.34'	**67.4 deg x 4.0' long x 0.66' rise Sharp-Crested Vee/Trap Weir** Cv= 2.52 (C= 3.15)

Primary OutFlow Max=1.75 cfs @ 11.94 hrs HW=57.60' (Free Discharge)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 1.75 cfs @ 1.60 fps)

Summary for Pond 7P: Infiltration Basin

Inflow Area = 0.454 ac, 33.44% Impervious, Inflow Depth = 3.06" for RMAT 50-Year event
Inflow = 1.92 cfs @ 11.95 hrs, Volume= 0.116 af
Outflow = 1.11 cfs @ 12.11 hrs, Volume= 0.116 af, Atten= 42%, Lag= 9.9 min
Discarded = 0.24 cfs @ 12.11 hrs, Volume= 0.095 af
Primary = 0.87 cfs @ 12.11 hrs, Volume= 0.021 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs
Peak Elev= 57.43' @ 12.11 hrs Surf.Area= 1,185 sf Storage= 1,314 cf
Flood Elev= 59.50' Surf.Area= 1,450 sf Storage= 2,012 cf

Plug-Flow detention time= 37.0 min calculated for 0.116 af (100% of inflow)
Center-of-Mass det. time= 37.0 min (893.7 - 856.7)

Volume	Invert	Avail.Storage	Storage Description
#1	56.00'	2,012 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
56.00	598	0	0
57.00	988	793	793
58.00	1,450	1,219	2,012

Device	Routing	Invert	Outlet Devices
#1	Discarded	56.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 32.00'
#2	Primary	57.20'	**24.0" W x 6.0" H Box Culvert** L= 6.5' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 57.20' / 57.09' S= 0.0169 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.00 sf

Discarded OutFlow Max=0.24 cfs @ 12.11 hrs HW=57.43' (Free Discharge)
1=Exfiltration (Controls 0.24 cfs)

Primary OutFlow Max=0.87 cfs @ 12.11 hrs HW=57.43' (Free Discharge)
2=Culvert (Inlet Controls 0.87 cfs @ 1.91 fps)

Summary for Pond 8P: Dry Well 1

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.07 cfs @ 11.95 hrs, Volume= 0.008 af, Atten= 56%, Lag= 0.7 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.007 af
Primary = 0.03 cfs @ 11.95 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.15' @ 11.94 hrs Surf.Area= 25 sf Storage= 75 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 62.6 min calculated for 0.008 af (92% of inflow)
Center-of-Mass det. time= 19.1 min (752.4 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.15' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.02 cfs @ 11.95 hrs HW=70.15' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.02 cfs @ 0.85 fps)

Summary for Pond 9P: Dry Well 2

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.07 cfs @ 11.95 hrs, Volume= 0.008 af, Atten= 56%, Lag= 0.7 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.007 af
Primary = 0.03 cfs @ 11.95 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.15' @ 11.94 hrs Surf.Area= 25 sf Storage= 75 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 75 cf

Plug-Flow detention time= 62.6 min calculated for 0.008 af (92% of inflow)
Center-of-Mass det. time= 19.1 min (752.4 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	4 cf	**6.0" Round Pipe Storage** L= 19.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		75 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.15' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.02 cfs @ 11.95 hrs HW=70.15' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.02 cfs @ 0.85 fps)

Summary for Pond 10P: Dry Well 3

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.13 cfs @ 11.95 hrs, Volume= 0.008 af, Atten= 18%, Lag= 0.8 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.008 af
Primary = 0.08 cfs @ 11.95 hrs, Volume= 0.000 af
Routed to Pond 15P : Infiltration Trench 2

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.21' @ 11.94 hrs Surf.Area= 25 sf Storage= 76 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 76 cf

Plug-Flow detention time= 41.9 min calculated for 0.008 af (96% of inflow)
Center-of-Mass det. time= 17.8 min (751.1 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	5 cf	**6.0" Round Pipe Storage** L= 24.0' S= 0.0010 '/'
#4	67.44'	1 cf	**0.50'W x 0.50'L x 3.16'H Prismatoid**
		76 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.21' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.07 cfs @ 11.95 hrs HW=70.21' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.07 cfs @ 1.32 fps)

Summary for Pond 11P: Dry Well 4

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.26 cfs @ 11.95 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.9 min
Discarded = 0.05 cfs @ 11.94 hrs, Volume= 0.008 af
Primary = 0.21 cfs @ 11.95 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.31' @ 11.94 hrs Surf.Area= 25 sf Storage= 78 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 78 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 14.9 min (748.2 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	7 cf	**6.0" Round Pipe Storage** L= 35.0' S= 0.0010 '/'
#4	67.45'	1 cf	**0.50'W x 0.50'L x 3.15'H Prismatoid**
		78 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.05 cfs @ 11.94 hrs HW=70.31' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=0.18 cfs @ 11.95 hrs HW=70.30' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.18 cfs @ 1.81 fps)

Summary for Pond 12P: Dry Well 5

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.12 cfs @ 11.94 hrs, Volume= 0.008 af, Atten= 21%, Lag= 0.1 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.007 af
Primary = 0.09 cfs @ 11.94 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.22' @ 11.94 hrs Surf.Area= 25 sf Storage= 73 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 73 cf

Plug-Flow detention time= 36.5 min calculated for 0.008 af (97% of inflow)
Center-of-Mass det. time= 17.3 min (750.5 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	2 cf	**6.0" Round Pipe Storage** L= 10.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		73 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.22' (Free Discharge)
└**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.08 cfs @ 11.94 hrs HW=70.22' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.08 cfs @ 1.39 fps)

Summary for Pond 13P: Dry Well 6

Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth = 8.46" for RMAT 50-Year event
Inflow = 0.16 cfs @ 11.93 hrs, Volume= 0.008 af
Outflow = 0.08 cfs @ 11.94 hrs, Volume= 0.008 af, Atten= 47%, Lag= 0.3 min
Discarded = 0.04 cfs @ 11.94 hrs, Volume= 0.007 af
Primary = 0.04 cfs @ 11.94 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 2
Peak Elev= 70.17' @ 11.94 hrs Surf.Area= 25 sf Storage= 74 cf
Flood Elev= 70.00' Surf.Area= 25 sf Storage= 74 cf

Plug-Flow detention time= 56.3 min calculated for 0.008 af (94% of inflow)
Center-of-Mass det. time= 18.6 min (751.8 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	61.10'	70 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 175 cf Overall - 1 cf Embedded = 174 cf x 40.0% Voids
#2	67.41'	1 cf	**6.0" Round Pipe Storage** Inside #1 L= 5.0' S= 0.0010 '/' 1 cf Overall - 0.2" Wall Thickness = 1 cf
#3	67.42'	3 cf	**6.0" Round Pipe Storage** L= 14.0' S= 0.0010 '/'
#4	67.43'	1 cf	**0.50'W x 0.50'L x 3.17'H Prismatoid**
		74 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
61.10	25	0	0	25
68.10	25	175	175	149

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.10'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	70.10'	**6.0" W x 6.0" H Box Culvert** L= 1.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 70.10' / 69.60' S= 0.5000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.25 sf

Discarded OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.17' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.04 cfs @ 11.94 hrs HW=70.17' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.04 cfs @ 1.05 fps)

Summary for Pond 14P: Infiltration Trench 1

Inflow Area = 0.232 ac, 26.34% Impervious, Inflow Depth = 3.04" for RMAT 50-Year event
Inflow = 1.51 cfs @ 11.91 hrs, Volume= 0.059 af
Outflow = 1.60 cfs @ 11.93 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.8 min
Discarded = 0.13 cfs @ 11.92 hrs, Volume= 0.049 af
Primary = 1.47 cfs @ 11.93 hrs, Volume= 0.009 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 55.72' @ 11.92 hrs Surf.Area= 234 sf Storage= 536 cf

Plug-Flow detention time= 37.1 min calculated for 0.058 af (99% of inflow)
Center-of-Mass det. time= 33.1 min (882.5 - 849.4)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	562 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 1,404 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	234	0	0	234
56.00	234	1,404	1,404	559

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	55.50'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.13 cfs @ 11.92 hrs HW=55.72' (Free Discharge)
1=Exfiltration (Controls 0.13 cfs)

Primary OutFlow Max=1.29 cfs @ 11.93 hrs HW=55.71' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Weir Controls 1.29 cfs @ 1.51 fps)

Summary for Pond 15P: Infiltration Trench 2

Inflow Area = 0.175 ac, 19.84% Impervious, Inflow Depth = 1.21" for RMAT 50-Year event
Inflow = 0.16 cfs @ 12.20 hrs, Volume= 0.018 af
Outflow = 0.05 cfs @ 12.66 hrs, Volume= 0.018 af, Atten= 66%, Lag= 27.9 min
Discarded = 0.05 cfs @ 12.66 hrs, Volume= 0.018 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.02 hrs / 3
Peak Elev= 66.00' @ 12.66 hrs Surf.Area= 135 sf Storage= 162 cf

Plug-Flow detention time= 23.1 min calculated for 0.018 af (100% of inflow)
Center-of-Mass det. time= 23.0 min (932.7 - 909.7)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	216 cf	**Custom Stage Data (Conic)**Listed below (Recalc) 540 cf Overall x 40.0% Voids

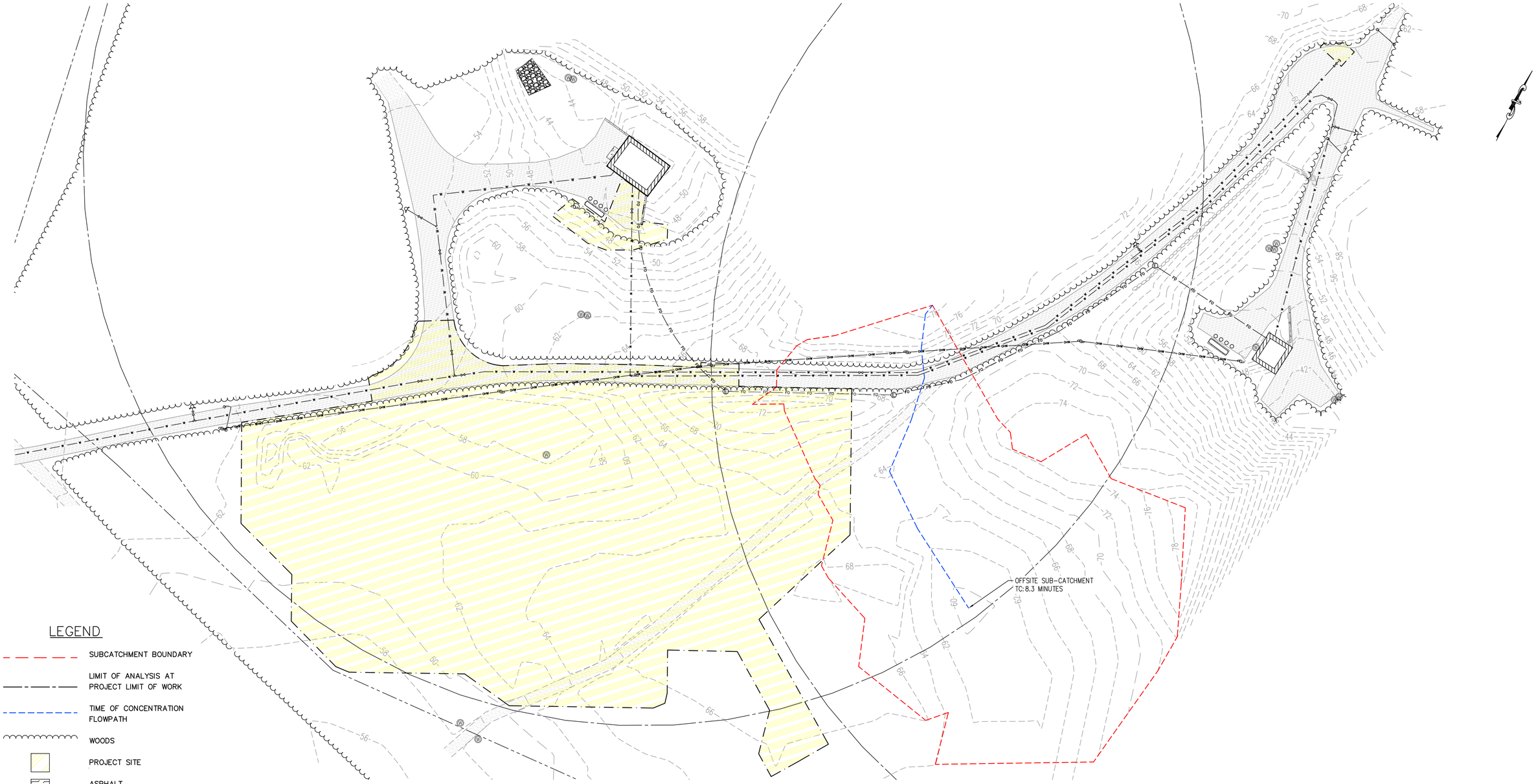
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
63.00	135	0	0	135
67.00	135	540	540	300

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'
#2	Primary	66.50'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.05 cfs @ 12.66 hrs HW=66.00' (Free Discharge)
1=Exfiltration (Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Appendix I – 100-Year 24-Hour Storm Offsite Analysis



LEGEND

- SUBCATCHMENT BOUNDARY
- LIMIT OF ANALYSIS AT PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT

PLAN VIEW

SCALE: 1" = 35'

FOR PERMITTING

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(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	MAY 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
EXISTING OFFSITE SUBCATCHMENT PLAN

DRAWING NO.:
AI-1

SHEET NO. 1 OF 3

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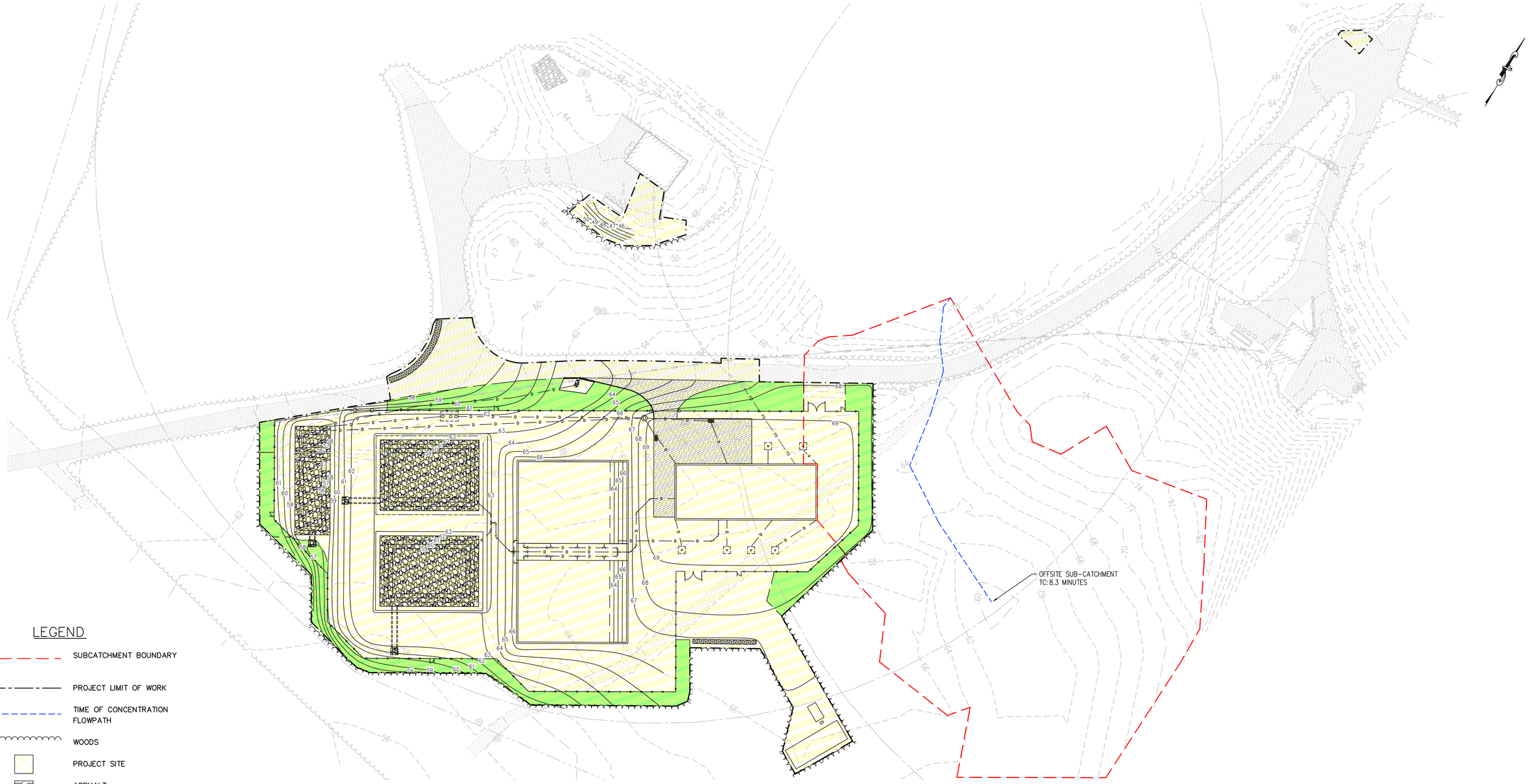

LEGEND

- SUBCATCHMENT BOUNDARY
- PROJECT LIMIT OF WORK
- TIME OF CONCENTRATION FLOWPATH
- WOODS
- PROJECT SITE
- ASPHALT
- BRUSH

PLAN VIEW

SCALE: 1" = 35'

FOR PERMITTING

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SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JUNE 2026
SCALE:	1" = 35'
DESIGNED BY:	GAC
CHECKED BY:	SCO
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT

WELLS 3 & 4 WTP

BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
PROPOSED OFFFSITE SUBCATCHMENT PLAN

DRAWING NO.:
AI-2

SHEET NO. 2 OF 2

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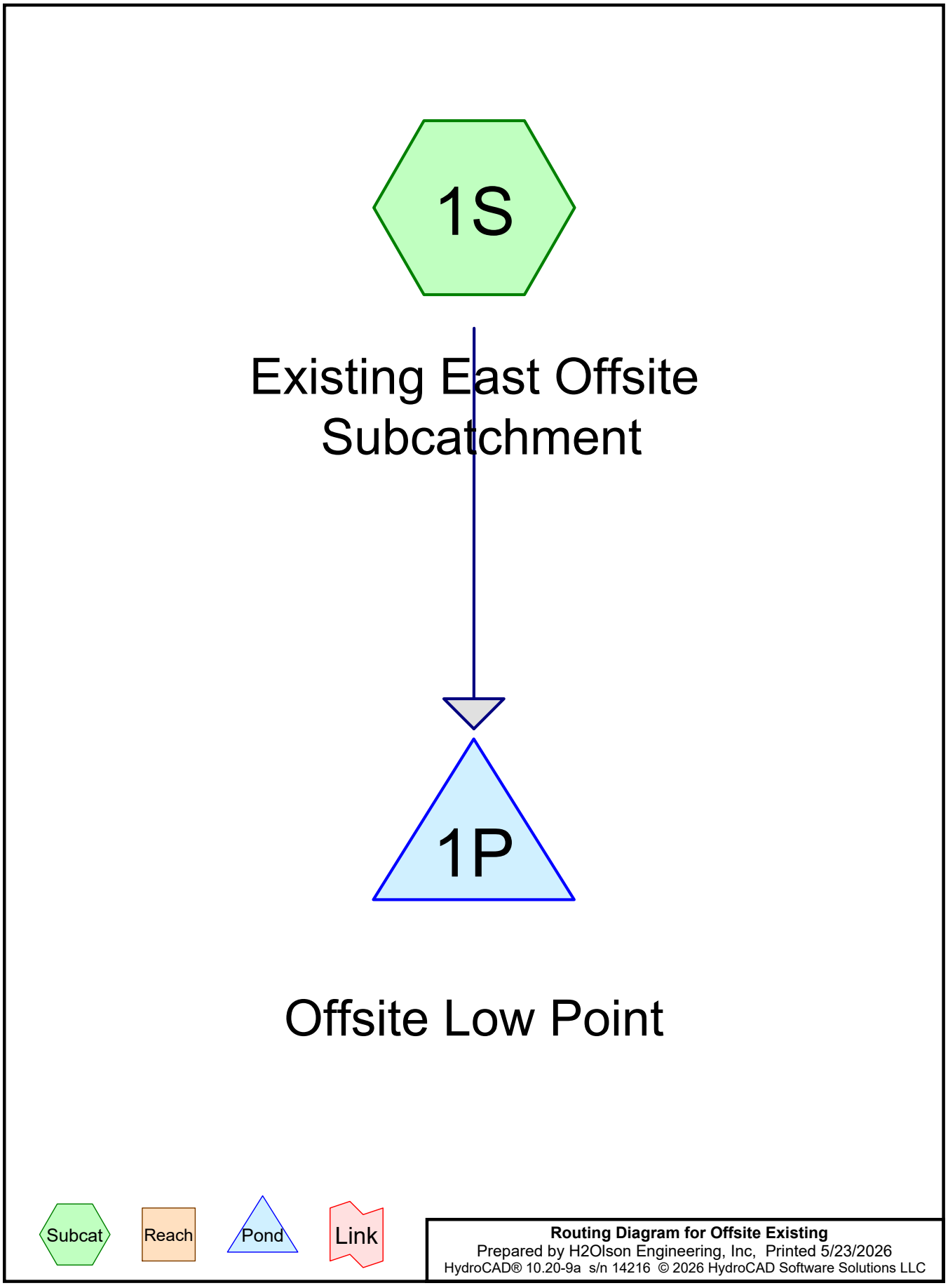

Routing Diagram for Offsite Existing
Prepared by H2Olson Engineering, Inc, Printed 5/23/2026
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Project Notes

Rainfall events imported from "BFD_Proposed (2).hcp"

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.016	49	50-75% Grass cover, Fair, HSG A (1S)
0.043	98	Paved parking, HSG A (1S)
1.357	30	Woods, Good, HSG A (1S)
1.416	**32**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.416	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.416		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.016	0.000	0.000	0.000	0.000	0.016	50-75% Grass cover, Fair	1S
0.043	0.000	0.000	0.000	0.000	0.043	Paved parking	1S
1.357	0.000	0.000	0.000	0.000	1.357	Woods, Good	1S
1.416	**0.000**	**0.000**	**0.000**	**0.000**	**1.416**	**TOTAL AREA**	

Time span=0.00-38.00 hrs, dt=0.05 hrs, 761 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing East Offsite Runoff Area=61,662 sf 3.02% Impervious Runoff Depth=0.41"
Flow Length=60' Tc=3.9 min CN=32 Runoff=0.30 cfs 0.048 af

Pond 1P: Offsite Low Point Peak Elev=60.10' Storage=63 cf Inflow=0.30 cfs 0.048 af
Outflow=0.13 cfs 0.048 af

Total Runoff Area = 1.416 ac Runoff Volume = 0.048 af Average Runoff Depth = 0.41"
96.98% Pervious = 1.373 ac 3.02% Impervious = 0.043 ac

Summary for Subcatchment 1S: Existing East Offsite Subcatchment

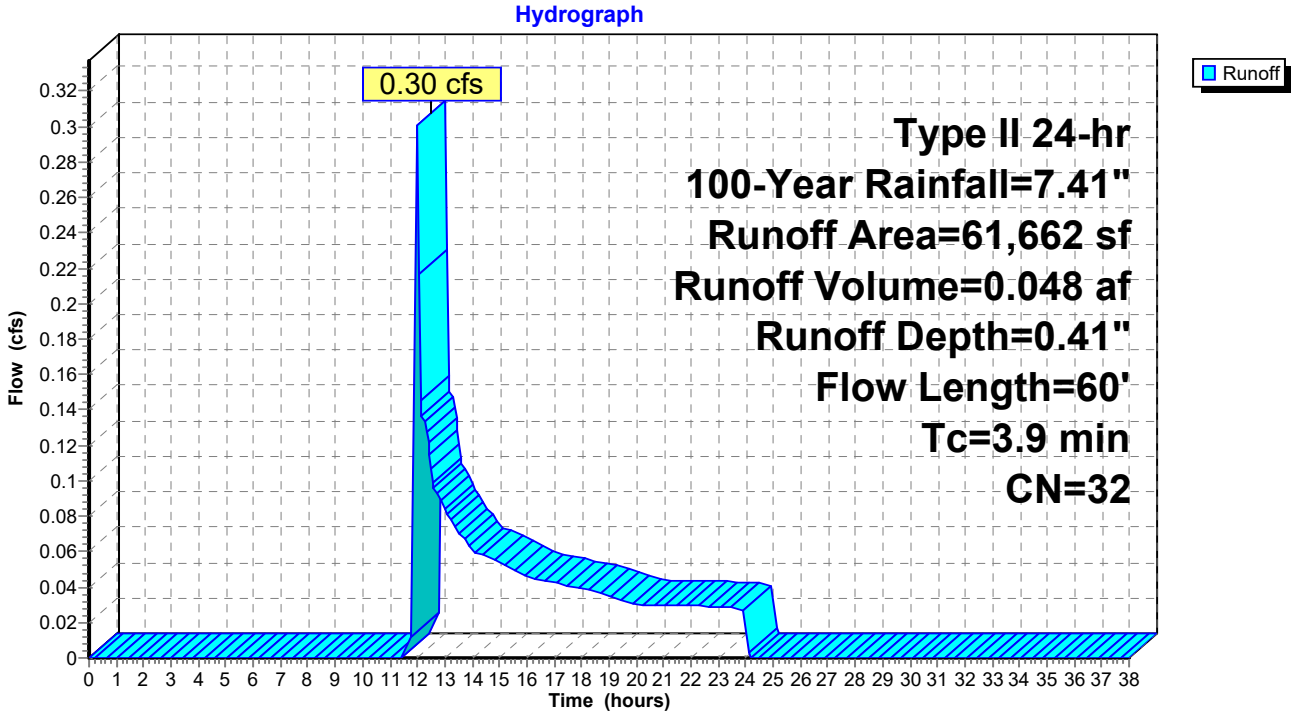
Runoff = 0.30 cfs @ 12.01 hrs, Volume= 0.048 af, Depth= 0.41"
Routed to Pond 1P : Offsite Low Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
59,124	30	Woods, Good, HSG A
678	49	50-75% Grass cover, Fair, HSG A
1,860	98	Paved parking, HSG A
61,662	32	Weighted Average
59,802		96.98% Pervious Area
1,860		3.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	30	0.1429	0.14		**Sheet Flow, Forest** Woods: Light underbrush n= 0.400 P2= 3.39"
0.3	30	0.1250	1.77		**Shallow Concentrated Flow, Forest/Access Road** Woodland Kv= 5.0 fps
3.9	60	Total			

Subcatchment 1S: Existing East Offsite Subcatchment



Summary for Pond 1P: Offsite Low Point

Inflow Area = 1.416 ac, 3.02% Impervious, Inflow Depth = 0.41" for 100-Year event
Inflow = 0.30 cfs @ 12.01 hrs, Volume= 0.048 af
Outflow = 0.13 cfs @ 12.31 hrs, Volume= 0.048 af, Atten= 56%, Lag= 17.8 min
Discarded = 0.13 cfs @ 12.31 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs
Peak Elev= 60.10' @ 12.31 hrs Surf.Area= 682 sf Storage= 63 cf

Plug-Flow detention time= 2.6 min calculated for 0.048 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (987.1 - 984.4)

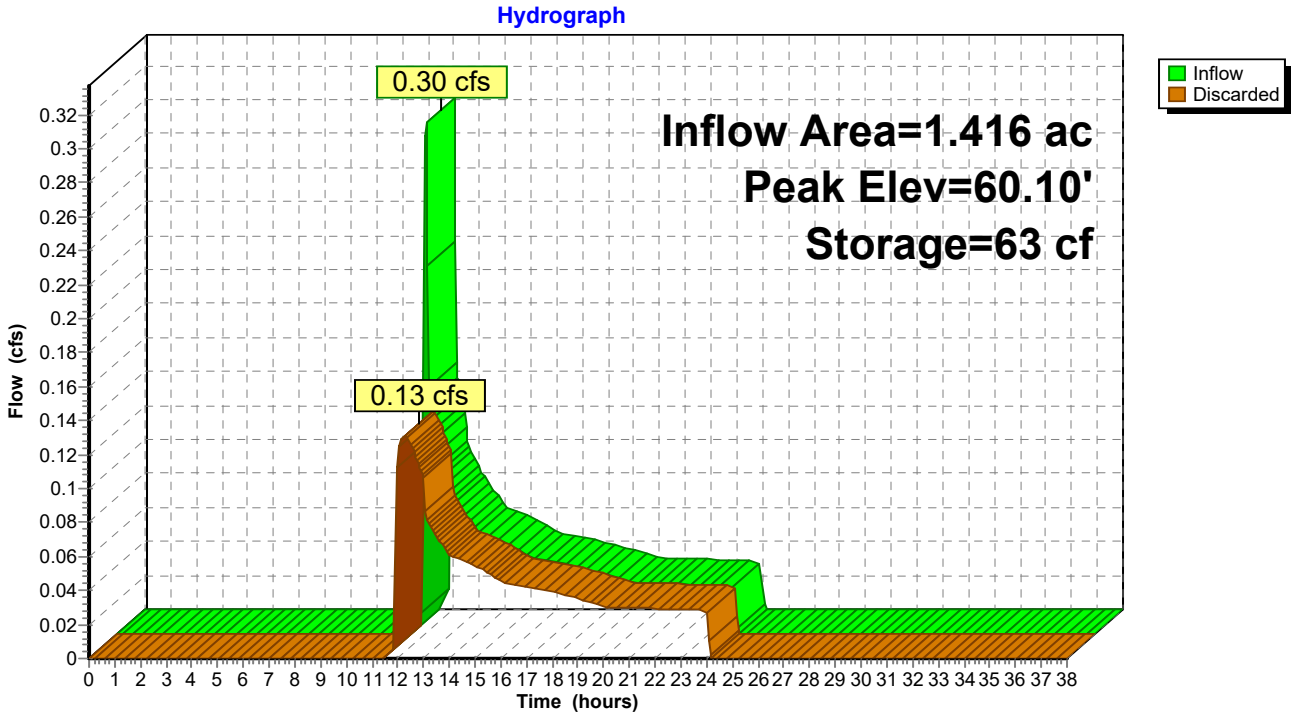
Volume	Invert	Avail.Storage	Storage Description
#1	60.00'	6,363 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

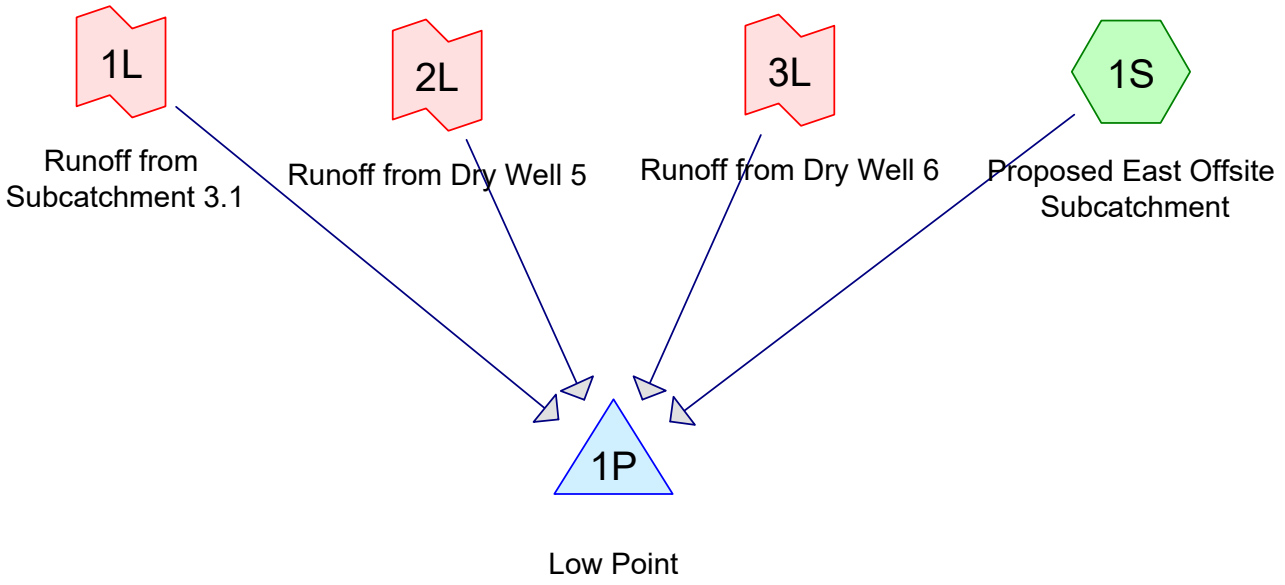
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
60.00	526	0	0	526
62.00	7,088	6,363	6,363	7,099

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'

Discarded OutFlow Max=0.13 cfs @ 12.31 hrs HW=60.10' (Free Discharge)
↑**1=Exfiltration** (Controls 0.13 cfs)

Pond 1P: Offsite Low Point





Subcat Reach Pond Link

Routing Diagram for Offsite
Prepared by H2Olson Engineering, Inc, Printed 5/27/2026
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.080	39	>75% Grass cover, Good, HSG A (1S)
0.033	30	Brush, Good, HSG A (1S)
0.043	98	Paved parking, HSG A (1S)
1.260	30	Woods, Good, HSG A (1S)
1.416	**33**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.416	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.416		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.080	0.000	0.000	0.000	0.000	0.080	>75% Grass cover, Good	1S
0.033	0.000	0.000	0.000	0.000	0.033	Brush, Good	1S
0.043	0.000	0.000	0.000	0.000	0.043	Paved parking	1S
1.260	0.000	0.000	0.000	0.000	1.260	Woods, Good	1S
1.416	**0.000**	**0.000**	**0.000**	**0.000**	**1.416**	**TOTAL AREA**	

Time span=0.00-38.00 hrs, dt=0.05 hrs, 761 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Proposed East Offsite Runoff Area=61,662 sf 3.02% Impervious Runoff Depth=0.47"
Flow Length=252' Tc=8.3 min CN=33 Runoff=0.35 cfs 0.056 af

Pond 1P: Low Point Peak Elev=60.36' Storage=295 cf Inflow=0.50 cfs 0.072 af
Outflow=0.22 cfs 0.072 af

Link 1L: Runoff Imported from BFD_Proposed Subcat 3.1 Hydrograph Table 5.23.csv Inflow=0.02 cfs 0.005 af
Primary=0.02 cfs 0.005 af

Link 2L: Primary Imported from BFD_Proposed Pond 12P Hydrograph Table5.27.csv Inflow=0.08 cfs 0.007 af
Primary=0.08 cfs 0.007 af

Link 3L: Primary Imported from BFD_Proposed Pond 13P Hydrograph Table5.27.csv Inflow=0.06 cfs 0.005 af
Primary=0.06 cfs 0.005 af

Total Runoff Area = 1.416 ac Runoff Volume = 0.056 af Average Runoff Depth = 0.47"
96.98% Pervious = 1.373 ac 3.02% Impervious = 0.043 ac

Summary for Subcatchment 1S: Proposed East Offsite Subcatchment

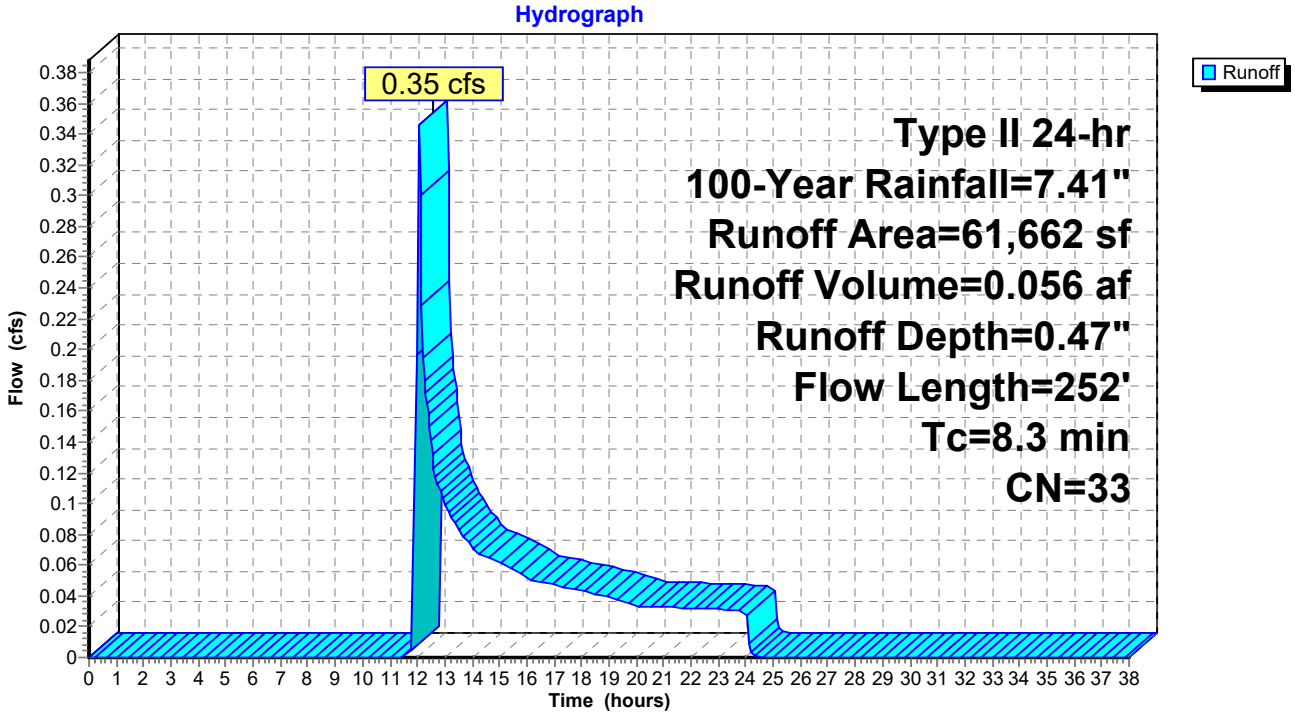
Runoff = 0.35 cfs @ 12.06 hrs, Volume= 0.056 af, Depth= 0.47"
Routed to Pond 1P : Low Point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.41"

Area (sf)	CN	Description
1,860	98	Paved parking, HSG A
54,868	30	Woods, Good, HSG A
3,502	39	>75% Grass cover, Good, HSG A
1,432	30	Brush, Good, HSG A
61,662	33	Weighted Average
59,802		96.98% Pervious Area
1,860		3.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.3265	0.21		**Sheet Flow, Woods** Woods: Light underbrush n= 0.400 P2= 3.39"
0.1	12	0.0080	1.82		**Shallow Concentrated Flow, Road** Paved Kv= 20.3 fps
4.3	190	0.0220	0.74		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
8.3	252	Total			

Subcatchment 1S: Proposed East Offsite Subcatchment



Summary for Pond 1P: Low Point

Inflow Area = 1.416 ac, 3.02% Impervious, Inflow Depth = 0.61" for 100-Year event
Inflow = 0.50 cfs @ 12.06 hrs, Volume= 0.072 af
Outflow = 0.22 cfs @ 12.51 hrs, Volume= 0.072 af, Atten= 55%, Lag= 26.8 min
Discarded = 0.22 cfs @ 12.51 hrs, Volume= 0.072 af

Routing by Stor-Ind method, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs
Peak Elev= 60.36' @ 12.51 hrs Surf.Area= 1,154 sf Storage= 295 cf

Plug-Flow detention time= 7.6 min calculated for 0.072 af (100% of inflow)
Center-of-Mass det. time= 7.6 min (931.8 - 924.2)

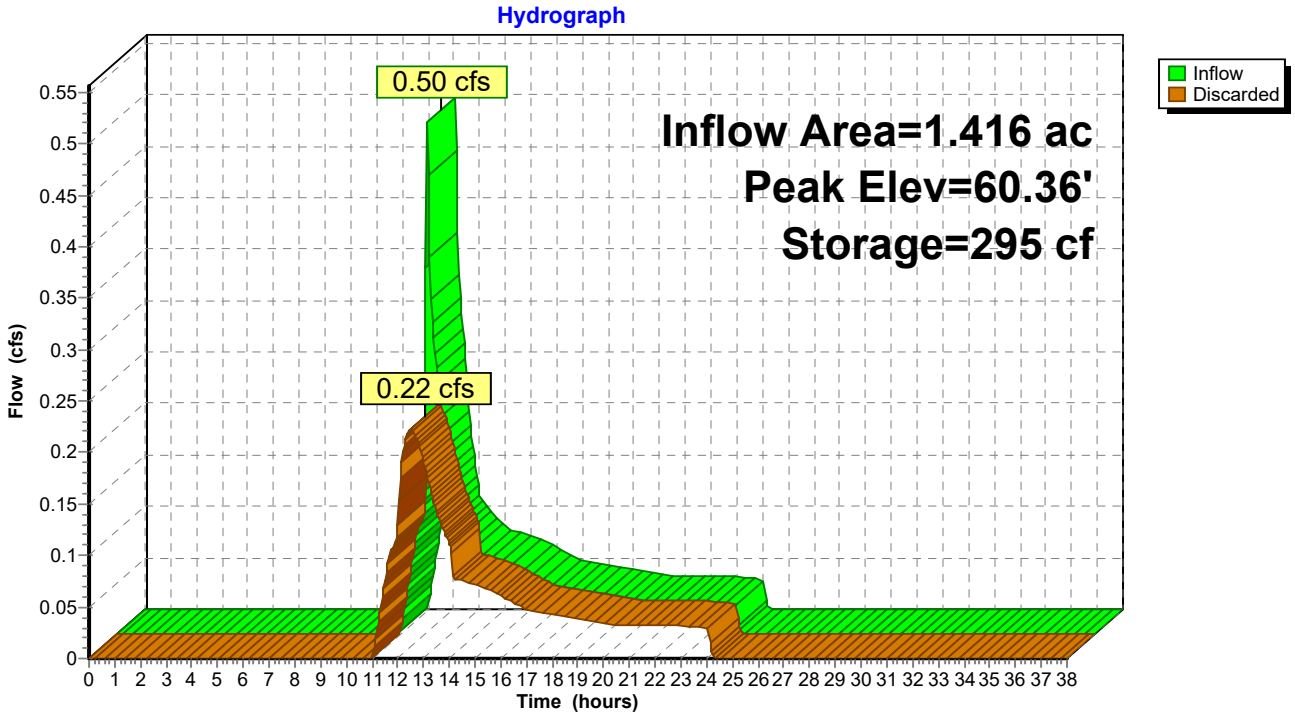
Volume	Invert	Avail.Storage	Storage Description
#1	60.00'	6,363 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
60.00	526	0	0	526
62.00	7,088	6,363	6,363	7,099

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**8.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 34.00'

Discarded OutFlow Max=0.22 cfs @ 12.51 hrs HW=60.36' (Free Discharge)
↑**1=Exfiltration** (Controls 0.22 cfs)

Pond 1P: Low Point



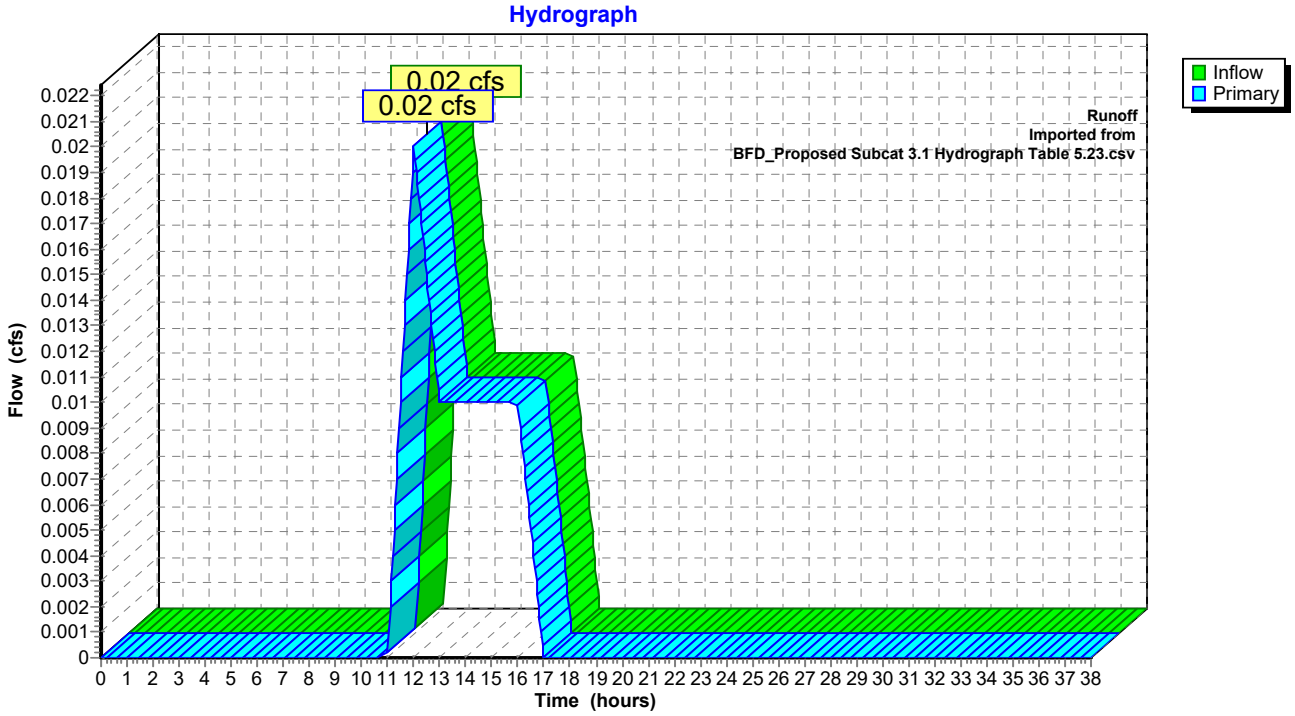
Summary for Link 1L: Runoff from Subcatchment 3.1

Inflow = 0.02 cfs @ 12.01 hrs, Volume= 0.005 af
Primary = 0.02 cfs @ 12.01 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 1P : Low Point

Primary outflow = Inflow, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs

Runoff Imported from BFD_Proposed Subcat 3.1 Hydrograph Table 5.23.csv

Link 1L: Runoff from Subcatchment 3.1



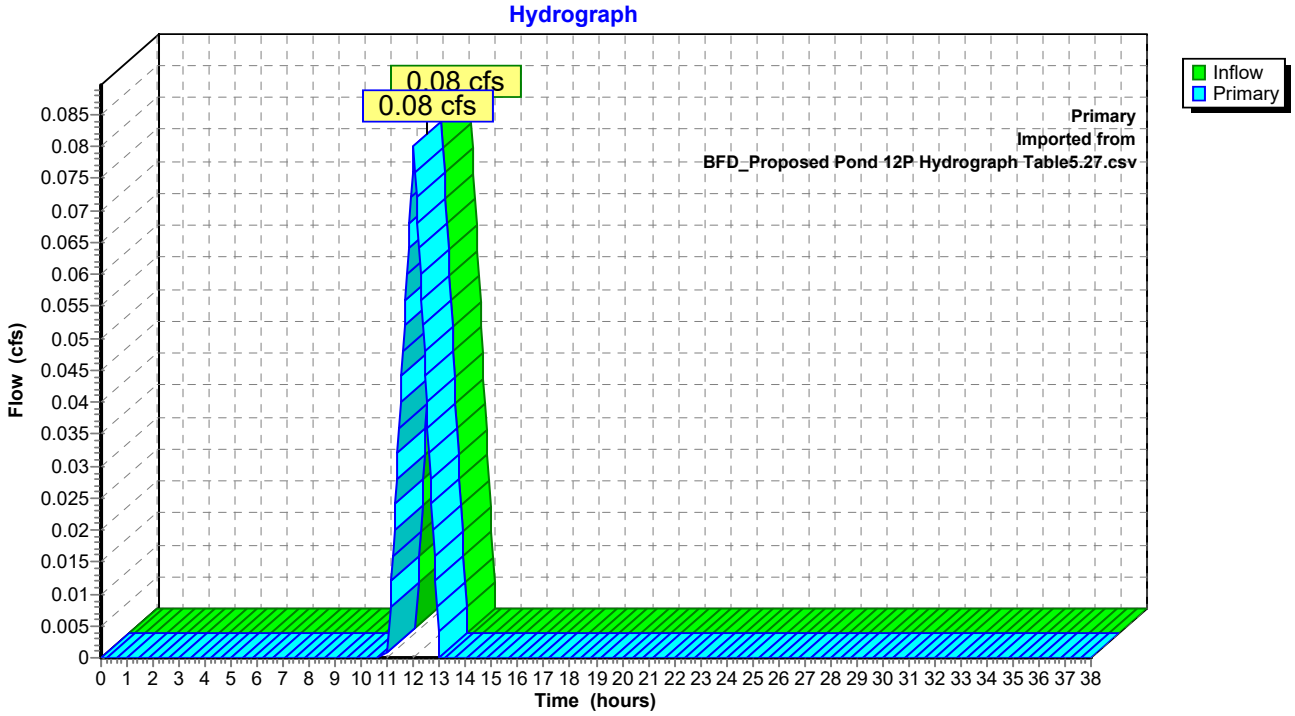
Summary for Link 2L: Runoff from Dry Well 5

Inflow = 0.08 cfs @ 12.00 hrs, Volume= 0.007 af
Primary = 0.08 cfs @ 12.00 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 1P : Low Point

Primary outflow = Inflow, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs

Primary Imported from BFD_Proposed Pond 12P Hydrograph Table5.27.csv

Link 2L: Runoff from Dry Well 5



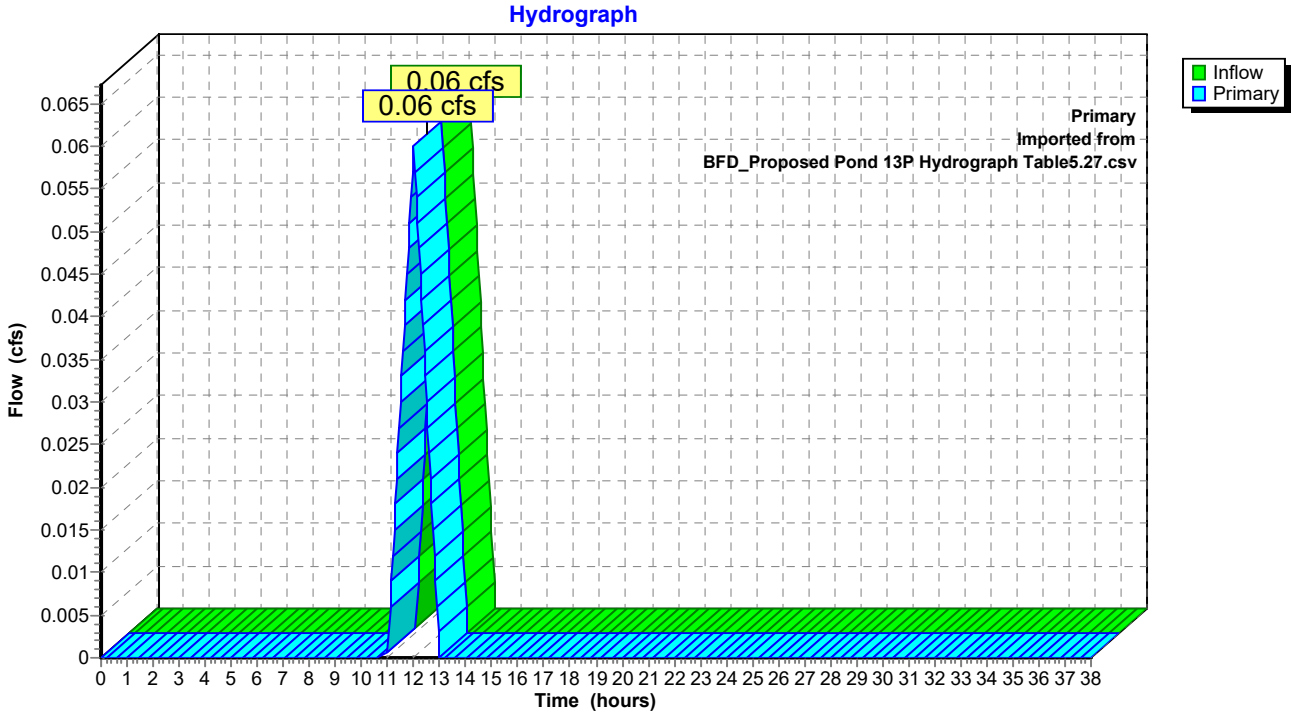
Summary for Link 3L: Runoff from Dry Well 6

Inflow = 0.06 cfs @ 12.00 hrs, Volume= 0.005 af
Primary = 0.06 cfs @ 12.00 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 1P : Low Point

Primary outflow = Inflow, Time Span= 0.00-38.00 hrs, dt= 0.05 hrs

Primary Imported from BFD_Proposed Pond 13P Hydrograph Table5.27.csv

Link 3L: Runoff from Dry Well 6



Appendix J – Supplemental Calculations

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Standards 3 and 4 Calculations	SHEET:	1
CALCULATED BY:	GAC		

Required Recharge Volume (Rv) and Water Quality Volume (VWQ)

Rv = Impervious Area x Runoff Depth***
*VWQ = Impervious Area x Runoff Depth****

**Volume calculated using the static method as per the Stormwater Management Standards.*
***A Runoff Depth of 0.6 inches is used as per the Stormwater Management Standards.*
****A Runoff Depth of 1.0 inches is used as per the Stormwater Management Standards.*

Total Recharge and Water Quality Volumes

Area on Site	Soil Group	Impervious Area (sf)
Pre-Development		
Existing Pavement	HSG A	5,628
Post-Development		
Existing Pavement	HSG A	5,628
New Pavement	HSG A	3,962
Water Treatment Building	HSG A	4,040
Total Impervious Area	HSG A	13,630
Net Change		+7,167

Impervious Area Draining to Proposed Infiltration BMPs

Infiltration BMP	Impervious Area (sf)
Infiltration Basin	6,621
Dry Wells Combined	3,030
Total	9,651

Adjusted Minimum Total Recharge Volume

Total Recharge Volume (cf)	681
Total Impervious Area / Impervious Area Draining to Infiltration BMPs	1.41
Adjusted Total Recharge Volume (cf)	962
Percentage of Site's Impervious Area Directed to Infiltration BMPs	71%

Total Recharge Volume Required:	962 cf
Total Recharge Volume Provided:	1,214 cf

Total Water Quality Volume Required:	1,136 cf
Total Water Quality Volume Provided:	2,282 cf

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Standards 3 and 4 Calculations	SHEET:	2
CALCULATED BY:	GAC		

Deep Sump Catch Basins - 1P and 2P

Water Quality Volume Required = Impervious Area x 1 in x (1 ft/12 in)

Required Water Quality Volume

Catch Basin	Sub-Catchment Draining to BMP	Impervious Area Within Sub-Catchment (sf)	Total Impervious Area Draining to BMP (sf)	Required Volume (cf)
1P	1.7	1,878	1,878	157
2P	1.8	1,927	1,927	161

Provided Water Quality Storage

Catch Basin	Bottom Area (sf)	Sump Depth (ft)	Provided Volume (cf)
1P	41	4.5	180
2P	41	4.5	180

Filtering Rain Garden - 3P

Water Quality Volume Required = Impervious Area x 1 in x (1 ft/12 in)
Water Quality Volume provided includes storage from both the ponding area and the pore space from the soil media.

Required Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Volume (cf)
1.9	2,816	235

Provided Water Quality Storage

Bottom Area (sf)	Ponding Depth (ft)	Soil Depth (ft)	Soil Voids	Provided Volume (cf)
200	0.5	2	40%	260

Drawdown

Drawdown Time = Rv /(K x 1ft/12in x Area)

Rv (cf)	260
K (in/hr)	8.27
Area (sf)	200
Drawdown (hr)	1.89

Oil/Grit Separator - 5P

Water Quality Volume Required = Impervious Area x (400 cf/1acre) x (1acre/43,560 sf)

Required Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Volume (cf)
1.7, 1.8, 1.9	3,805	125

Provided Water Quality Storage

Water Depth (ft)	Bottom Area (sf)	Provided Volume (cf)
5	71	294

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Standards 3 and 4 Calculations	SHEET:	3
CALCULATED BY:	GAC		

Sediment Forebay - 6P

Water Quality Volume Required = Impervious Area x 0.1 in x 0.083 ft/in

Required Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Volume (cf)
1.2, 1.7, 1.8, 1.9	6,621	114

Provided Water Quality Storage

Water Depth (ft)	Bottom Area (sf)	Provided Volume (cf)
2	78	154

Drawdown

Drawdown Time = Rv /(K x 1ft/12in x Area)

Rv (cf)	154
K (in/hr)	8.27
Area (sf)	78
Drawdown (hr)	2.86

Infiltration Basin - 7P

Water Quality Volume Required = Impervious Area x 1 in x (1 ft/12 in)
Recharge Volume Required = Impervious Area x 0.6 in x (1 ft/12 in)

Required Recharge and Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Recharge Volume (cf)	Required Water Quality Volume (cf)
1.1, 1.2, 1.7, 1.8, 1.9	0	530	552

Provided Water Quality and Water Recharge Storage

Water Depth (ft)	Bottom Area (sf)	Provided Volume (cf)
2	598	794

Drawdown

Drawdown Time = Rv /(K x 1ft/12in x Area)

Rv (cf)	794
K (in/hr)	8.27
Area (sf)	598
Drawdown (hr)	1.93

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Standards 3 and 4 Calculations	SHEET:	4
CALCULATED BY:	GAC		

Dry Wells - 8P, 9P, 10P, 11P, 12P, 13P

Water Quality Volume Required = Impervious Area x 1 in x (1 ft/12 in)
Recharge Volume Required = Impervious Area x 0.6 in x (1 ft/12 in)

Required Recharge and Water Quality Volume

Sub-Catchments Draining to BMP	Impervious Area Within Sub-Catchments (sf)	Required Recharge Volume (cf)	Required Water Quality Volume (cf)
1.10	505	25	42
1.11	505	25	42
1.12	505	25	42
1.13	505	25	42
1.14	505	25	42
1.15	505	25	42

Provided Water Quality and Water Recharge Storage

Dry Well	Water Depth (ft)	Bottom Area (sf)	Voids	Provided Volume (cf)
8P	7	25	40%	70
9P	7	25	40%	70
10P	7	25	40%	70
11P	7	25	40%	70
12P	7	25	40%	70
13P	7	25	40%	70
			Total	420

Drawdown

Drawdown Time = Rv /(K x 1ft/12in x Area)

Rv (cf)	70
K (in/hr)	8.27
Area (sf)	25
Drawdown (hr)	4.06

PROJECT NAME:	Barnstable Fire District Wells 3&4 WTP	DATE:	6/1/2026
DESCRIPTION:	Closed Drainage System Calculations	SHEET:	1
CALCULATED BY:	GAC		

Closed Drainage System Capacity

Start Node	Stop Node	Length (ft)	Slope	n	Pipe (in)	Capacity* (cfs)	Velocity* (fps)
Catch Basin 1	Flow Splitter	12	0.387	0.013	12	0.40	2.25
Catch Basin 2	Flow Splitter	43	0.108	0.013	12	0.41	2.26
Rain Garden	Sediment Forebay	184	0.008	0.013	8	0.42	2.81
Flow Splitter	Oil/Grit	130	0.002	0.013	12	0.75	2.07
Flow Splitter	Sediment Forebay	221	0.012	0.013	6	0.07	2.06
Oil/Grit	Sediment Forebay	78	0.017	0.013	12	0.75	2.65

**Calculations perfomed for the 24-hour 25-year storm.*

PROJECT NAME: Barnstable Fire District Wells 3&4 WTP
DESCRIPTION: Estimated High Groundwater Calculations
CALCULATED BY: GAC

DATE: 6/1/2026
SHEET: 1

Estimated High Groundwater

Test Location	Grade (ft)	Depth to Groundwater (ft)	Groundwater Elevation (ft)
Boring B-1	64	-	-
Boring B-2	62	30	32
Boring B-3	60	-	-
Boring B-4	63	-	-
Boring B-5	60	26	34
Test Pit Resid-1	61	-	-
Test Pit Resid-2	61	-	-
Test Pit SW-1	62	-	-

Index Observation Well	Groundwater Adjustment (ft)	Depth to Estimated High Groundwater (ft)	Estimated High Groundwater Elevation (ft)
A1W-247R	5.30	21	39

Depth to Esitmated High Groundwater = Site Depth to Groudwater - Groundwater Adjustment*
**26 feet was used as the Site Depth to Groundwater*

Calculations perfomed as per Cape Cod Comission's Technical Bulletin 92-001, "Estimation of High Groundwater Levels for Construction and Land Use Planning" (revised in 2006)

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Train 1: WTP Roof and New Pavement

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Oil Grit Separator	0.25	0.75	0.19	0.56
Sediment Forebay	0.00	0.56	0.00	0.56
Infiltration Basin	0.80	0.56	0.45	0.11
	0.00	0.11	0.00	0.11

Total TSS Removal = 89%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BFD Wells 3&4 WTP
Prepared By: GAC
Date: 6/1/2026

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Train 2: New and Existing Pavement

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Filtering Rain Garden	**0.00**	**1.00**	**0.00**	**1.00**
Sediment Forebay	**0.00**	**1.00**	**0.00**	**1.00**
Infiltration Basin	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BFD Wells 3&4 WTP
Prepared By: GAC
Date: 6/1/2026

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Train 3: WTP Roof

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Dry Well	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

Total TSS Removal = 80%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: BFD Wells 3&4 WTP
Prepared By: GAC
Date: 6/1/2026

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

NOAA Atlas 14, Volume 10, Version 3
Location name: Hyannis, Massachusetts, USA*
Latitude: 41.6831°, Longitude: -70.3204°
Elevation: 57 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.267 (0.219-0.323)	0.337 (0.276-0.409)	0.452 (0.369-0.551)	0.548 (0.444-0.672)	0.679 (0.529-0.874)	0.776 (0.592-1.02)	0.881 (0.649-1.21)	1.01 (0.687-1.40)	1.20 (0.781-1.72)	1.36 (0.861-1.99)
10-min	0.378 (0.310-0.458)	0.477 (0.391-0.580)	0.640 (0.523-0.780)	0.775 (0.629-0.950)	0.961 (0.750-1.24)	1.10 (0.837-1.45)	1.25 (0.919-1.72)	1.43 (0.975-1.98)	1.70 (1.10-2.44)	1.92 (1.22-2.82)
15-min	0.445 (0.365-0.539)	0.562 (0.461-0.682)	0.753 (0.615-0.918)	0.912 (0.740-1.12)	1.13 (0.882-1.46)	1.29 (0.985-1.71)	1.47 (1.08-2.02)	1.68 (1.15-2.34)	1.99 (1.30-2.87)	2.26 (1.44-3.32)
30-min	0.660 (0.542-0.801)	0.830 (0.681-1.01)	1.11 (0.904-1.35)	1.34 (1.08-1.64)	1.66 (1.29-2.14)	1.89 (1.44-2.50)	2.15 (1.58-2.95)	2.45 (1.68-3.41)	2.92 (1.90-4.20)	3.31 (2.10-4.86)
60-min	0.876 (0.719-1.06)	1.10 (0.901-1.33)	1.46 (1.20-1.78)	1.77 (1.43-2.16)	2.18 (1.70-2.81)	2.49 (1.90-3.29)	2.83 (2.08-3.89)	3.23 (2.21-4.49)	3.84 (2.50-5.53)	4.36 (2.77-6.40)
2-hr	1.23 (1.01-1.48)	1.53 (1.26-1.84)	2.02 (1.66-2.44)	2.42 (1.98-2.95)	2.98 (2.34-3.81)	3.40 (2.61-4.44)	3.84 (2.86-5.24)	4.39 (3.03-6.04)	5.22 (3.44-7.44)	5.94 (3.81-8.62)
3-hr	1.47 (1.22-1.76)	1.81 (1.50-2.18)	2.38 (1.96-2.86)	2.84 (2.33-3.45)	3.49 (2.76-4.44)	3.97 (3.06-5.16)	4.48 (3.35-6.07)	5.11 (3.55-6.98)	6.06 (4.02-8.57)	6.88 (4.45-9.91)
6-hr	1.92 (1.61-2.29)	2.34 (1.95-2.79)	3.02 (2.51-3.62)	3.59 (2.96-4.32)	4.37 (3.47-5.49)	4.94 (3.84-6.35)	5.56 (4.19-7.43)	6.30 (4.42-8.51)	7.41 (4.97-10.3)	8.34 (5.45-11.8)
12-hr	2.42 (2.03-2.86)	2.89 (2.43-3.42)	3.66 (3.06-4.36)	4.31 (3.58-5.15)	5.19 (4.16-6.46)	5.86 (4.58-7.42)	6.56 (4.95-8.60)	7.35 (5.22-9.81)	8.50 (5.77-11.7)	9.45 (6.24-13.2)
24-hr	2.87 (2.43-3.38)	3.39 (2.87-3.99)	4.24 (3.57-5.01)	4.95 (4.14-5.87)	5.92 (4.77-7.28)	6.65 (5.23-8.32)	7.41 (5.62-9.56)	8.24 (5.91-10.9)	9.40 (6.46-12.8)	10.3 (6.90-14.3)
2-day	3.27 (2.79-3.82)	3.82 (3.26-4.47)	4.73 (4.01-5.55)	5.48 (4.62-6.46)	6.52 (5.29-7.94)	7.31 (5.79-9.04)	8.12 (6.20-10.3)	8.98 (6.51-11.7)	10.2 (7.06-13.6)	11.1 (7.50-15.1)
3-day	3.54 (3.03-4.12)	4.11 (3.51-4.78)	5.03 (4.28-5.87)	5.80 (4.90-6.80)	6.85 (5.58-8.29)	7.66 (6.09-9.42)	8.48 (6.51-10.7)	9.35 (6.83-12.1)	10.6 (7.39-14.0)	11.5 (7.84-15.6)
4-day	3.78 (3.24-4.38)	4.35 (3.73-5.05)	5.28 (4.51-6.14)	6.05 (5.13-7.07)	7.11 (5.82-8.57)	7.91 (6.33-9.70)	8.74 (6.75-11.0)	9.64 (7.06-12.4)	10.9 (7.64-14.4)	11.9 (8.11-16.0)
7-day	4.42 (3.81-5.09)	4.99 (4.30-5.76)	5.94 (5.10-6.87)	6.72 (5.73-7.80)	7.79 (6.42-9.32)	8.61 (6.93-10.5)	9.45 (7.35-11.8)	10.3 (7.65-13.2)	11.6 (8.22-15.2)	12.6 (8.67-16.7)
10-day	5.02 (4.34-5.76)	5.61 (4.85-6.45)	6.58 (5.67-7.59)	7.39 (6.33-8.56)	8.51 (7.03-10.1)	9.36 (7.56-11.3)	10.2 (7.97-12.6)	11.1 (8.28-14.1)	12.4 (8.83-16.1)	13.3 (9.27-17.6)
20-day	6.83 (5.96-7.80)	7.53 (6.55-8.59)	8.66 (7.51-9.91)	9.60 (8.28-11.0)	10.9 (9.07-12.8)	11.9 (9.67-14.2)	12.9 (10.1-15.7)	13.9 (10.4-17.3)	15.1 (10.9-19.3)	16.0 (11.3-20.8)
30-day	8.41 (7.36-9.55)	9.19 (8.03-10.4)	10.5 (9.12-11.9)	11.5 (9.99-13.2)	13.0 (10.9-15.2)	14.1 (11.5-16.7)	15.2 (12.0-18.3)	16.3 (12.3-20.2)	17.5 (12.8-22.3)	18.4 (13.0-23.8)
45-day	10.4 (9.17-11.8)	11.3 (9.94-12.8)	12.8 (11.2-14.5)	14.0 (12.2-15.9)	15.7 (13.2-18.2)	17.0 (13.9-19.9)	18.2 (14.4-21.7)	19.3 (14.8-23.8)	20.7 (15.2-26.0)	21.5 (15.4-27.5)
60-day	12.2 (10.7-13.8)	13.2 (11.6-14.9)	14.8 (13.0-16.7)	16.1 (14.1-18.3)	17.9 (15.1-20.7)	19.4 (16.0-22.7)	20.8 (16.4-24.6)	21.9 (16.8-26.9)	23.3 (17.2-29.2)	24.2 (17.4-30.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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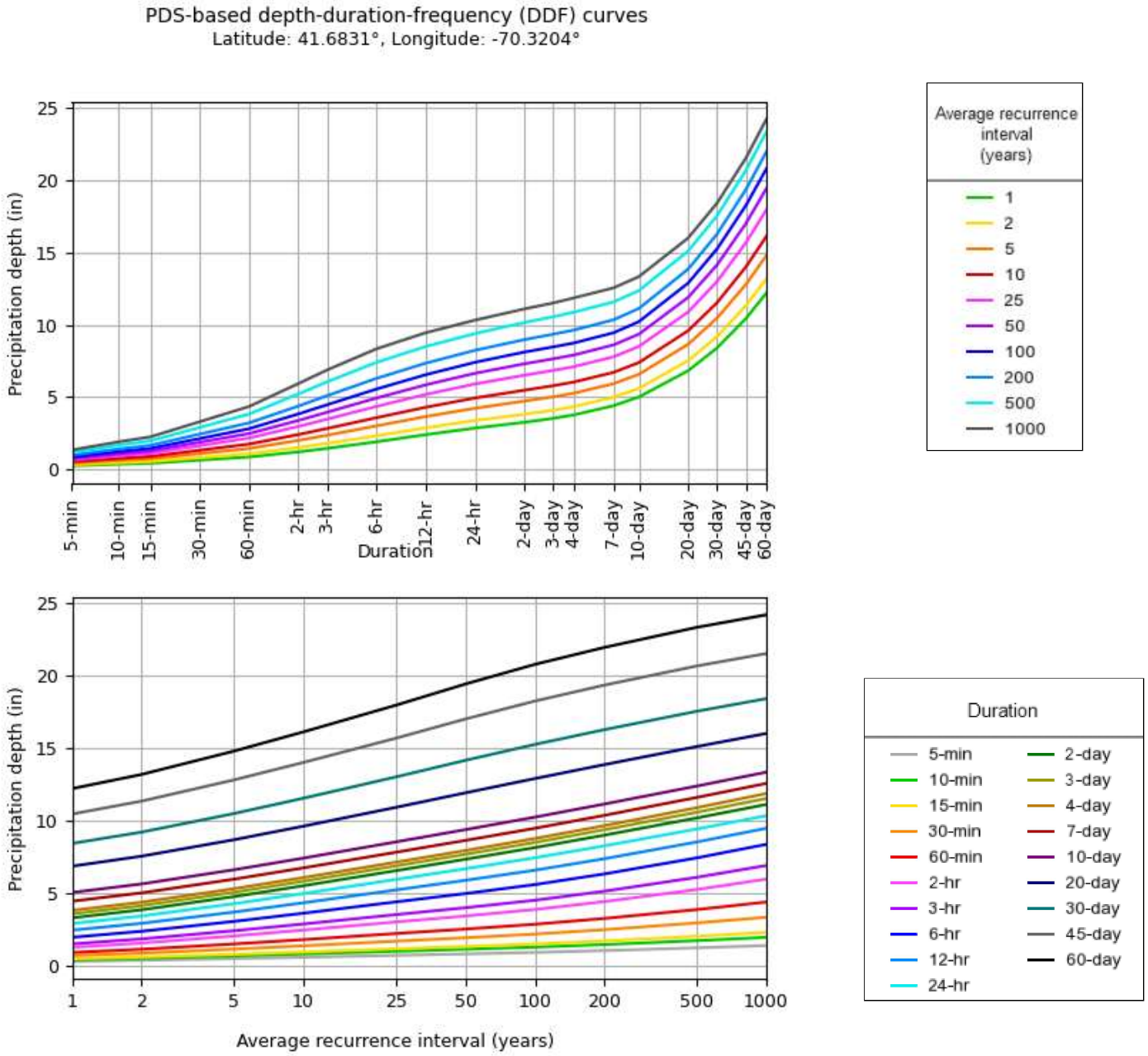
PF graphical



NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Mon Mar 23 12:34:40 2026

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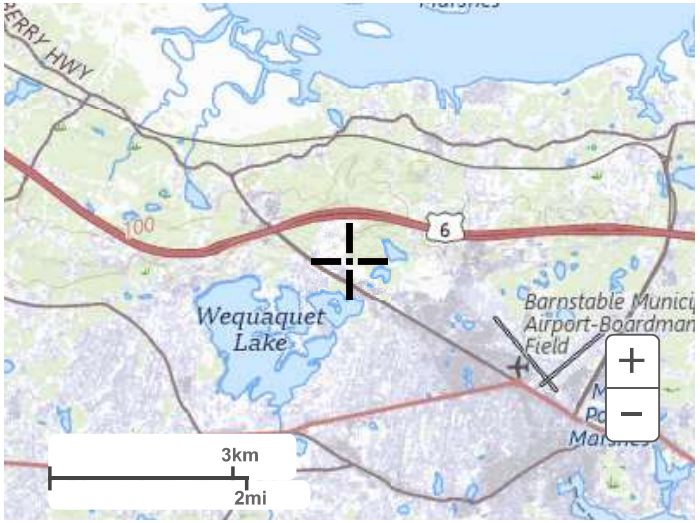
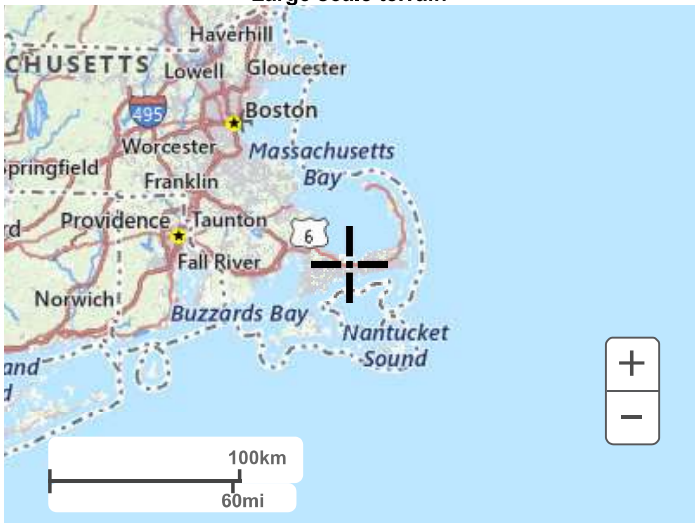
Maps & aerials

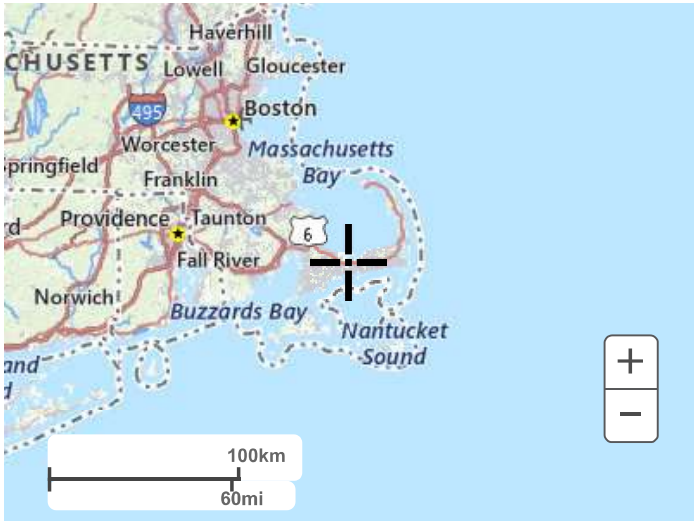
Small scale terrain



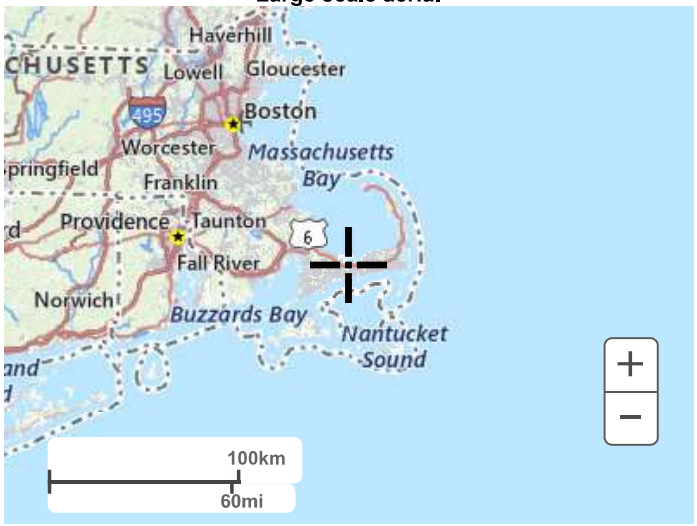
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Climate Resilience Design Standards Tool Project Report

Barnstable Fire District Wells 3&4 WTP
Date Created: 3/4/2026 3:17:12 PM
Created By: GCordeiro
Date Report Generated: 5/7/2026 7:02:11 PM
Tool Version: Version 1.4
Project Contact Information: Steve Olson (sco@h2olsonengineering.com)

Project Summary

Link to Project

Estimated Capital Cost: $17800000.00
End of Useful Life Year: 2060
Project within mapped Environmental Justice neighborhood: Yes

Ecosystem Service Benefits	Scores
Project Score	Moderate
Exposure	**Scores**
Sea Level Rise/Storm Surge	Not Exposed
Extreme Precipitation - Stormwater Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	Not Exposed
Extreme Heat	High Exposure



Asset Preliminary Climate Risk Rating Summary

Number of Assets: 1

Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Stormwater Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
Facility Building	Low Risk	High Risk	Low Risk	High Risk

Climate Resilience Design Standards Summary

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
Sea Level Rise/Storm Surge					
Facility Building					
Extreme Precipitation					
Facility Building	2070			50-yr (2%)	Tier 3
Extreme Heat					
Facility Building	2070		90th		Tier 3

Scoring Rationale - Project Exposure Score

The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. The rationale behind the exposure rating is provided below.

Sea Level Rise/Storm Surge

This project received a "Not Exposed" because of the following:

- Not located within the predicted mean high water shoreline by 2030
- No historic coastal flooding at project site
- Not located within the Massachusetts Coast Flood Risk Model (MC-FRM)

Extreme Precipitation - Stormwater Flooding

This project received a "High Exposure" because of the following:

- Increased impervious area
- Maximum annual daily rainfall exceeds 10 inches within the overall project's useful life
- No historic flooding at project site
- Existing impervious area of the project site is less than 10%

Extreme Precipitation - Riverine Flooding

This project received a "Not Exposed" because of the following:

- No historic riverine flooding at project site
- The project is not within a mapped FEMA floodplain [outside of the Massachusetts Coast Flood Risk Model (MC-FRM)]
- Project is more than 500ft from a waterbody
- Project is not likely susceptible to riverine erosion

Extreme Heat

This project received a "High Exposure" because of the following:

- Not located within 100 ft of existing water body
- Increased impervious area
- Existing trees are being removed as part of the proposed project
- Existing impervious area of the project site is less than 10%
- 10 to 30 day increase in days over 90 deg. F within project's useful life

Scoring Rationale - Asset Preliminary Climate Risk Rating

A Preliminary Climate Risk Rating is determined for each infrastructure and building asset by considering the overall project Exposure Score and responses to Step 4 questions provided by the user in the Tool. Natural Resource assets do not receive a risk rating. The following factors are what influenced the risk ratings for each asset.

Asset - Facility Building
Primary asset criticality factors influencing risk ratings for this asset:

- Asset must be operable at all times, even during natural hazard event
- Less than 10,000 people would be directly affected by the loss/inoperability of the asset
- The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
- Inoperability of the asset would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses
- Inoperability is likely to significantly impact other facilities, assets, or buildings and will likely affect their ability to operate
- Spills and/or releases of hazardous materials would be relatively easy to clean up

Project Climate Resilience Design Standards Output

Climate Resilience Design Standards and Guidance are recommended for each asset and climate parameter. The Design Standards for each climate parameter include the following: recommended planning horizon (target and/or intermediate), recommended return period (Sea Level Rise/Storm Surge and Precipitation) or percentile (Heat), and a list of applicable design criteria that are likely to be affected by climate change. Some design criteria have numerical values associated with the recommended return period and planning horizon, while others have tiered methodologies with step-by-step instructions on how to estimate design values given the other recommended design standards.

Asset: Facility Building — Building/Facility

Sea Level Rise/Storm Surge — Low Risk

Applicable Design Criteria

Projected Tidal Datums: NOT APPLICABLE

Projected Water Surface Elevation: NOT APPLICABLE

Projected Wave Action Water Elevation: NOT APPLICABLE

Projected Wave Heights: NOT APPLICABLE

Projected Duration of Flooding: NOT APPLICABLE

Projected Design Flood Velocity: NOT APPLICABLE

Projected Scour & Erosion: NOT APPLICABLE

Extreme Precipitation — High Risk

Target Planning Horizon: 2070
Return Period: 50-yr (2%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

The projected values, standards, and guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence.

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Facility Building	2070	50-Year (2%)	8.7	Downloadable Methodology PDF

Projected Riverine Peak Discharge & Peak Flood Elevation: NOT APPLICABLE

Extreme Heat — High Risk

Target Planning Horizon: 2070
Percentile: 90th Percentile

LIMITATIONS: The recommended standards are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Applicable Design Criteria

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Annual Average Temperature [°F]	Projected Summer Average Temperature [°F]	Projected Winter Average Temperature [°F]
Facility Building	2070	90th	60.65	78.47	42.71

LIMITATIONS: The recommended Standards for Projected Average Annual/Summer/Winter Temperature are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Growing Degree Days: NOT APPLICABLE

Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Days with Max Temp >95°F (days)	Projected Days with Max Temp >90°F (days)	Projected Days with Max Temp <32°F (days)
Facility Building	2070	90th	9	35	42

LIMITATIONS: The recommended Standards for ProjectedÂ Days per Year with Max Temp >95Â°F, >90Â°F, <32Â°F are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Number of Heat Waves Per Year (events)	Projected Average Heat Wave Duration (days)
Facility Building	2070	90th	0	4

LIMITATIONS: The recommended Standards for ProjectedÂ Number of Heat Waves Per Year and Average Heat Wave DurationÂ are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Percentile	Projected Cooling Degree Days (base = 65°) (degree days)	Projected Heating Degree Days (base = 65°) (degree days)
Facility Building	2070	90th	1749	3338

LIMITATIONS: The recommended Standards for ProjectedÂ Cooling Degree Days and Heating Degree DaysÂ are determined by the user-drawn polygon and relationships as defined in the supporting Section Documents. The guidance provided within this Tool may be used to inform plans and designs, but is not comprehensive and does not provide guarantees for resilience. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence. One avenue to seek more information would be to access the comprehensive temperature and precipitation projections including additional return periods, time horizons, and seasons at the Climate Projections Dashboard.

Projected Heat Index: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Project Inputs

Core Project Information

Name:	Barnstable Fire District Wells 3&4 WTP
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2060
Location of Project:	Barnstable
Estimated Capital Cost:	$17,800,000
Who is the Submitting Entity?	Private Other H2Olson Engineering Inc. Steve Olson (sco@h2olsonengineering.com)
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Permitting
Is climate resiliency a core objective of this project?	No
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	Yes
Brief Project Description:	The main goals of the project are to increase the drinking water capacity of the Barnstable Fire District and improve the water quality at Well 3 and Well 4. The project includes the construction of a new water treatment plant, a paved access driveway, two sand filters and two infiltration basins for the treatment of water treatment residuals, a septic system, stormwater best management practices (BMPs), new yard piping, new overhead electrical lines, new underground fiberoptic lines, two new generators, three new propane tanks, yard fencing, and three new water hydrants. The project will require Massachusetts Historical Commission Review (completed), MESA Project Review with NHESP (completed), a MEPA Secretary's Certificate, coverage under the NPDES Construction General Permit, MassDEP drinking water permit (WS 24), a Title 5 Permit, a local stormwater management permit, and a local building permit.

Project Ecosystem Service Benefits

Factors Influencing Output

- ✓ Project reduces storm damage
- ✓ Project protects public water supply
- ✓ Project recharges groundwater
- ✓ Project filters stormwater using green infrastructure
- ✓ Project improves water quality
- ✓ Project prevents pollution

Factors to Improve Output

- ✓ Incorporate nature-based solutions that may provide flood protection
- ✓ Incorporate strategies that reduce carbon emissions
- ✓ Incorporate nature-based solutions that sequester carbon carbon
- ✓ Increase biodiversity, protect critical habitat for species, manage invasive populations, and/or provide connectivity to other habitats
- ✓ Preserve, enhance, and/or restore coastal shellfish habitats
- ✓ Incorporate vegetation that provides pollinator habitat
- ✓ Identify opportunities to remediate existing sources of pollution
- ✓ Provide opportunities for passive and/or active recreation through open space
- ✓ Increase plants, trees, and/or other vegetation to provide oxygen production
- ✓ Mitigate atmospheric greenhouse gas concentrations and other toxic air pollutants through nature-based solutions
- ✓ Incorporate education and/or protect cultural resources as part of your project

Is the primary purpose of this project ecological restoration?

No

Project Benefits

Provides flood protection through nature-based solutions	No
Reduces storm damage	Yes
Recharges groundwater	Yes
Protects public water supply	Yes
Filters stormwater using green infrastructure	Yes
Improves water quality	Yes
Promotes decarbonization	No

Enables carbon sequestration	No
Provides oxygen production	No
Improves air quality	No
Prevents pollution	Yes
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	No
Protects land containing shellfish	No
Provides pollinator habitat	No
Provides recreation	No
Provides cultural resources/education	No

Project Climate Hazard Exposure

Is the primary purpose of this project ecological restoration?	No
Does the project site have a history of coastal flooding?	No
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	No
Does the project site have a history of riverine flooding?	No
Does the project result in a net increase in impervious area of the site?	Yes
Are existing trees being removed as part of the proposed project?	Yes

Project Assets

Asset: Facility Building
Asset Type: Typically Unoccupied
Asset Sub-Type: Water treatment plant (potable water)
Construction Type: New Construction
Construction Year: 2030
Useful Life: 30

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Building must be accessible/operable at all times, even during natural hazard event

Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.
Impacts would be limited to local area and/or municipality

Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.
Less than 10,000 people

Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the building/facility would result in moderate or severe injuries or moderate or severe impacts to chronic illnesses

If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?
Spills and/or releases of hazardous materials would be relatively easy to clean up

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Significant – Inoperability is likely to impact other facilities, assets, or buildings and will likely affect their ability to operate

If this building/facility was damaged beyond repair, how much would it approximately cost to replace?
Between $10 million and $30 million

Is this a recreational facility which can be vacated during a natural hazard event?
No

If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?
Some alternative programs and/or services are available to support the community

If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
Impact on natural resources can be mitigated naturally

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?
Loss of building may reduce the ability to maintain some government services, while a majority of services will still exist.

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?
Loss of confidence in government agency

Report Comments

N/A

APPENDIX F

EJ Documentation

Environmental Justice Screening Form

Project Name	Barnstable Fire District Wells 3&4 Water Treatment Plant
Anticipated Date of MEPA Filing	April 30, 2026
Proponent Name	Barnstable Fire District Water Department
Contact Information (e.g., consultant)	Stephen Olson, P.E. sco@h2olsonengineering.com 508-375-7007
Public website for project or other physical location where project materials can be obtained (if available)	10 Riverside Drive Suite #103 Lakeville, MA 02347
Municipality and Zip Code for Project (if known)	Barnstable, MA 02630
Project Type* (list all that apply)	Water Supply – Treatment/conveyance
Is the project site within a mapped 100-year FEMA flood plain? Y/N/ unknown	No
Estimated GHG emissions of conditioned spaces (click **here** for GHG Estimation tool)	5.46 tpy (tons per year)

Project Description

1. Provide a brief project description, including overall size of the project site and square footage of proposed buildings and structures if known.

The proposed project involves the construction of a new water treatment plant at 1660 Route 132 in Barnstable, Massachusetts. The new building will be located on the same property as Well 3 and Well 4, two wells owned and operated by the Barnstable Fire District Water Department to supply water to the Barnstable Fire District service zone located within the Town of Barnstable. Construction will include the new 3,800-square-foot water treatment plant building, two concrete sand filters and associated infiltration basins for treatment residuals, a Title 5 compliant septic system for the facility restroom, propane fueled emergency generators, and associated yard piping. The total size of the project site is approximately 90,000 square feet.

2. List anticipated MEPA review thresholds (301 CMR 11.03) (if known)

301 CMR 11.03(4)(b)4. – Construction of a New drinking water treatment plant with a Capacity of 1,000,000 or more gpd.

3. List all anticipated state, local and federal permits needed for the project (if known)

MEPA Secretary's Certificate (EEOEA)
Massachusetts Historical Commission Review - Completed
MESA Project Review (NHESP) - Completed
Title 5 Permit (MassDEP)

Local Building Permit (Town of Barnstable)
Site Plan Review (Town of Barnstable)
NPDES Construction General Permit (USEPA)
BRP WS 24 – Approval to Construct a Water Treatment Facility of 1 million Gallons per Day or Greater (MassDEP)

4. Identify EJ populations and characteristics (Minority, Income, English Isolation) within 5 miles of project site (can attach map identifying 5-mile radius from EJ Maps Viewer in lieu of narrative)

EJ populations within 5 miles of the project site include block groups identified for Minority, Income, and English Isolation. Languages identified within 5 miles of the project site include Portuguese and Portuguese Creole. A map depicting this information is attached to this form.

5. Identify any municipality or census tract meeting the definition of "vulnerable health EJ criteria" in the DPH EJ Tool located in whole or in part within a 1 mile radius of the project site.

According to the DPH EJ Tool, there are no census tracts within 1 mile of the project site, or within the Town of Barnstable, that meet the definition of "vulnerable health EJ criteria".

6. Identify potential short-term and long-term environmental and public health impacts that may affect EJ Populations and any anticipated mitigation.

The construction is not anticipated to result in any short-term public health impacts. Construction period impacts including noise, dust, and emissions are only expected to impact areas immediately adjacent to the Site, which comprises of a dense, wooded area and the Hyannis Golf Course, and will be mitigated in accordance with local, state, and federal requirements.

Long term public health impacts associated with the Project include a slight increase in GHG emissions compared to the existing Well 3 and Well 4 Pumping and Treatment facilities due to the increase in size and power requirements for the building and treatment equipment. Mitigation for this potential increase in GHG emissions includes adherence to the 2024 International Energy Conservation Code.

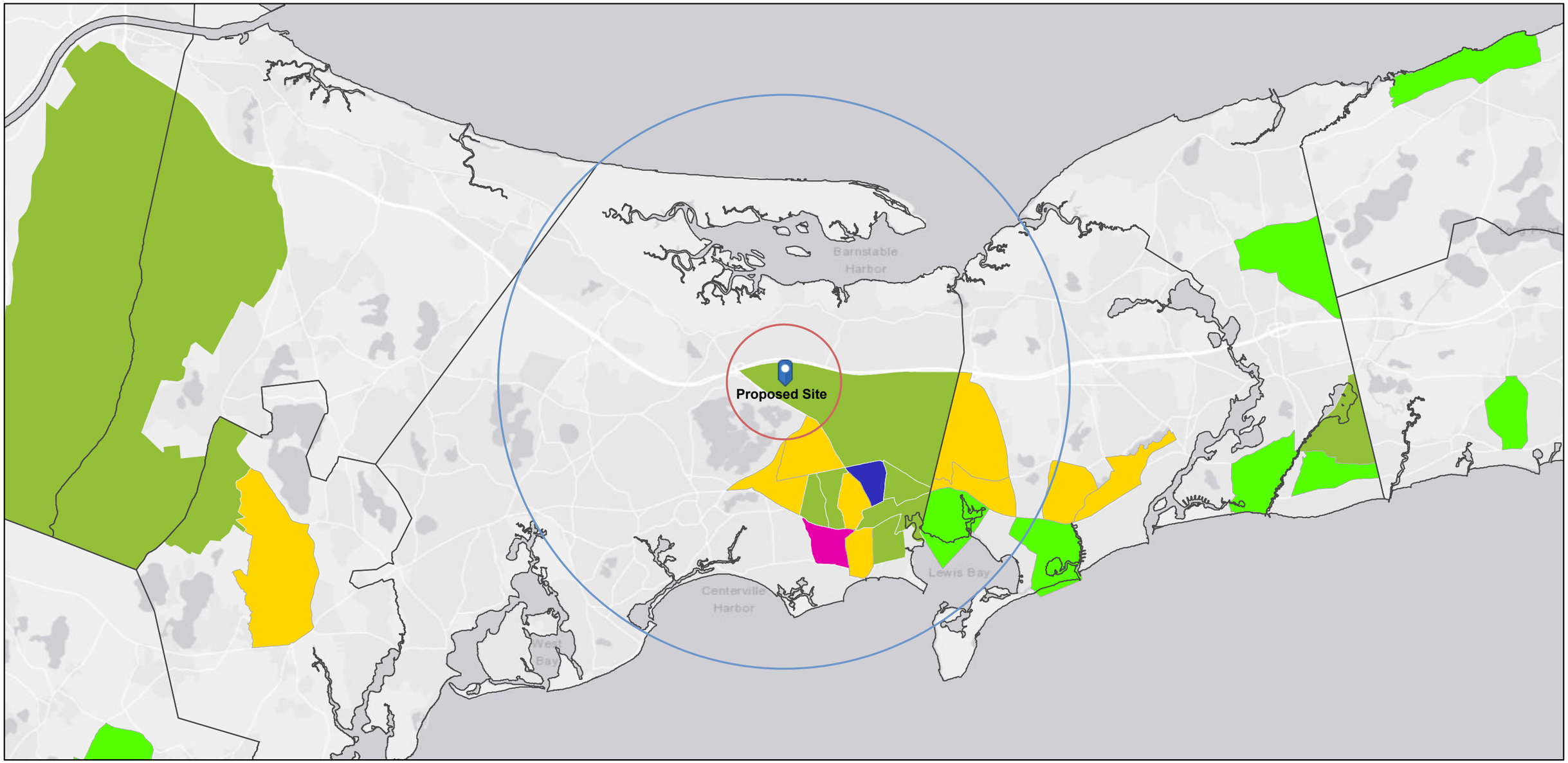
7. Identify project benefits, including "Environmental Benefits" as defined in 301 CMR 11.02, that may improve environmental conditions or public health of the EJ population.

The project will supply improved water quality and provide increased reliability of clean, safe, public drinking water to all customers serviced by the Barnstable Fire District Water Department, and all members of the general public that make use of the businesses and facilities which use or serve public drinking water.

8. Describe how the community can request a meeting to discuss the project, and how the community can request oral language interpretation services at the meeting. Specify how to request other accommodations, including meetings after business hours and at locations near public transportation.

The community can request a meeting to discuss the project by contacting Steve Olson at the contact information listed above. In this request, the community can note other accommodations needed such as oral language interpretation services, meetings after business hours, or meetings at locations near public transportation. Oral language interpretation service requests must be made one (1) week in advance of any scheduled meeting.

Barnstable Fire District Wells 3&4 WTP



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0 1.25 2.5 5 mi

0 2 4 8 km

Distance & Direction - Circle Graphics

- 1 Mile Radius
- 5 Mile Radius

MA 2020 Environmental Justice Block Groups

- Minority: the block group minority population is >= 40%, or the block group minority population is >= 25% and the median household income of the municipality the block group is in is < 150% of the Massachusetts median household income
- Income: the block group median household income is 65% or less than the state median household income
- Minority and Income
- Minority and English isolation
- Minority, Income and English isolation

MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS

MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS | MassGIS, MassDOT - Highway Division, MassDEP, MWRA | EEA GIS |

Formulário de avaliação de Justiça ambiental

Nome do projeto	Estação de Tratamento de Água dos Poços 3 e 4 do Distrito de Bombeiros de Barnstable
Data prevista de protocolo do MEPA	30 de Abril de 2026
Nome do proponente	Departamento de Água do Distrito de Bombeiros de Barnstable
Informações de contato (por exemplo, consultor)	Steve Olson, P.E. sco@h2olsonengineering.com 508-375-7007
Site público do projeto ou outro local físico onde os materiais do projeto podem ser obtidos (se disponíveis)	10 Riverside Drive Suite #103 Lakeville, MA 02347
Município e código postal do Projeto (se souber)	Barnstable, MA 02630
Tipo de projeto* (liste todos os que se aplicam)	Abastecimento de água – Tratamento/transporte
O local do projeto está dentro de uma planície de inundação de 100 anos mapeada do FEMA? S/N/Não sei	Não
Emissões estimadas de GEE de espaços condicionados (clique **aqui** para acessar uma ferramenta de estimativa de GEE)	5,46 tpa (toneladas por ano)

Descrição do projeto

1. Forneça uma breve descrição do projeto, incluindo o tamanho geral do local do projeto e a metragem quadrada dos prédios e estruturas propostos, se souber.

O projeto proposto envolve a construção de uma nova estação de tratamento de água na Route 132, nº 1660, em Barnstable, Massachusetts. O novo edifício ficará localizado na mesma propriedade que os poços 3 e 4, dois poços pertencentes e operados pelo Departamento de Água do Distrito de Bombeiros de Barnstable para fornecer água à zona de serviço do Distrito de Bombeiros de Barnstable, localizada na cidade de Barnstable. A construção incluirá o novo edifício da estação de tratamento de água com 3.800 pés quadrados, dois filtros de areia de concreto e bacias de infiltração associadas para resíduos de tratamento, um sistema séptico em conformidade com o Título 5 para o banheiro da instalação, geradores de emergência a propano e tubulação associada no pátio. O tamanho total do local do projeto é de aproximadamente 90.000 pés quadrados.

2. Liste os limites previstos de revisão do MEPA (301 CMR 11.03) (se souber).

301 CMR 11.03(4)(b)4. – Construção de uma nova estação de tratamento de água potável com capacidade igual ou superior a 1.000.000 gpd.

3. Liste todas as autorizações estaduais, locais e federais previstas necessárias para o projeto (se souber).

Certificado do Secretário da MEPA (EEOEA)
Revisão da Comissão Histórica de Massachusetts - Concluída
Revisão do Projeto MESA (NHESP) - Concluída
Licença Título 5 (MassDEP)
Licença de construção local (Cidade de Barnstable)
Revisão do plano do local (Departamento de Construção da Cidade de Barnstable)
Licença Geral de Construção NPDES (EPA)
WS 24 – Aprovação para construir uma estação de tratamento de água com capacidade igual ou superior a 1 milhão de galões por dia (MassDEP)

4. Identifique as populações e características de Justiça ambiental (minoria, renda, falta de conhecimento de inglês) dentro de 5 milhas (8 km) do local do projeto (você pode anexar um mapa que mostre o raio de 5 milhas a partir do Visualizador de mapas de Justiça ambiental em vez de descrever por escrito).

As populações afetadas pela justiça ambiental num raio de 8 km do local do projeto incluem grupos de quarteirões identificados como minorias, de baixa renda e com isolamento linguístico em inglês. As línguas identificadas num raio de 8 km do local do projeto incluem português e crioulo português. Um mapa com essas informações está anexado a este formulário.

5. Identifique qualquer município ou setor censitário que atenda à definição de "critérios de saúde de vulneráveis de Justiça ambiental" pela Ferramenta de Justiça ambiental localizado totalmente ou parcialmente dentro do raio de 1 milha (1,6 km) do local do projeto.

De acordo com a ferramenta EJ do DPH, não há setores censitários num raio de 1,6 km do local do projeto, ou dentro da cidade de Barnstable, que atendam à definição de "critérios EJ de saúde vulnerável".

6. Identifique potenciais impactos ambientais e de saúde pública de curto e longo prazo que podem afetar as Populações de Justiça ambiental e qualquer mitigação prevista.

Não se prevê que a construção tenha qualquer impacto a curto prazo na saúde pública. Os impactos durante o período de construção, incluindo ruído, poeira e emissões, deverão afetar apenas as áreas imediatamente adjacentes ao local, que compreende uma área densamente arborizada e o campo de golfe Hyannis, e serão mitigados de acordo com os requisitos locais, estaduais e federais.

Os impactos de longo prazo na saúde pública associados ao projeto incluem um ligeiro aumento nas emissões de GEE em comparação com as instalações existentes de bombeamento e tratamento dos Poços 3 e 4, devido ao aumento no tamanho e nos requisitos de energia para o edifício e os equipamentos de tratamento. A mitigação desse aumento potencial nas emissões de GEE inclui a adesão ao Código Internacional de Conservação de Energia de 2024.

7. Identifique os benefícios do projeto, incluindo os "Benefícios ambientais", conforme definido no 301 CMR 11.02, que podem melhorar as condições ambientais ou a saúde pública da População de Justiça ambiental.

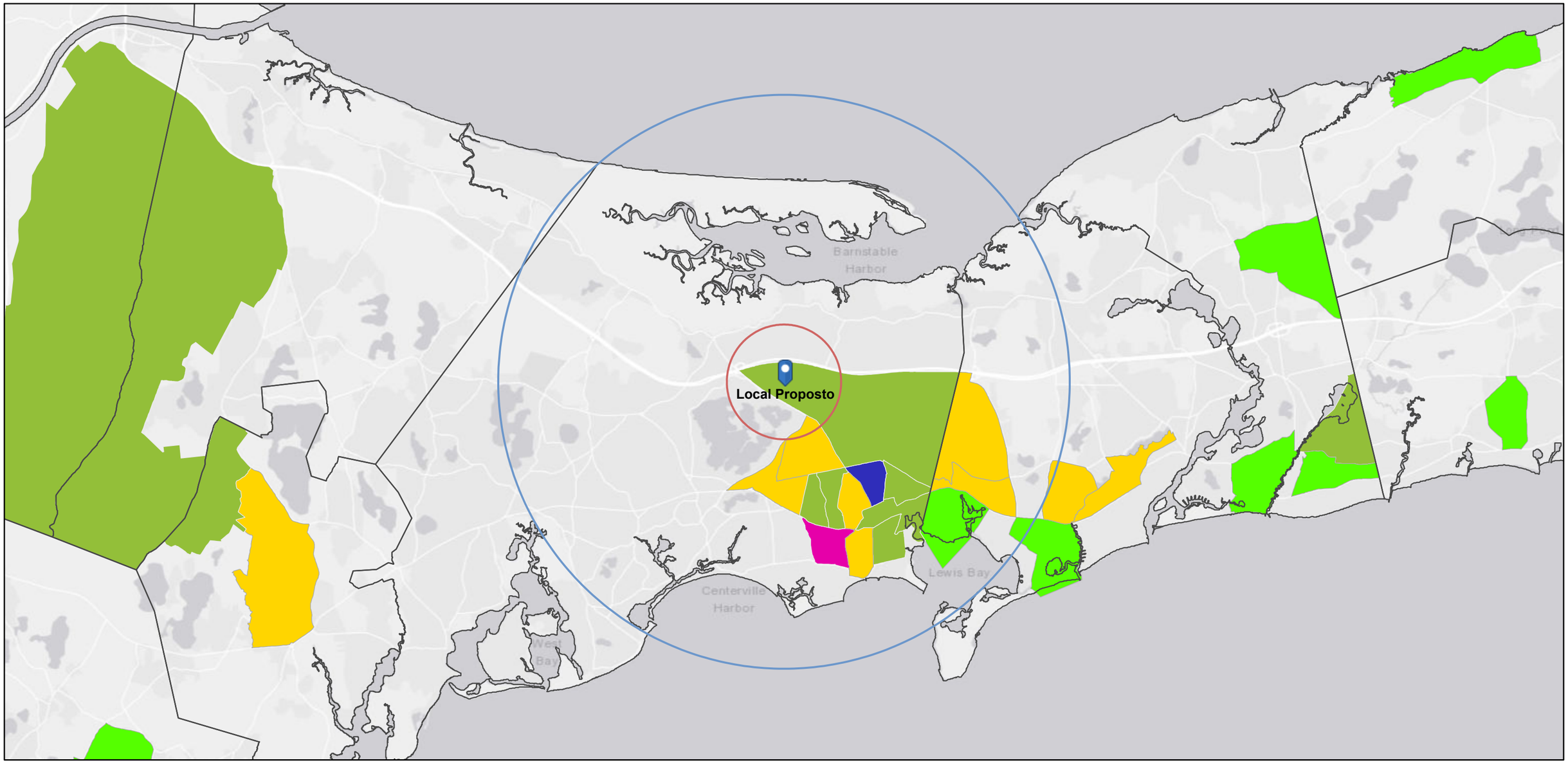
O projeto proporcionará uma melhor qualidade da água e aumentará a confiabilidade do abastecimento público de água potável limpa e segura a todos os clientes atendidos pelo Departamento de Água do Distrito de Barnstable Fire e a todos os membros do público em geral

que utilizam os negócios e instalações que utilizam ou fornecem água potável pública.

8. Descreva como a comunidade pode organizar uma reunião para discutir o projeto e como a comunidade pode solicitar serviços de interpretação para a reunião. Especifique como solicitar outras acomodações, incluindo reuniões fora do horário comercial e em locais próximos a transportes públicos.

A comunidade pode solicitar uma reunião para discutir o projeto entrando em contato com Steve Olson através das informações de contato listadas acima. Nessa solicitação, a comunidade pode indicar outras acomodações necessárias, como serviços de interpretação oral, reuniões após o horário comercial ou reuniões em locais próximos ao transporte público. As solicitações de serviços de interpretação oral devem ser feitas com uma (1) semana de antecedência de qualquer reunião agendada.

Estação de Tratamento de Água de Poços 3 e 4 do Distrito de Bombeiros de Barnstable



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1:144,448

0 1.25 2.5 5 milhas

0 2 4 8 km

Distância e Direção - Gráficos Circulares

- Raio de 1,6 km
- Raio de 8 km

MA 2020 Grupos de Justiça Ambiental

- Minoria: a população minoritária do grupo de blocos é >= 40%, ou a população minoritária do grupo de blocos é >= 25% e a renda familiar média do município em que o grupo de blocos se encontra é < 150% da renda familiar média de Massachusetts
- Renda: a renda média familiar do grupo de quarteirões é 65% ou menos do que a renda média familiar do estado
- Minoria e Renda
- Minoria e Isolamento em Inglês
- Minoria, Renda e Isolamento em Inglês

MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS

MassGIS, Esri, HERE, Garmin, USGS, EPA, NPS | MassGIS, MassDOT - Divisão de Rodovias, MassDEP, MWRA | EEA GIS |

Project-Specific EJ Reference List

Please populate all items in the grey boxes. Your Project-Specific EJ Reference List will auto-populate in the table below.
Add any supplemental contacts identified through additional research to the right table titled "Supplemental Community Contacts".

Project Name: Barnstable Fire District Wells 3&4 Water Treatment Plant

Project Address: 1660 Route 132, Barnstable, MA 02630

Date Generated: 1/27/2026

Filing Type: ☑ ENF/EENF ☐ Single EIR ☐ DEIR ☐ FEIR ☐ Other

MA Municipalities in Project's DGA:					
Barnstable	*Blank*	*Blank*	*Blank*	*Blank*	*Blank*

Note: if there are more than six municipalities in the project DGA, unhide row 14 above. If the DGA contains more than 12 municipalities, contact MEPA-EJ@mass.gov for further instructions.

Click below to email MEPA and be sure to attach this completed project-specific EJ Reference List Excel file
↓
Email MEPA-EJ@mass.gov

Project-Specific EJ Reference List *(auto-populates)*

Contact Name	Title	Phone	Email	Affiliation	Contact Type	Proponent Notes (contact status, removal requests, updates)
Claire B.W. Muller	Movement Building Director	(508) 308-9261	claire@uumassaction.org	Unitarian Universalist Mass	Statewide CBO	
Julia Blatt	Executive Director	(617) 714-4272	juliablatt@massriversalliance.org	Mass Rivers Alliance	Statewide CBO	
Jodi Valenta	Massachusetts State Director	(617) 367-6200	Jodi.Valenta@tpl.org	The Trust for Public Land	Statewide CBO	
Kerry Bowie	Board President	Not Provided	kerry@msaadapartners.com	Browning the GreenSpace	Statewide CBO	
Sylvia Broude	Executive Director	(617) 292-4821	sylvia@communityactionworks.org	Community Action Works	Statewide CBO	
Britteny Jenkins	Vice President	Not Provided	Bjenkins@clf.org	Conservation Law Foundation	Statewide CBO	
Alex St. Pierre	Director of Communities &	Not Provided	aestpierre@clf.org	Conservation Law Foundation	Statewide CBO	
Paulina Muratore	Director of Transportation	Not Provided	pmuratore@clf.org	Conservation Law Foundation	Statewide CBO	
Breanne Frank	Associate Attorney	Not Provided	bfrank@clf.org	Conservation Law Foundation	Statewide CBO	
Amy Boyd Rabin	Vice President of Policy	(617) 221-8258	aboydrabin@environmentalleague.org	Environmental League of	Statewide CBO	
Ben Hellerstein	MA State Director	(617) 747-4368	ben@environmentmassachusetts.org	Environment Massachusetts	Statewide CBO	
Robb Johnson	Executive Director	(978) 443-2233	robb@massland.org	Mass Land Trust Coalition	Statewide CBO	
Cindy Luppi	New England Director	(617) 338-8131 x208	cluppi@cleanwater.org	Clean Water Action	Statewide CBO	
Dálida Rocha	Executive Director	Not Provided	dalida@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Lezlie Braxton Campbell	Deputy Director	Not Provided	braxton@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Lena Entin	Director of Individual Giving	Not Provided	lena@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Danny Timpona	Organizing Director	Not Provided	danny@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Miles Gresham	Campaign Director	Not Provided	miles@n2nma.org	Neighbor to Neighbor Mass.	Statewide CBO	
Rob Moir	Executive Director	Not Provided	rob@oceanriver.org	Ocean River Institute	Statewide CBO	
Vickash Mohanka	Director, MA Chapter	Not Provided	vick.mohanka@sierraclub.org	Sierra Club MA	Statewide CBO	
Heidi Ricci	Director of Policy	Not Provided	hricci@massaudubon.org	Mass Audubon	Statewide CBO	
Bettina Washington	Tribal Historic Preservation	(508) 560-9014	thpo@wampanoagtribe-nsn.gov	Wampanoag Tribe of Gay Head	Federal Tribe	
Brian Weeden	Chair	(774) 413-0520	Brian.Weeden@mwtribe-nsn.gov	Mashpee Wampanoag Tribe	Federal Tribe	
Nakia Hendricks Jr.	Office Manager	Not Provided	106Review@mwtribe-nsn.gov	Mashpee Wampanoag Tribe	Federal Tribe	
David Weeden	THPO/Director	(774) 327.0068	David.Weeden@mwtribe-nsn.gov	Mashpee Wampanoag Tribe	Federal Tribe	
Alma Gordon	President	Not Provided	tribalcouncil@chappaquiddickwampanoag.org	Chappaquiddick Tribe of the	Indigenous Org	
Cheryll Toney Holle	Chair	(774) 317-9138	crwritings@gmail.com	Nipmuc Nation (Hassanamisco	Indigenous Org	
John Peters, Jr.	Executive Director	(617) 573-1292	john.peters@mass.gov	Massachusetts Commission on	Indigenous Org	
Melissa Ferretti	Chair	(508) 304-5023	melissa@herringpondtribe.org	Herring Pond Wampanoag Tribe	Indigenous Org	

Supplemental Community Contacts

Contact Name	Title	Affiliation	Email	Phone
Ami Bowen	Vice President of Marketing and	Harbor Community Health	abowen@hhsi.us	(617) 533-2358
Kelly Milkman	Director of Land Stewardship	Barnstable Land Trust Inc.	kelly@blt.org	(508) 771-2585 x102
Janet Milkman	Executive Director	Barnstable Land Trust Inc.	janet@blt.org	(508) 771-2585 x101
Kristina E. Dower	Executive Director	Community Action Committee of	info@cacci.cc	508-771-1727
Andrew Gottlieb	Executive Director	Association to Preserve Cape	info@apcc.org	(508) 619-3185
Kristin Andres	Director of Education &	Association to Preserve Cape	info@apcc.org	(508) 619-3185
Zenas Crocker	Executive Director	Barnstable Clean Water Coalition	info@bcleanwater.org	508-420-0780

Project-Specific EJ Reference List *(auto-populates)*

Contact Name	Title	Phone	Email	Affiliation	Contact Type	Proponent Notes (contact status, removal requests, updates)
Patricia D. Rocker	Council Chair	Not Provided	rockerpatriciad@verizon.net	Chappaquiddick Tribe of the	Indigenous Org	
Raquel Halsey	Executive Director	(617) 232-0343	rhalsey@naicob.org	North American Indian Center of	Indigenous Org	
Cora Pierce	Not Provided	Not Provided	Coradot@yahoo.com	Pocassett Wampanoag Tribe	Indigenous Org	
Elizabeth Solomon	Not Provided	Not Provided	Solomon.Elizabeth@gmail.com	Massachusetts Tribe at	Indigenous Org	
Barry Margolin	Chair, Policy & Program	Not Provided	info@capecodclimate.org	Cape Cod Climate Change	Local CBO	
Kristina Dower	Executive Director	(508) 771-1727	info@cacci.cc	Community Action Committee of	Local CBO	

APPENDIX G

MEPA Emissions Footprint Estimation Tool Printout

Emissions Footprint Estimation Tool

The objective of this tool is to provide an estimate of project emissions for ENF reporting.

To use the tool:
- populate the area of each proposed building (column B), in square feet.
- use the pull down menu to select building use (column C)

For mixed use buildings, use multiple rows. For example, if a building is proposed to be 10,000-sf ground floor retail and 40,000-sf residential use two rows, one for the retail and one for the residential.

If more then twenty rows are needed, use multiples of this spreadsheet and sum the totals.

Electric and gas EUI estimates are based on pre-solved prototypes available here https://www.energycodes.gov/prototype-building-models

Emission rates are: 600 lbs/MWhr for grid electricitly and 116 lbs/MMBtu

For office sizes
- Use "small office" if <=20,000-sf
- Use "large office" if >20,000-sf

For hotel sizes
- Use "small hotel" if <=50,000-sf
- Use "large hotel" if >50,000-sf

			EUI (kBtu/sf-yr)		Annual Emissions (tpy)		
Building (or use) No.	Area (sf)	Use	fossil fuel	electric	fossil	electric	total
1	2,020	office (small)	5.5	20.5	0.6	3.6	4.3
2	2,020	warehouse	4.3	6.0	0.5	1.1	1.6
3			-	-	-	-	-
4			-	-	-	-	-
5			-	-	-	-	-
6			-	-	-	-	-
7			-	-	-	-	-
8			-	-	-	-	-
9			-	-	-	-	-
10			-	-	-	-	-
11			-	-	-	-	-
12			-	-	-	-	-
13			-	-	-	-	-
14			-	-	-	-	-
15			-	-	-	-	-
16			-	-	-	-	-
17			-	-	-	-	-
18			-	-	-	-	-
19			-	-	-	-	-
20			-	-	-	-	-
			-	-	-	-	-

Total project emissions to enter into ENF form - represents near-term emissions rate	5.9	**tpy**

APPENDIX H

Pilot Scale Treatability Study Report

Barnstable Fire District Water Department Well 3 & 4
Pilot Scale Treatability Study

Section 1: Introduction

With the assistance of the Barnstable Fire District Water Department (BFD) staff, H2Olson Engineering, Inc. (H2Olson) completed a pilot scale treatability study using pressurized media filtration columns for the removal of source water iron, and manganese in accordance with the Massachusetts Department of Environmental Protection (MassDEP) permit application BRP-WS21 approved on February 24, 2025. The pilot study was completed over a 2-week period in April 2025 using three (3) filter columns filled with GreensandPlus™ media capped with anthracite. Presented herein are the results, findings, and conclusions of the pilot scale treatability study.

Background

The Barnstable Fire District Water Department supplies water to its customers from three active groundwater supply wellfields: the Phinney's Lane well (Well 1); the Breeds Hill Road wells (Well 2 and Well 5); and the Route 132 wells (Well 3 and Well 4). Groundwater from the Route 132 wells is treated at a combined chemical addition facility located at the Well 4 pump station, where potassium hydroxide is added for pH adjustment and sodium hypochlorite is added for disinfection. Both the raw water and chemically treated water are routinely sampled and tested. A summary of recent existing available water quality information for Well 3 and Well 4 is summarized in Table 1.

Table 1
Water Quality Sampling Results

Testing Location	Parameter	Averages	Range
Well 3 Raw Water	Iron (mg/L)	0.06	0.06-0.06
	Manganese (mg/L)	0.02	0.0087-0.025
	Alkalinity (mg/L as $CaCO_3$)	7.33	5.9-10
	Turbidity (NTU)	0.56	0.23-0.93
	pH (pH units)	6.03	5.9-6.3
Well 4 Raw Water	Iron (mg/L)	0.77	0.72-0.8
	Manganese (mg/L)	0.05	0.026-0.094
	Alkalinity (mg/L as $CaCO_3$)	20.00	15-24
	Turbidity (NTU)	1.01	0.21-2.5
	pH (pH units)	6.20	6-6.6

Testing Location	Parameter	Averages	Range
Well 3 & 4 Finished Water	Iron (mg/L)	0.22	0.21-0.22
	Manganese (mg/L)	0.03	0.028-0.03
	Alkalinity (mg/L as $CaCO_3$)	72.67	64-81
	Turbidity (NTU)	0.25	0.22-0.3
	pH (pH units)	6.45	6-6.9

In addition to the routine water quality parameters summarized in Table 1, per and perfluoro sulfonic PFAS compounds have been detected in the raw water at these wells above the USEPA MCLs of 4 ppt for PFOS and PFOA. An evaluation of PFAS treatment options identified that GAC is the recommended treatment alternative based on the individual PFAS compounds and levels detected in the source water. However, the presence of source water iron and manganese can make the use of GAC media problematic due to accumulated headloss. Therefore, based on an evaluation of raw water quality, a pilot scale treatability study was proposed to investigate the use of a pressurized media filtration system for the efficient removal of iron and manganese.

Section 2: Pilot Test Description

The pilot scale pressurized media filtration system was supplied by Hungerford & Terry and consisted of three (3) individual filter columns; GreensandPlus™ and anthracite filter media; and chemical feed systems for potassium hydroxide, sodium permanganate, and sodium hypochlorite. H2Olson installed and operated the system and all associated interconnecting piping and valves for feed water, backwashing, filter effluent, and sampling.

The pilot study involved an evaluation of two different chemicals for pre-oxidation (sodium permanganate and chlorine). Treatment Train #1 consisted of the application of potassium hydroxide for pH adjustment and sodium permanganate for oxidation. Treatment Train #2 consisted of the application of potassium hydroxide for pH adjustment and chlorine for oxidation. Each treatment train utilized a 50% blend of raw water from wells 3 and 4. The feed water was obtained from the raw water line prior to the addition of chemicals. After chemical addition for each treatment train, the pretreated water was piped to the filter columns. Filter #1 was dedicated to Train 1 and Filter #3 was dedicated to Train 2. The feed water for Filter #2 was alternated between Train 1 and Train 2. A schematic diagram of the pilot treatment system is provided in Appendix A. Each filter column consisted of a 12" of gravel base, 24" of GreensandPlus™ media, topped with 12" of anthracite. The design criteria for the pilot filter columns are presented in Table 2.

All three filter columns included manual control valves, a flow meter, and influent/effluent pressure gauges for operational control and monitoring. Control valves were adjusted regularly throughout the course of each filter run to maintain target filter loading rates. The GreensandPlus™ filter media was conditioned by soaking the media in a 7.1% solution of chlorine overnight prior to operating the filters. When the target filter run time (24 to 48 hours) was achieved, the filters were backwashed individually for approximately 20 minutes at a backwash rate of 12 gpm/sf to achieve 25% expansion of the media. The filter backwash waste was collected in a basin for decanting, and the next filter run was started after the backwashing process was completed.

Table 2
Pressure Vessel Pilot Units

	GreensandPlus™ Filter
	Top Layer
Media Type	Anthracite
Media Depth	12”
Effective Size	0.6 – 0.8 mm
Uniformity Coefficient	Less than 1.6
	Bottom Layer
Media Type	GreensandPlus™
Media Depth	24”
Effective Size	0.3 – 0.35 mm
Uniformity Coefficient	Less than 1.60
Media Support	12” of ¼” x 1/8” Gravel
Column Diameter	6”
Average Loading Rates	3.0, 3.5, 5.2 gpm/sf
Peak Loading Rates	3, 4, 6 gpm/sf
Backwash Loading Rate	Target 12 gpm/sf
Backwash Duration	Up to 20 minutes

The pilot system and equipment were set up and operated between April 14, 2025 and April 25, 2025. The first filter run began on April 17th. Four filter runs were completed between April 14th and April 25th. The pilot system was staffed 8 to 12 hours per day while the filters were in operation. Detailed operating records were recorded including flow rate, loading rate, head loss, run time, and chemical dosages.

Water Quality Sampling

Raw, pretreated, filter effluent, and process residuals were collected and tested for various water quality parameters as outlined in Table 3. Routine water quality analyses {temperature, pH, turbidity, iron (total and dissolved), manganese (total and dissolved), color, total and free chlorine (Train 2 only) and UV-254} were completed on-site by the pilot operations staff using bench-top analytical instruments, including a HACH ratio turbidimeter, HACH spectrophotometer (DR 1900), HACH Sensor portable water pH meter, and a Real Tech UV-254 portable UVT meter. Dissolved iron and manganese samples were tested by filtering the water samples with 0.45 µm filters. All bench top laboratory equipment was calibrated daily. All other water quality parameters and supplemental samples were collected and sent to Pace Analytical, an independent laboratory located in Mansfield, Massachusetts, certified by the Massachusetts DEP.

Table 3
Water Quality Sampling Schedule

Parameter	Sample Location	Lab Testing Frequency	Field Testing Frequency
Temperature	Raw, Filter Effluent	N/A	1 to 3 times during each filter run
pH	Raw, Treated, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Turbidity	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Alkalinity	Raw, Filter Effluent	2 Filter Runs	Not Applicable
Carbon Dioxide	Raw, Filter Effluent	2 Filter Runs	Not Applicable
Iron (total and dissolved)	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Manganese (total and dissolved)	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
UV-254	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Color	Raw, Filter Effluent	2 Filter Runs	1 to 3 times during each filter run
Total Organic Carbon	Raw, Filter Effluent	2 Filter Runs	Not Applicable
Total Coliform	Raw, Filter Effluent	1 Filter Run	Not Applicable
VOCs	Raw, Filter Effluent	1 Filter Run	Not Applicable
PFAS	Raw, Filter Effluent	1 Filter Run	Not Applicable
Sanitary Group (Ca, Mg, K, Na, SO_4, NO_3, NO_2, Hardness)	Raw, Filter Effluent	1 Filter Run	Not Applicable
IOCs (As, Ba, Cd, Cr, Pb, Hg, Se, Ag)	Raw, Filter Effluent	1 Filter Run	Not Applicable
TSS, Fe, Mn, pH	Filter Backwash Supernatant	1 Occurrence	Not Applicable
TSS	Filter Backwash Residuals	1 Occurrence	Not Applicable
RCRA8 Metals	Filter Backwash Residuals	1 Occurrence	Not Applicable

Residuals testing consisted of total suspended solids (TSS), and heavy metals. The filter backwash waste was collected in a common storage tank and allowed to settle after each filter run. An observable supernatant layer was established after an hour of settling, and the basin was entirely clear except for a thin layer of solids on the bottom of the basin after 16 hours of settling. The supernatant from the filter backwash waste was sampled and tested for TSS, iron, manganese, and pH.

Water Quality Goals

The water quality performance goals that were established for the pilot scale treatability study are presented in Table 4.

Table 4
Treated Water Quality Goals

Location	Parameter	Goal
Filter Effluent	Iron	Less than 0.10 mg/L
Filter Effluent	Manganese	Less than 0.025 mg/L
Filter Effluent	pH	Between 6.8 and 7.2

Section 3: Results and Conclusions

After testing and optimizing chemical treatment and backwashing the filters, four filter runs were completed for the pilot scale treatability study. A summary of the operational data for each filter run including: filter run times, average filter flows, average filter loading rates, and head loss at the end of each filter run is presented in Table 5. The complete set of operating records and log sheets documenting the filter flows, loading rates, head loss, run times, and chemical dosages are provided in Appendix B. In addition, filter head loss graphs for each filter run are also provided in Appendix B.

Table 5
Proposed Pilot Test Run Plan

Filter Number	Train	Run Time (hours)	Filter Flow (gpm)	Filter Loading Rate (gpm/sf)	Headloss (psi)
Filter Run #1 (4/17 – 4/18)					
Filter #1	1	26.75	0.35	4.01	1.2
Filter #2	1	26.75	0.44	5.04	4.5
Filter #3	2	26.75	0.35	4.01	0.9
Filter Run #2 (4/21 – 4/23)					
Filter #1	1	47.75	0.35	4.01	1.5
Filter #2	2	47.75	0.44	5.04	4.8
Filter #3	2	47.75	0.35	4.01	0.9
Filter Run #3 (4/23 – 4/24)					
Filter #1	1	23.50	0.35	4.01	1.1
Filter #2	2	23.50	0.52	5.96	4.5
Filter #3	2	23.50	0.35	4.01	1.0
Filter Run #4 (4/24 – 4/26)					
Filter #1	1	54.45	0.35	4.01	1.0
Filter #2	1	54.45	0.52	5.96	5.0
Filter #3	2	54.45	0.35	4.01	0.9

Operations

The initial target filter loading rates employed in Filters #1, #2, and #3 were 4 gpm/sf, 5 gpm/sf, and 4 gpm/sf respectively. However, the loading rate for Filter #2 was adjusted to 6 gpm/sf for Filter Runs 3 and 4. Prior to the start of Filter Run 1, the dosages for chlorine, potassium hydroxide and sodium permanganate were adjusted to meet target pretreatment conditions. The average applied chemical dosages for sodium permanganate, potassium hydroxide and chlorine during the pilot study were 0.35 mg/L, 44 mg/L and 0.48 mg/L, respectively.

A review of the operating data provided in Appendix B and Table 5 indicates that filter 2, which experienced highest loading rate, also experienced the greatest head loss. The lower filter loading rates generally experienced lower headloss. Each of the three filters achieved their respective run times without any degradation of water quality. Filter run times greater than 48 hours were achieved in Filter Run #2 without any negative impacts to effluent water quality or headloss. The accumulated headloss for all the three filters was less than the recommended terminal headloss of 8-10 psi after nearly 48 hours of runtime in Filter Run #2 and over 54 hours of runtime in Filter Run #4.

A summary of the average field-testing water quality results for each filter run is presented in Table 6. Individual field test results for each filter run and the independent laboratory water quality analyses are provided in Appendix C.

Table 6
Water Quality Summary: Average Field Test Results

Filter Run	Temp. (C°)	pH (S.U.)	Turb. (NTU)	UV-254 (1/cm)	Color (C.U.)	Total Fe (mg/L)	Diss. Fe (mg/L)	Avg T. Mn (mg/L)	*Min T. Mn (mg/L)	Diss. Mn (mg/L)
Raw Water										
1	N/A	6.69	0.28	0.009	2	0.31	0.25	0.033	0.021	0.025
2	14.55	6.93	0.17	0.005	3	0.26	0.23	0.023	0.019	0.025
3	N/A	6.36	0.46	0.010	2	0.29	0.23	0.021	0.017	0.022
4	N/A	6.36	0.21	0.009	5	0.22	0.18	0.026	0.023	0.024
Filter #1										
1	N/A	6.90	0.16	0.013	2	0.02	0.01	0.005	0.000	0.005
2	15.2	7.08	0.00	0.005	0	0.02	0.01	0.002	0	0.002
3	N/A	6.93	0.04	0.005	0	0.03	0.01	0.000	0	0.001
4	N/A	7.01	0.06	0.003	4	0.02	0.01	0.004	0.003	0.004
Filter #2										
1	N/A	6.89	0.06	0.012	2	0.14	0.01	0.003	0.000	0.003
2	15.67	7.13	0	0.006	0	0.01	0.02	0	0	0
3	N/A	6.96	0.04	0.016	0	0.02	0.02	0.000	0	0.001
4	N/A	7.08	0.05	0.004	1	0.01	0.01	0.004	0.003	0.004
Filter #3										
1	N/A	6.90	0.06	0.012	1	0.02	0.01	0.005	0	0.002
2	15.77	7.1	0	0.006	0	0.02	0.02	0.001	0	0.001
3	N/A	6.95	0.01	0.006	0	0.02	0.03	0.002	0	0.001
4	N/A	7.17	0.13	0.005	3	0.02	0.01	0.006	0.003	0.003
Train 1 Treated Water										
Filter Run	Temp. (C)	pH (S.U.)	Free Cl2 (mg/L)	Total Cl2 (mg/L)	Color (C.U.)	Total Fe (mg/L)	Diss Fe (mg/L)	Avg T. Mn (mg/L)	*Min T. Mn (mg/L)	Diss. Mn (mg/L)
1		6.90								
2		7.12								
3		6.96								
4		7.02								
Train 2 Treated Water										
1		6.96	0.02	0.13						
2		7.20	0.09	0.13						
3		7.04	0.10	0.12						
4		6.99	0.11	0.15						

* Minimum total manganese concentration measured for the filter run

Water Quality

A review of the water quality information provided in Appendix C and Table 6 indicates that all of the pilot study water quality goals established in Table 4 were met. There was one field testing error in the 3rd sample round for Filter #2 in Filter Run #1 for manganese that was erroneous, and this individual result was not included in the average for the filter run.

A review and evaluation of the filter effluent pH results indicated that the pre-treatment conditions were conducive to iron and manganese removal using permanganate as oxidant and GreensandPlus™ filter media (average pH levels were between 6.89 and 7.17, within target pH levels). Filter effluent turbidity results were also all favorable. A review of the individual and average turbidity results indicate that filter effluent turbidities were all less than 1 NTU and exhibited not upward trend during the filter runs.

The presence of natural organic matter (NOM) was evaluated during the pilot study by testing for both ultraviolet light absorbance at a wavelength of 245 nm (UV-254) and total organic carbon (TOC). Raw water and filter effluent NOM water quality results exhibited extremely low levels. The average level of UV-254 was 0.007 1/cm (raw and filter effluent) and the average TOC concentration reported by the laboratory was 0.34 mg/L (raw and filter effluent, with 3 out of 8 samples reported as non-detect).

A review of filter effluent manganese results indicates that greater than 96% of all the individual field test the results were $\leq$ 0.01 The remaining 4% of the total field tests were less than 0.015 mg/L, less than half of the Secondary Standard of 0.05 mg/L, and below the pilot study water quality goal of 0.025 mg/L. Similarly, a review and evaluation of filter effluent iron test results greater than 96% of all the individual field test the results were $\leq$ 0.05 mg/L. The remaining 4% of the total field tests were less than 0.07 mg/L, well below the Secondary Standard of 0.3 mg/L and the water quality goal of 0.01 mg/L.

In addition to the field-tested routine water quality parameters listed in Table 3, water samples from the pilot study were also sampled and tested at a MassDEP certified laboratory for various other organic, inorganic, and metallic compounds as noted in Table 3 for Filter Runs. These supplemental test results are also included in Appendix C, and a summary of the results based on a review and evaluation of the data is provided below:

- The presence of E. Coli and Coliforms were not detected in either the source water or treated water.
- Chemical addition of potassium hydroxide to achieve a treated water pH resulted in an average increase in alkalinity of approximately 45 mg/L as $CaCO_3$
- The source water from Well 3 and 4 exhibits low levels of background natural organic matter (NOM), as noted by the low levels of total organic carbon (TOC) (0.54 mg/L and ND), color (7 APCU and ND), and UV-254 (0.005 1/cm and ND).
- The source water is soft, with low levels of calcium 5.84 mg/L. Magnesium concentrations were also low (3.77 mg/L). The total hardness level was 30.1 mg/L. Treatment at both locations did not significantly alter hardness.
- Potassium levels increased by approximately 43 mg/L as a result of the addition of potassium hydroxide for pH adjustment. However, there was no significant increase in

sodium levels as a result of adding sodium permanganate. This is likely due to the low levels of sodium permanganate required for effective oxidation.

- Nitrite was not detected in either the raw or filtered water, however nitrate was detected in both locations in the raw and filtered water with a concentration of 1.1 mg/L
- Heavy metals testing showed a very low concentration of barium in the source and filter effluent samples. There were no other detectable levels of heavy metals in the source water or treated water.
- Volatile organic compounds where not detected in the raw or filtered water.
- The only PFAS compound detected in the pilot study was PFOS. The PFOS concentration reported for the raw water was 3.5 nanograms per liter (ng/L). The reported levels of PFOS in the filter effluent were slightly higher, with an average concentration of 4.1 ng/L. This could be due to the materials of construction for the pilot equipment such as Teflon pipe tape, or just laboratory instrument variability at these levels.

The supernatant from the backwash waste was sampled after being allowed to settle for 24 hours. The reported sampling results indicate a pH of 6.68 and the reported level of suspended solids was "not detected". The manganese concentration of the backwash supernatant (0.167 mg/L) was higher than the source water manganese level (0.026 mg/L). However, the iron concentration of the backwash supernatant (0.172 mg/L) was lower than the source water iron level (0.27 mg/L). Lower iron levels were anticipated since the iron in the filter backwash waste had already been oxidized and the solids were allowed to settle. Settled solids from the filter backwash waste (residuals) were sampled and tested for metals. A review and evaluation of the reported results indicates low levels of arsenic, barium, cadmium and lead, while the follow metals were not detected in the residuals sample: chromium, mercury, selenium, and silver.

Section 4: Summary and Recommendations

1. The use of GreensandPlus^{TM} and anthracite as filter media and the addition of sodium permanganate at a dose of ~ 0.35 mg/L or the addition of sodium hypochlorite at a dose of 0.5 mg/L and a pH between 6.9 and 7.2 were both shown to be equally effective for the oxidation and removal of source water iron and manganese levels.
2. Although the pilot scale study indicated low levels of PFAS (~ 4 ng/L of PFOS), historic PFAS levels for these 2 sources indicate PFAS6 levels in the order of 10 ng/L. Therefore, treatment for PFAS6 is recommended, and will be required to meet future USEPA PFAS MCLs. Based on the predominant PFAS6 compounds present in the raw water (PFOS, PFOA, and PFHxS) the use of granular activated carbon (GAC) is the recommended treatment alternative for the removal of PFAS.
3. Since sodium hypochlorite is already used, the future use for pre-oxidation would allow the existing chemical addition facility to be reused for pretreatment.
4. The use of chorine for pre-oxidation is recommended due to the low levels of NOM and the fact that sodium hypochlorite is already used for treatment. Continued use of chlorine for pre-oxidation would allow the continued use of the existing chemical addition facilities for pretreatment.
5. Low levels of chlorine residual will not negatively impact the ability of the post filtration GAC contactors to remove PFAS since the mechanism for the removal of chlorine using GAC is catalytic reduction. Therefore, the adsorptive capacity of the GAC will not be

degraded by influent chlorine residuals in the range of 0.2 mg/L, and may even extend bed life due to oxidation of other organic compounds with chlorine.

6. Based on the current source water iron and manganese levels, the pilot scale results for iron, manganese, headloss, and filter run time support a recommended filter loading rate up to 6 gpm/sf.

Section 5: Conceptual Design

Based on the results of the pilot study, pressure filtration using GreensandPlus™ and anthracite filter media using potassium hydroxide for pH adjustment and sodium hypochlorite for pre-oxidation are recommended for the treatment of the blended source water from the Barnstable Fire District Well 3 and Well 4 for the removal of iron and manganese levels. Furthermore, based on the presence and levels of various PFAS compounds, the use of granular activated carbon (GAC) contactors with an empty bed contact time of 10 minutes, using bituminous based GAC with an iodine number greater than 950 mg/g is recommended to meet MassDEP and future USEPA water quality standards for PFAS.

The treatment facility will be designed to effectively remove iron, manganese, and PFAS at a design flow of 1,500 gpm (2.16 MGD). The source water will be pre-treated with potassium hydroxide for pH adjustment and sodium hypochlorite for pre-oxidation in the existing chemical addition facility at Well 4. The existing chemical storage, handling, and feed facilities at Well 4 will continue to be used for pre-treatment for the recommended GAC facilities. Following pre-treatment, four (4) 9-ft diameter GreensandPlus™ pressure vessels connected in parallel will be used to remove the oxidized source water iron and manganese. Following iron and manganese removal, a total of six (6) 12-ft GAC filters configured in three (3) trains of two (2) vessels in series (lead/lag) will be used to remove PFAS compounds from the filter effluent. After treatment by GAC, a secondary sodium hypochlorite system in the new building will be employed for disinfection and to meet target distribution system chlorine residuals. A washwater supply tank and backwash pumping system will be used to provide sufficient washwater to backwash all four GreensandPlus™ filters, and for conditioning the GAC media. Filter backwash waste will be discharged into gravity sand filters followed by infiltration basins to be constructed on site.

Based on standard pressure vessel sizing, four (4) 9-foot diameter GreensandPlus™ pressure vessels were selected yielding a combined hydraulic capacity of 1,500 gpm (2.16 MGD), 375 gpm per filter. The preliminary design is based upon Hungerford & Terry GreensandPlus™ vertical pressure filter system. To meet treatment and hydraulic requirements for PFAS removal, three sets of two 12-ft diameter GAC pressure vessels are needed to treat a design capacity of 1,500 gpm. The hydraulic capacity of each set of GAC pressure vessels will be 500 gpm to ensure an empty bed contact time (EBCT) of 10 minutes.

Filter backwash loading rates recommended for GreensandPlus™ are 12 gallons per minute per square foot (gpm/sf) representing a required backwash flow rate of 763 gpm per filter. This backwash flow rate must be delivered after PFAS treatment. During a backwash, the treatment facilities will still be able to produce a combined flow of 1,125 gpm, based on three (3) on-line GreensandPlus™ filters and the GAC filter trains. It is anticipated that each filter backwash will

generate approximately 10,000 gallons of backwash waste. To ensure adequate washwater availability, a washwater supply tank is proposed to be constructed below the building integral to the foundation. The tank will be sized to hold four washwater volumes, to allow backwash of each of the four filters. The tank size will be approximately 40,000 gallons. The backwash waste will be directed to two (2) gravity sand filters and two (2) infiltration basins designed with a storage capacity of 35,000 gallons each, representing a sufficient volume of storage for one (1) full cycle of filter backwashes. A summary of the engineering design parameters, including target chemical dosages, for the proposed Well 3 and 4 WTP are presented in Table 7. A 6-month full scale demonstration study consisting of monthly PFAS sampling will be conducted if necessary to demonstrate the performance of the GAC contactors.

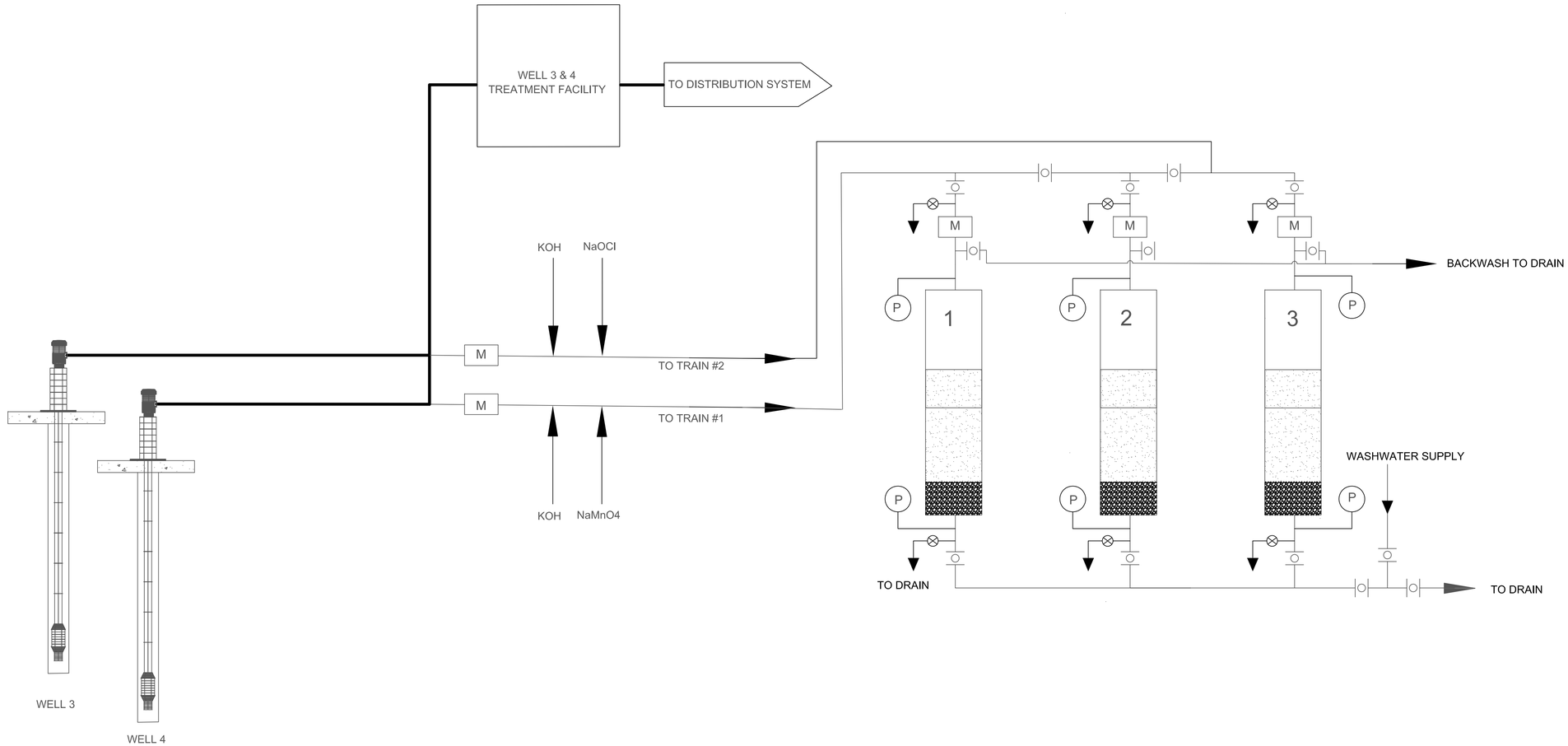
Table 7
Treatment Facility Design Parameters

Hydraulic Design Capacity	1,500 gpm (2.16 MGD)
GreensandPlus™ Filter Parameters	
Fe/Mn Filter Loading Rate	6 gpm/sf
Number of Fe/Mn Filters	4
Fe/Mn Filter Size	9 ft diameter
Hydraulic Filter Capacity (per filter)	375 gpm
Filter Run Time	24 – 48 hours
Backwash Rate	12 gpm/sf
Backwash Flow Rate	763 gpm
Backwash Volume	7,630 gallons
Rinse to Waste Flow Rate	382 gpm
Rinse to Waste Volume	1,145 gallons
GAC Contactor Parameters	
Loading Rate	6.37 gpm/sf
EBCT	10 min
GAC Media	Bituminous, 12x40 mesh, Iodine # > 950 mg/g
Number of Contactors	6
Contactor Size	10 ft diameter
Hydraulic Capacity (per contactor)	500 gpm
Residuals Handling	
Gravity Sand Filter Daily Volume	35,000 gallons
Number of Sand Drying Beds	2
Rinsewater Basin Volume	35,000 gallons
Number of Rinsewater Basins	2
Chemical Feed	
Pre Sodium Hypochlorite dosage	0.5 mg/L
Pre-Potassium Hydroxide dosage	50 mg/L
Post Sodium Hypochlorite dosage	2 mg/L

A conceptual floor plan and conceptual site civil plans are shown in Appendix D. An engineer's opinion of probable project costs is also included in Appendix D.

Appendix A

Schematic of the Pilot System



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DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JULY 2025
SCALE:	N.T.S.
DESIGNED BY:	RAT
CHECKED BY:	SCO
DRAWN BY:	MGN
APPROVED BY:	SCO

WELL 3 & 4 PILOT SCALE TREATABILITY STUDY

BARNSTABLE FIRE DISTRICT WATER DEPARTMENT

DRAWING TITLE:
PILOT TREATMENT SYSTEM SCHEMATIC

DRAWING NO.:
APP. A

Appendix B

Pilot Study Operating Records, Log Sheets, and Chemical Dosage Records

Town of Barnstable
Well 3 & 4 Pilot Study

Flow Log

	Flow		Filter 1					Filter 2					Filter 3					Comments
Date and Time	WTP Feed gpm	Pilot Feed gpm	Flow (gpm)	Headloss Out (psi)	Headloss In (psi)	Headloss Difference (psi)	Run Time (hrs)	Flow (gpm)	Headloss Out (psi)	Headloss In (psi)	Headloss Difference (psi)	Run Time (hrs)	Flow (gpm)	Headloss Out (psi)	Headloss In (psi)	Headloss Difference (psi)	Run Time (hrs)	
4/17 10:15 a.m.		2/2	0.35	51	52	1		0.44	45	51	6		0.35	50	50	0		Start Filter 1
4/17 12:25 p.m.		1.8/2	0.35	51	52	1		0.27	48	52	4		0.33	49	50	1		**Adjusted F1, F2, T1**
4/17 1:10 p.m.		2/2	0.33	51	52	1		0.4	47	53	6		0.34	48	49	1		Adjusted F1, F2, F3
4/17 2:10 p.m.		2/2	0.35	51	52	1		0.425	47.5	51	3.5		0.35	49	49.5	0.5		Adjusted F2
4/17 3:30 p.m.		2/2	0.35	51	52	1		0.44	47	51.5	4.5		0.35	49	49.5	0.5		
4/17 5:40 p.m.		2/2	0.325	51	52	1		0.38	48	52	4		0.34	49.5	50	0.5		Adjusted F1, F2, F3
4/18 8:05 a.m.		2/2	0.34	51	52	1		0.39	47	51.5	4.5		0.34	49	5	-44		Adjusted F1, F2, F3
4/18 10:05 a.m.		2/2	0.35	50.5	52	1.5		0.42	47	51.5	4.5		0.35	49	50	1		Adjusted F2
4/18 11:20 a.m.		2/2	0.35	50.5	52	1.5		0.44	46	51	5		0.35	49	50	1		
4/18 1:00 p.m.		2/2	0.35	50.5	52	1.5		0.425	46.5	51.5	5		0.35	49	50	1		
4/21 8:30 a.m.		2/2	0.35	50	51	1		0.44	51	54	3		0.35	52	52	0		
4/21 8:45 a.m.		2/2	0.35	53	53.5	0.5		0.44	51	54	3		0.35	51	52	1		
4/21 9:30 a.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.35	47	48	1		
4/21 10:30 a.m.		2/2	0.35	51	52	1		0.44	47	51.5	4.5		0.35	48.5	49	0.5		
4/21 11:30 a.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.31	49	49	0		Adjusted F3
4/21 12:30 a.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.35	49	49	0		
4/21 1:30 p.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.35	49	49	0		
4/21 2:36 p.m.		2/2	0.35	51	52	1		0.4	47	52	5		0.33	49	49	0		Adjusted F2, F3
4/21 3:30 p.m.		2/2	0.35	51	52	1		0.44	47	52	5		0.35	49	49	0		
4/21 3:50 p.m.		2/2	0.35	51	52	1		0.44	47	51	4		0.35	49	49	0		
4/22 8:15 a.m.		2/2	0.35	50	52	2		0.3	48	52	4		0.32	47	48	1		Adjusted F2, F3
4/22 9:15 a.m.		2/2	0.35	50	52	2		0.44	47	52	5		0.35	48	49	1		Filter Run 2 (start)
4/22 10:10 a.m.		2/2	0.35	51	52.5	1.5		0.44	47	52	5		0.35	48	49	1		
4/22 11:35 a.m.		2/2	0.35	50	52	2		0.44	47	52	5		0.35	48	49	1		
4/22 12:35 a.m.		2/2	0.35	50.5	52	1.5		0.425	47	52	5		0.35	47.5	49	1.5		Adjusted F2
4/22 1:30 p.m.		2/2	0.35	50	52	2		0.44	46	52	6		0.35	48	49	1		
4/22 2:30 p.m.		2/2	0.35	50	52	2		0.44	46	52	6		0.34	47	48.5	1.5		
4/22 3:30 p.m.		2/2	0.35	50.5	52	1.5		0.44	46.5	52	5.5		0.35	47.5	49	1.5		
4/22 4:30 p.m.		2/2	0.35	50.5	52	1.5		0.44	46.5	52	5.5		0.35	47.5	49	1.5		
4/23 8:15 a.m.		2/2	0.36	50	52	2		0.38	45	51.5	6.5		0.33	46	47.5	1.5		Adjusted F1, F2, F3 (End of filter run 2)
4/23 9:45 a.m.		2/2	0.35	51.5	52	0.5		0.52	47.5	51.5	4		0.35	50	50	0		Start of filter run 3
4/23 10:00 a.m.		2/2	0.32	52	52.5	0.5		0.46	48	52	4		0.3	50.5	50.5	0		Adjusted F1, F2, F3
4/23 11:05 a.m.		2/2	0.28	52	53	1		0.46	48	52	4		0.32	50.5	50.5	0		Adjusted F1, F2, F3
4/23 12:12 p.m.		2/2	0.31	51	52	1		0.48	47	51	4		0.34	49.8	50	0.2		Adjusted F1, F2, F3
4/23 1:03 p.m.		2/2	0.33	50	51	1		0.52	46.5	51	4.5		0.35	49	49.9	0.9		Adjusted F1
4/23 2:15 p.m.		2/2	0.32	50.5	52	1.5		0.51	47	51	4		0.33	49.1	50	0.9		Adjusted F1, F2, F3
4/23 3:58 p.m.		2/2	0.35	51	51.9	0.9		0.52	47	51.5	4.5		0.35	49.1	50	0.9		
4/23 4:45 p.m.		2/2	0.35	51	52	1		0.52	47	51	4		0.35	50	50	0		
4/24 8:15 a.m.		2/2	0.32	50	52	2		0.47	46	51	5		0.33	49	50	1		Adjusted F1, F2, F3
4/24 9:15 a.m.		2/2	0.35	51	52	1		0.52	46	51.5	5.5		0.35	49	50	1		End of filter run 3
4/24 10:00 a.m.		2/2	0.35	51.5	52	0.5		0.52	47.5	51.5	4		0.35	49.5	50	0.5		Start of filter run 4
4/24 10:15 a.m.		2/2	0.31	52	52	0		0.47	48	52	4		0.325	50	50	0		Adjusted F1, F2, F3
4/24 11:10 a.m.		2/2	0.33	51.5	52	0.5		0.5	48	52	4		0.34	50	50	0		Adjusted F1, F2, F3
4/24 12:00 p.m.		2/2	0.31	52	52	0		0.51	47.5	52	4.5		0.34	50	50	0		Adjusted F1, F2, F3
4/24 1:05 p.m.		2/2	0.31	51	52	1		0.52	47	52	5		0.35	49	50	1		Adjusted F1
4/24 2:02 p.m.		2/2	0.35	51	52	1		0.48	47	51.5	4.5		0.3	49	50	1		Adjusted F2, F3
4/24 3:08 p.m.		2/2	0.34	51	51.5	0.5		0.52	47	51	4		0.35	49	49.5	0.5		Adjusted F1
4/24 3:55 p.m.		2/2	0.32	51	51.9	0.9		0.52	47	51	4		0.35	49	49.5	0.5		Adjusted F1
4/25 8:15 a.m.		1.9/2	0.27	51	52	1		0.48	46	51.2	5.2		0.34	48.9	50	1.1		Adjusted F1, F2, F3
4/25 10:00 a.m.		2/2	0.35	50.5	51.5	1		0.5	46	51	5		0.35	48.5	49.5	1		Adjusted F2 (Start of filter run 4)
4/25 11:45 a.m.		2/2	0.35	50	51	1		0.52	45	51	6		0.35	48	49	1		
4/25 1:00 p.m.		2/2	0.34	50	51	1		0.52	45	51	6		0.35	48	49	1		Adjusted F1
4/25 2:05 p.m.		2/2	0.35	50	51	1		0.52	45	51	6		0.35	48	49	1		
4/25 3:00 p.m.		2/2	0.35	50	51	1		0.52	45	51	6		0.35	48	49	1		
4/25 3:45 p.m.		2/2	0.35	50.1	52	1.9		0.52	45	51.1	6.1		0.35	48.1	49.9	1.8		
4/25 4:27 p.m.		2/2	0.34	50	52	2		0.51	44	52	8		0.35	47.5	50	2.5		Adjusted F1

Town of Barnstable
Well 3 & 4 Pilot Study
Chemical Usage Log

		Pump 1 NaMnO4					Pump 2 KOH					Pump 3 KOH					Pump 4 NaOCl					
Date	Time	Batch Conc	Level L	Pump Setting	mL/min	Dosage (mg/L)	Batch Conc	Level L	Pump Setting	mL/min	Dosage (mg/L)	Batch Conc	Level L	Pump Setting	mL/min	Dosage (mg/L)	Batch Conc	Level L	Pump Setting	mL/min	Dosage (mg/L)	Comments
4/17/25	10:41 AM		39.8	0.25				47	2.3				46.5	2.3				12.3	2			
4/17/25	3:20 PM		39.5	0.25				46	2.35				46	2.3				12	2			pH = 6.63, Increase Pump 2 and 3 by 0.05%
4/17/25	6:00 PM		39	0.25				45.5	2.35				45.1	2.3				11.9	2			
4/18/25	8:05 AM		38.6	0.25				43	2.35				43.5	2.3				11.5	2			pH = 7.43/7.65, Decrease Pump 2 and 3 by 0.05%
4/18/25	10:45 AM		38.5	0.25	0.902778			42.8	2.3				43	2.25				11.4	2			
4/18/25	1:00 PM		38.2	0.25				42.5	2.3				42.8	2.25				11.2	2			End of Filter Run 1
4/21/25	8:30 AM		39	0.24				42	2.3				42	2.25				11.2	2			
4/21/25	9:50 AM		39	0.24				42	2.3				43	2.25				11.2	2			Start of Filter Run 2
4/21/25	1:11 PM		39	0.24				42	2.3				43	2.25				11	2			
4/21/25	4:00 PM		39	0.24				41	2.3				41	2.25				10.9	2			
4/22/25	8:15 AM		38	0.24	0.694444			39	2.3				39	2.25				10.3	2			
4/22/25	11:35 AM		38	0.24				39	2.3				39	2.25				10.2	2			
4/22/25	2:30 PM		37.5	0.24				38	2.3				38.7	2.25				10.1	2			
4/23/25	8:15 AM		37	0.24	0.694444			35	2.3				35	2.25				9.4	2			End of Filter Run 2
4/23/25	11:05 AM		37	0.24				34.9	2.3				34.9	2.25				9.4	2			
4/23/25	1:00 PM		37	0.24	0.520833			34.9	2.3				34.9	2.25				9.3	2			Start of Filter Run 3
4/23/25	2:10 PM		37	0.24				34.9	2.3				34.9	2.25				9.25	2.5			
4/23/25	2:40 PM		37	0.24				34.9	2.3				34.9	2.25				9.25	2.25			
4/23/25	4:00 PM		37	0.24				34.8	2.3				34.9	2.25				9.1	2.25			
4/24/25	8:15 AM		36.5	0.24	0.347222			31.5	2.3				31.5	2.25				8.2	2.25			
4/24/25	11:15 AM		36.5	0.24				31.2	2.3				31.25	2.25				8.2	2.25			Start of Filter Run 4
4/24/25	1:05 PM		36.5	0.24				31.5	2.3				31.5	2.25				8.2	2.25			
4/25/25	10:15 AM		36	0.24	0.347222			27.5	2.3				27.5	2.25				7.3	2.25			
4/25/25	3:30 PM		36	0.24				26	2.3				26	2.25				7	2.25			
4/26/25	4:30 AM		37	0.24				23	2.3				23	2.25				6	2.25			

Appendix C

Water Quality Sampling Results

Town of Barnstable
Well 3 & 4 Pilot Study

Location: BFD Well 3 & 4
Filter Run: 1

Water Quality Sampling Log

Raw

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.			6.98	0.19	0.006	3	0.35	0.25	0.022	0.018
4/17 2:11 p.m.			6.62	0.74	0.026	4	0.29	0.18	0.067	0.036
4/17 3:45 p.m.			6.88	0.26	0.004	UR	0.33	0.24	0.033	0.029
4/18 8:20 a.m.			6.49	0.12	0.008	-2	0.29	0.27	0.023	0.024
4/18 11:30 a.m.			6.47	0.09	0.002	2	0.30	0.29	0.021	0.019

Treated - Train 1

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.			6.82							
4/17 2:11 p.m.			6.63							
4/17 3:45 p.m.			6.93							
4/18 8:20 a.m.			7.43							
4/18 11:30 a.m.			6.69							

Treated - Train 2

Run / Date / Time		Temp C	pH S.U.	Free Cl2	Total CL2	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.			6.80	0.01	0.020					
4/17 2:11 p.m.			6.68	0.01	0.150					
4/17 3:45 p.m.			6.93	0.03	0.190					
4/18 8:20 a.m.			7.65	0.02	0.170					
4/18 11:30 a.m.			6.72	0.01	0.130					

Filter #1

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.	0.00		6.78	0.40	0.006	1	0.03	0.03	0.004	0.006
4/17 2:11 p.m.	3.18		6.77	0.01	0.040	0	0.01	0.01	0.002	0.002
4/17 3:45 p.m.	4.75		6.82	0.32	0.006	5	0.06	0.06	0.013	0.012
4/18 8:20 a.m.	21.33		7.41	0.07	0.008	-1	0.02	0.00	0.004	0.004
4/18 11:30 a.m.	24.50		6.70	0.02	0.004	5	0.00	0.00	0.000	-0.001

Filter #2

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.	0.00		6.78	0.10	0.008	2	0.03	0.03	-0.001	0.000
4/17 2:11 p.m.	3.18		6.77	0.08	0.040	0	0.02	0.02	0.008	0.009
4/17 3:45 p.m.	4.75		6.78	*1.76	0.002	-1	*0.62	0.00	*0.152	0.002
4/18 8:20 a.m.	21.33		7.35	0.04	0.010	UR	0.02	0.01	0.003	0.005
4/18 11:30 a.m.	24.50		6.75	0.03	0.002	5	-0.01	-0.01	0.000	0.000

Filter #3

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/17 11:00 a.m.	0.00		6.78	0.10	0.008	2	0.02	0.02	0.004	-0.001
4/17 2:11 p.m.	3.18		6.77	0.08	0.040	0	0.01	0.00	0.007	0.003
4/17 3:45 p.m.	4.75		6.84	0.00	0.002	-1	0.00	0.00	0.007	0.004
4/18 8:20 a.m.	21.33		7.31	0.09	0.007	4	0.07	0.01	0.008	0.005
4/18 11:30 a.m.	24.50		6.79	0.02	0.005	1	0.00	0.00	-0.001	0.000

Notes:

F1 = T1 = 4 gpm/sf
F2 = T1 = 5 gpm/sf
F3 = T2 = 5 gpm/sf

	Fe (tot)	Fe (dissolved)
Well 3	0.06	0.02
Well 4	0.63	0.59

	Mn (tot)	Mn (dissolved)
Well 3	ND	ND
Well 4	0.055	0.058

Possible bad sample

* Sampling Error, not used for average.

H2Olson Engineering, Inc.

Town of Barnstable
Well 3 & 4 Pilot Study

Location: BFD Well 3 & 4
Filter Run: 2

Water Quality Sampling Log

Raw

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.		11.6	7.38	0.26	0.002	2	0.30	0.26	0.027	0.024
4/21 11:00 a.m.		14.8	7.44	0.04	0.003	-1	0.26	0.24	0.024	0.029
4/21 2:00 p.m.		13.8	7.60	0.27	0.007	1	0.25	0.22	0.024	0.032
4/22 8:45 a.m.		15.4	6.49	0.24	0.004	0	0.24	0.22	0.030	0.026
4/22 11:40 a.m.		N/A	6.29	0.12	0.007	6	0.24	0.21	0.020	0.024
4/22 2:30 p.m.		16.3	6.34	0.17	0.005	7	0.28	0.25	0.019	0.018
4/23 8:40 a.m.		15.4	7.00	0.07	0.004	4	0.24	0.21	0.019	0.021

Treated - Train 1

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.		11.5	6.96							
4/21 11:00 a.m.		13.3	7.36							
4/21 2:00 p.m.		13.7	7.54							
4/22 8:45 a.m.		13.6	6.99							
4/22 11:40 a.m.		12.4	6.88							
4/22 2:30 p.m.		N/A	7.11							
4/23 8:40 a.m.		15.3	7.07							

Treated - Train 2

Run / Date / Time		Temp C	pH S.U.	Free Cl2	Total CL2	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.		11.5	7.00	0.20	0.200					
4/21 11:00 a.m.		13.9	7.50	0.11	0.170					
4/21 2:00 p.m.		12.8	7.55	0.12	0.140					
4/22 8:45 a.m.		13.6	7.01	0.08	0.014					
4/22 11:40 a.m.		12.2	7.02	0.08	0.140					
4/22 2:30 p.m.		N/A	7.15	0.00	0.070					
4/23 8:40 a.m.		15.2	7.14	0.07	0.170					

Filter #1

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.	0.00	15.8	6.94	0.09	0.009	8	0.02	0.02	0.001	-0.004
4/21 11:00 a.m.	2.42	15.5	7.34	0.01	0.007	-2	0.02	0.01	0.006	0.007
4/21 2:00 p.m.	5.42	14.5	7.30	0.00	0.010	2	0.02	0.02	0.009	-0.002
4/22 8:45 a.m.	24.17	14.4	6.96	-0.10	0.004	-3	0.03	0.01	0.002	0.004
4/22 11:40 a.m.	27.08	N/A	6.99	-0.07	0.005	-2	0.02	0.01	0.000	0.000
4/22 2:30 p.m.	29.92	15	7.12	0.09	0.003	-3	0.01	0.01	0.000	0.002
4/23 8:40 a.m.	48.08	16	6.89	0.01	0.002	UR	0.02	0.02	-0.003	0.004

Filter #2

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.	0.00	15.1	6.99	0.06	0.017	UR	0.02	0.02	-0.003	-0.004
4/21 11:00 a.m.	2.42	15.2	7.39	-0.27	0.004	-2	0.01	0.01	-0.003	-0.004
4/21 2:00 p.m.	5.42	14.2	7.36	0.05	0.006	1	0.01	0.03	-0.001	0.002
4/22 8:45 a.m.	24.17	15.9	7.25	-0.05	0.003	-2	0.02	0.02	-0.001	0.002
4/22 11:40 a.m.	27.08	18.1	6.93	0.07	0.003	2	0.01	0.01	-0.004	-0.005
4/22 2:30 p.m.	29.92	15.2	7.07	0.03	0.002	-5	0.01	0.01	0.000	0.001
4/23 8:40 a.m.	48.08	16	6.97	0.02	0.004	-4	0.02	0.03	-0.003	-0.001

Filter #3

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/21 8:35 a.m.	0.00	14.6	7.00	0.05	0.009	0	0.02	0.02	0.000	0.007
4/21 11:00 a.m.	2.42	15.1	7.37	-0.24	0.004	-1	0.03	0.01	0.008	0.003
4/21 2:00 p.m.	5.42	14.7	7.33	0.02	0.009	-3	0.03	0.02	0.000	0.000
4/22 8:45 a.m.	24.17	15.8	6.94	-0.02	0.007	-2	0.01	0.01	0.000	-0.001
4/22 11:40 a.m.	27.08	18	6.99	0.06	0.004	2	0.01	0.01	-0.003	-0.004
4/22 2:30 p.m.	29.92	16.3	7.05	-0.03	0.002	-3	0.01	0.01	-0.001	0.000
4/23 8:40 a.m.	48.08	15.9	6.99	0.01	0.004	-2	0.01	0.03	0.003	0.000

Notes:

F1 = T1 = 4 gpm/sf
F2 = T2 = 5 gpm/sf
F3 = T2 = 4 gpm/sf

Turn on Chem Pumps @ 8:30 a.m.
Run to waste until 8:45 a.m.
Start FR#2 @ 8:45 a.m.

H2Olson Engineering, Inc.

Town of Barnstable
Well 3 & 4 Pilot Study

Location: BFD Well 3 & 4
Filter Run: 3

Water Quality Sampling Log

Raw

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.			6.14	0.71	0.009	3	0.33	0.22	0.017	0.019
4/23 1:30 p.m.			6.49	0.61	0.016	4	0.27	0.22	0.026	0.026
4/24 8:45 a.m.			6.44	0.06	0.005	0	0.27	0.24	0.021	0.020

Treated - Train 1

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.			7.11							
4/23 1:30 p.m.			6.68							
4/24 8:45 a.m.			7.09							

Treated - Train 2

Run / Date / Time		Temp C	pH S.U.	Free Cl2	Total CL2	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.			7.07	0.03	0.090					
4/23 1:30 p.m.			7.00	0.15	0.150					
4/24 8:45 a.m.			7.04	0.12	0.120					

Filter #1

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.	0.00		6.92	0.09	0.005	0	0.05	0.01	-0.004	-0.002
4/23 1:30 p.m.	2.75		6.81	0.05	0.006	-1	0.02	0.01	0.002	0.004
4/24 8:45 a.m.	22.00		7.05	-0.01	0.005	-4	0.02	0.01	0.001	0.000

Filter #2

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.	0.00		6.97	0.03	0.007	-5	0.02	0.02	-0.006	-0.006
4/23 1:30 p.m.	2.75		6.90	0.05	0.034	2	0.02	0.02	0.003	0.003
4/24 8:45 a.m.	22.00		7.00	0.04	0.006	4	0.01	0.01	0.003	0.001

Filter #3

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/23 10:45 a.m.	0.00		6.95	0.06	0.005	-4	0.03	0.05	-0.002	-0.002
4/23 1:30 p.m.	2.75		6.89	0.01	0.008	7	0.03	0.02	0.008	0.002
4/24 8:45 a.m.	22.00		7.01	-0.03	0.006	-3	0.00	0.01	0.001	0.002

Notes:

Adjusted Cl2 pump from 2 to 2.5%

Train 2

	Tot Cl2	Free Cl2
2:30 p.m.	0.34	0.31

F1 = T1 = 4 gpm/sf
F2 = T2 = 6 gpm/sf
F3 = T2 = 4 gpm/sf

H2Olson Engineering, Inc.

Town of Barnstable
Well 3 & 4 Pilot Study

Location: BFD Well 3 & 4
Filter Run: 4

Water Quality Sampling Log

Raw

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.			6.51	0.37	0.012	-4	0.22	0.18	0.023	0.020
4/24 2:00 p.m.			6.35	0.31	0.008	8	0.21	0.16	0.026	0.025
4/25 8:20 a.m.			6.42	0.07	0.008	7	0.23	0.21	0.025	0.024
4/25 1:30 p.m.			6.14	0.07	0.008	7	0.2	0.18	0.029	0.025

Treated - Train 1

Run / Date / Time		Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.			7.16							
4/24 2:00 p.m.			6.82							
4/25 8:20 a.m.			6.99							
4/25 1:30 p.m.			7.12							

Treated - Train 2

Run / Date / Time		Temp C	pH S.U.	Free Cl2	Total CL2	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.			6.99	0.06	0.11					
4/24 2:00 p.m.			6.81	0.13	0.19					
4/25 8:20 a.m.			7.12	0.13	0.16					
4/25 1:30 p.m.			7.05	0.13	0.15					

Filter #1

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.	0.00		6.99	0.12	0.003	4	0.01	0.01	0.008	0.005
4/24 2:00 p.m.	1.92		6.87	0.11	0.003	5	0.01	0	0.003	0.002
4/25 8:20 a.m.	20.25		7.04	0.13	0.002	5	0.02	0.01	0.003	0.003
4/25 1:30 p.m.	25.42		7.12	-0.14	0.005	1	0.03	0.02	0.003	0.005
4/26 4:20 p.m.										

Filter #2

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.	0.00		7.1	0.12	0.004	1	0.01	0.01	0.004	0.006
4/24 2:00 p.m.	1.92		6.95	0.05	0.007	6	0	-0.01	0.006	0.005
4/25 8:20 a.m.	20.25		7.16	0.1	0.003	-1	0.01	0.01	0.004	0.003
4/25 1:30 p.m.	25.42		7.09	-0.06	0.003	-2	0.03	0.01	0.003	0.002
4/26 4:20 p.m.			7.09				0.01	0.01		

Filter #3

Run / Date / Time	Time hrs	Temp C	pH S.U.	Turbidity NTU	UV-254 1/cm	Color (S.U.)	Fe (tot) mg/L	Fe (filt) mg/L	Mn (tot) mg/L	Mn (filt) mg/L
4/24 12:05 p.m.	0.00		7.05	0	0.004	3	0.01	0	0.005	0.006
4/24 2:00 p.m.	1.92		6.88	0.42	0.006	2	0.03	0.02	0.012	0.001
4/25 8:20 a.m.	20.25		7.16	0.08	0.004	-2	0.01	0.01	0.004	0.003
4/25 1:30 p.m.	25.42		7.07	0.01	0.004	10	0.02	0.02	0.003	0.002
4/26 4:20 p.m.			7.69				0.02	0.01		

Notes:

F1 = T1 = 4 gpm/sf
F2 = T1 = 6 gpm/sf
F3 = T2 = 4 gpm/sf

H2Olson Engineering, Inc.

Town of Barnstable
Well 3 & 4 Pilot Study
Barnstable Fire District
Laboratory Water Quality Results

Parameter	Run-1						Run-2					
	Raw	Treatment Train 1	Treatment Train 2	Filter 1	Filter 2	Filter 3	Raw	Treatment Train 1	Treatment Train 2	Filter 1	Filter 2	Filter 3
Total Metals												
Antimony, Total (mg/L)							ND			ND	ND	ND
Arsenic, Total (mg/L)							ND			ND	ND	ND
Barium, Total (mg/L)							0.0074			0.0123	0.0167	0.019
Beryllium, Total (mg/L)							ND			ND	ND	ND
Cadmium, Total (mg/L)							ND			ND	ND	ND
Calcium, Total (mg/L)							5.84			5.61	5.6	5.6
Chromium, Total (mg/L)							ND			ND	ND	ND
Iron, Total (mg/L)	0.304			ND	ND	ND	0.33			ND	ND	ND
Magnesium, Total (mg/L)							3.77			3.85	3.85	3.84
Manganese, Total (mg/L)	0.0214			ND	ND	ND	0.0178			ND	ND	ND
Mercury, Total (mg/L)							ND			ND	ND	ND
Nickel, Total (mg/L)							0.0045			ND	0.0025	0.0026
Potassium, Total (mg/L)							ND			43.4	36.3	37.7
Selenium, Total (mg/L)							ND			ND	ND	ND
Sodium, Total (mg/L)							18.2			18.6	18.8	18.8
Thallium, Total (mg/L)							ND			ND	ND	ND
General Chemistry												
Turbidity (NTU)	0.29			ND	0.2	ND	0.77			0.61	0.61	0.65
Color, Apparent (A.P.C.U.)	7			6	6	5	ND			5	5	ND
UV Absorbance @ 254 nm (Abs/cm)	0.005			0.006	ND	ND	ND			ND	ND	ND
Alkalinity, Total (mg CaCO3/L)	17.8			63.5	68.9	58.6	19			68.9	60.1	61.6
Carbon Dioxide (mg/L)	260			440	420	370	320			470	430	450
Fluoride (mg/L)							ND			ND	ND	ND
pH (H) (SU)	6.63	7.02	6.99	7.12	7	6.89	6.43	7	7.29	6.86	6.83	6.81
Nitrogen, Nitrite (mg/L)							ND			ND	ND	ND
Nitrogen, Nitrate (mg/L)							1.1			1.1	1.1	1.1
Total Organic Carbon (mg/L)	0.54			0.54	ND	ND	ND			0.502	0.585	0.52
Bacteria In Water												
Coliform, Total (col/100 mL)							Negative			Negative	Negative	Negative
Escherichia Coli (col/100 mL)							Negative			Negative	Negative	Negative
Anions by Ion Chromatography												
Chloride (mg/L)							28.1			28	28.4	28.4
Sulfate (mg/L)							10.6			10.4	10.4	10.5
Total Hardness by SM 2340B												
Hardness (mg/L)							30.1			29.8	29.8	29.8
PFAs by EPA 537.1												
Perfluorobutanesulfonic Acid (PFBS) (ng/L)							ND			ND	ND	ND
Perfluorohexanoic Acid (PFHxA) (ng/L)							ND			ND	ND	ND
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA) (ng/L)							ND			ND	ND	ND
Perfluoroheptanoic Acid (PFHpA) (ng/L)							ND			ND	ND	ND
Perfluorohexanesulfonic Acid (PFHxS) (ng/L)							ND			ND	ND	ND
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA) (ng/L)							ND			ND	ND	ND
Perfluorooctanoic Acid (PFOA) (ng/L)							ND			ND	ND	ND
Perfluorononanoic Acid (PFNA) (ng/L)							ND			ND	ND	ND
Perfluorooctanesulfonic Acid (PFOS) (ng/L)							3.50			4.37	3.92	4.12
Perfluorodecanoic Acid (PFDA) (ng/L)							ND			ND	ND	ND
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS) (ng/L)							ND			ND	ND	ND
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA) (ng/L)							ND			ND	ND	ND
Perfluoroundecanoic Acid (PFUnA) (ng/L)							ND			ND	ND	ND
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA) (ng/L)							ND			ND	ND	ND
Perfluorododecanoic Acid (PFDoA) (ng/L)							ND			ND	ND	ND
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS) (ng/L)							ND			ND	ND	ND
Perfluorotridecanoic Acid (PFTrDA) (ng/L)							ND			ND	ND	ND
Perfluorotetradecanoic Acid (PFTA) (ng/L)							ND			ND	ND	ND
PFAS, Total (6) (ng/L)							3.5			4.37	3.92	4.12

Town of Barnstable
Well 3 & 4 Pilot Study
Residuals Sampling Results

Parameter	Run-2 FBW Residuals	Run-2 FBW Supernatant
Total Metals		
Arsenic, Total (mg/L)	0.0047	
Barium, Total (mg/L)	0.0546	
Cadmium, Total (mg/L)	0.0005	
Chromium, Total (mg/L)	ND	
Iron, Total (mg/L)		0.172
Lead, Total (mg/L)	0.0066	
Manganese, Total (mg/L)		0.167
Mercury, Total (mg/L)	ND	
Selenium, Total (mg/L)	ND	
Silver, Total (mg/L)	ND	
General Chemistry		
Solids, Total Suspended (mg/L)	100	ND
pH (H) (SU)		6.68

FBW - Filter Backwash

H2Olson Engineering, Inc.

ANALYTICAL REPORT

Lab Number:	L2523741
Client:	H2Olson Engineering, Inc. 10 Riverside Drive, Suite 103 Lakeville, MA 02347
ATTN:	Stephen Olson
Phone:	(508) 375-7007
Project Name:	WELL 3&4 PILOT STUDY
Project Number:	127.25.01
Report Date:	04/28/25

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Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0826), IL (200077), IN (C-MA-03), KY (KY98045), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), OR (MA-1316), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #525-23-122-91930A1).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Lab Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2523741-01	R1-RW	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-02	R1-T1-F1	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-03	R1-T1-F2	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-04	R1-T2-F3	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-05	R1-T1-TRT	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25
L2523741-06	R1-T2-TRT	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/17/25 13:30	04/17/25

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Pace Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments and solids are reported on a dry weight basis unless otherwise noted. Tissues are reported "as received" or on a wet weight basis, unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Pace's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Pace Project Manager and made arrangements for Pace to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

Case Narrative (continued)

Total Organic Carbon

The WG2058429-4 MS recovery performed on L2523741-02 is outside the acceptance criteria for total organic carbon (117%); however, the associated LCS recovery is within criteria. No further action was taken.

Carbon Dioxide

The WG2055722-1 Laboratory Duplicate RPD performed on L2523741-01 is outside the acceptance criteria for carbon dioxide (42%) due to the non-homogeneous nature of the native sample.

Alkalinity, Total

The WG2055723-3 Laboratory Duplicate RPD performed on L2523741-01 is outside the acceptance criteria for alkalinity, total (18%) due to the non-homogeneous nature of the native sample.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:  Kelly Stenstrom

Title: Technical Director/Representative Date: 04/28/25

METALS

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2523741
Project Number: 127.25.01
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-01
Client ID: R1-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.304		mg/l	0.0500	--	1	04/22/25 12:55	04/28/25 15:38	EPA 3005A	19,200.7	JMF
Manganese, Total	0.0214		mg/l	0.0100	--	1	04/22/25 12:55	04/28/25 15:38	EPA 3005A	19,200.7	JMF

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2523741
Project Number: 127.25.01
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-02
Client ID: R1-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.0500	--	1	04/22/25 12:55	04/28/25 15:42	EPA 3005A	19,200.7	JMF
Manganese, Total	ND		mg/l	0.0100	--	1	04/22/25 12:55	04/28/25 15:42	EPA 3005A	19,200.7	JMF

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2523741
Project Number: 127.25.01
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-03
Client ID: R1-T1-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.0500	--	1	04/22/25 12:55	04/28/25 15:47	EPA 3005A	19,200.7	JMF
Manganese, Total	ND		mg/l	0.0100	--	1	04/22/25 12:55	04/28/25 15:47	EPA 3005A	19,200.7	JMF

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2523741
Project Number: 127.25.01
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-04
Client ID: R1-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	ND		mg/l	0.0500	--	1	04/22/25 12:55	04/28/25 15:51	EPA 3005A	19,200.7	JMF
Manganese, Total	ND		mg/l	0.0100	--	1	04/22/25 12:55	04/28/25 15:51	EPA 3005A	19,200.7	JMF

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG2056634-1										
Iron, Total	ND		mg/l	0.0500	--	1	04/22/25 12:55	04/23/25 11:06	19,200.7	CEY
Manganese, Total	ND		mg/l	0.0100	--	1	04/22/25 12:55	04/23/25 11:06	19,200.7	CEY

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG2056634-2								
Iron, Total	109		-		85-115	-		
Manganese, Total	107		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2056634-3 QC Sample: L2523388-01 Client ID: MS Sample												
Iron, Total	ND	1	1.12	112		-	-		75-125	-		20
Manganese, Total	0.0199	0.5	0.562	108		-	-		75-125	-		20

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2523741

Report Date: 04/28/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2056634-4 QC Sample: L2523388-01 Client ID: DUP Sample						
Iron, Total	ND	ND	mg/l	NC		20
Manganese, Total	0.0199	0.0195	mg/l	2		20

INORGANICS
&
MISCELLANEOUS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-01
Client ID: R1-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.29		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
Color, Apparent	7.0		A.P.C.U.	5.0	--	1	-	04/17/25 21:52	121,2120B	AAS
UV Absorbance @ 254nm	0.005		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
Alkalinity, Total	17.8		mg CaCO3/L	2.00	NA	1	-	04/18/25 10:54	121,2320B	MRM
Carbon Dioxide	260		mg/l	2.0	--	1	-	04/18/25 10:20	121,4500CO2-D	MRM
pH (H)	6.63		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS
Total Organic Carbon	0.540		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-02
Client ID: R1-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
Color, Apparent	6.0		A.P.C.U.	5.0	--	1	-	04/17/25 21:52	121,2120B	AAS
UV Absorbance @ 254nm	0.006		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
Alkalinity, Total	63.5		mg CaCO3/L	2.00	NA	1	-	04/18/25 10:55	121,2320B	MRM
Carbon Dioxide	440		mg/l	2.0	--	1	-	04/18/25 10:20	121,4500CO2-D	MRM
pH (H)	7.12		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS
Total Organic Carbon	0.540		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-03
Client ID: R1-T1-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.20		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
Color, Apparent	6.0		A.P.C.U.	5.0	--	1	-	04/17/25 21:52	121,2120B	AAS
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
Alkalinity, Total	68.9		mg CaCO3/L	2.00	NA	1	-	04/18/25 10:58	121,2320B	MRM
Carbon Dioxide	420		mg/l	2.0	--	1	-	04/18/25 10:20	121,4500CO2-D	MRM
pH (H)	7.00		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-04
Client ID: R1-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	ND		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
Color, Apparent	5.0		A.P.C.U.	5.0	--	1	-	04/17/25 21:52	121,2120B	AAS
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
Alkalinity, Total	58.6		mg CaCO3/L	2.00	NA	1	-	04/18/25 11:01	121,2320B	MRM
Carbon Dioxide	370		mg/l	2.0	--	1	-	04/18/25 10:20	121,4500CO2-D	MRM
pH (H)	6.89		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-05
Client ID: R1-T1-TRT
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
pH (H)	7.02		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

SAMPLE RESULTS

Lab ID: L2523741-06
Client ID: R1-T2-TRT
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/17/25 13:30
Date Received: 04/17/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
pH (H)	6.99		SU	-	NA	1	-	04/17/25 21:02	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2523741
Report Date: 04/28/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2055428-1										
Turbidity	ND		NTU	0.20	--	1	-	04/17/25 22:33	44,180.1	AAS
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2055723-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	04/18/25 10:25	121,2320B	MRM
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2055972-1										
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/19/25 05:15	121,5910B	DMO
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2058429-1										
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/25/25 03:45	121,5310C	DEW

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-06 Batch: WG2055418-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2055428-2								
Turbidity	91		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2055723-2								
Alkalinity, Total	104		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2055972-2								
UV Absorbance @ 254nm	78		-			-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2058429-2								
Total Organic Carbon	101		-		90-110	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055723-4 QC Sample: L2523741-01 Client ID: R1-RW												
Alkalinity, Total	17.8	100	125	107		-	-		86-116	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2058429-4 QC Sample: L2523741-02 Client ID: R1-T1-F1												
Total Organic Carbon	0.540	16	19.3	**117**	Q	-	-		85-115	-		15

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2523741

Report Date: 04/28/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-06 QC Batch ID: WG2055418-2 QC Sample: L2523899-03 Client ID: DUP Sample						
pH	7.10	7.08	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055422-1 QC Sample: L2523741-04 Client ID: R1-T2-F3						
Color, Apparent	5.0	5.0	A.P.C.U.	0		
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055428-3 QC Sample: L2523923-01 Client ID: DUP Sample						
Turbidity	15	15	NTU	0		13
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055722-1 QC Sample: L2523741-01 Client ID: R1-RW						
Carbon Dioxide	260	400	mg/l	**42**	Q	26
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055723-3 QC Sample: L2523741-01 Client ID: R1-RW						
Alkalinity, Total	17.8	21.4	mg CaCO3/L	**18**	Q	10
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2055972-3 QC Sample: L2523741-04 Client ID: R1-T2-F3						
UV Absorbance @ 254nm	ND	ND	Abs/cm	NC		
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2058429-3 QC Sample: L2523741-01 Client ID: R1-RW						
Total Organic Carbon	0.540	ND	mg/l	NC		15

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2523741-01A	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-01B	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-01C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-01D	Plastic 120ml unpreserved	A	7	7	4.5	Y	Absent		TURB-180(2)
L2523741-01E	Plastic 250ml HNO3 preserved	A	<2	<2	4.5	Y	Absent		FE-UI(180),MN-UI(180)
L2523741-01F	Plastic 500ml unpreserved/No Headspace	A	NA		4.5	Y	Absent		ALK-T-2320(14),CO2(1)
L2523741-01G	Amber 500ml unpreserved	A	7	7	4.5	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2523741-02A	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-02B	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-02C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-02D	Plastic 120ml unpreserved	A	7	7	4.5	Y	Absent		TURB-180(2)
L2523741-02E	Plastic 250ml HNO3 preserved	A	<2	<2	4.5	Y	Absent		FE-UI(180),MN-UI(180)
L2523741-02F	Plastic 500ml unpreserved/No Headspace	A	NA		4.5	Y	Absent		ALK-T-2320(14),CO2(1)
L2523741-02G	Amber 500ml unpreserved	A	7	7	4.5	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2523741-03A	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-03B	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-03C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-03D	Plastic 120ml unpreserved	A	7	7	4.5	Y	Absent		TURB-180(2)
L2523741-03E	Plastic 250ml HNO3 preserved	A	<2	<2	4.5	Y	Absent		FE-UI(180),MN-UI(180)
L2523741-03F	Plastic 500ml unpreserved/No Headspace	A	NA		4.5	Y	Absent		ALK-T-2320(14),CO2(1)
L2523741-03G	Amber 500ml unpreserved	A	7	7	4.5	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2523741-04A	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)
L2523741-04B	Vial H2SO4 preserved	A	NA		4.5	Y	Absent		TOC-5310(28)

*Values in parentheses indicate holding time in days

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2523741
Report Date: 04/28/25

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2523741-04C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-04D	Plastic 120ml unpreserved	A	7	7	4.5	Y	Absent		TURB-180(2)
L2523741-04E	Plastic 250ml HNO3 preserved	A	<2	<2	4.5	Y	Absent		FE-UI(180),MN-UI(180)
L2523741-04F	Plastic 500ml unpreserved/No Headspace	A	NA		4.5	Y	Absent		ALK-T-2320(14),CO2(1)
L2523741-04G	Amber 500ml unpreserved	A	7	7	4.5	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2523741-05C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)
L2523741-06C	Plastic 60ml unpreserved	A	7	7	4.5	Y	Absent		PH-4500(.01)

*Values in parentheses indicate holding time in days

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: Data Usability Report

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

Report Format: Data Usability Report

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2523741
Project Number:	127.25.01	**Report Date:**	04/28/25

Data Qualifiers

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

REFERENCES

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

MCL References

The following links provide the most up-to-date Maximum Contaminant Levels (MCL) or Maximum Residual Disinfectant Levels (MRDL) from the EPA's National Primary Drinking Water Regulations (NPDWR) and the MassDEP's Drinking Water Standards and Guidelines.

EPA

https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

MassDEP

https://www.mass.gov/guides/drinking-water-standards-and-guidelines

LIMITATION OF LIABILITIES

Pace Analytical Services performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Pace Analytical Services shall be to re-perform the work at it's own expense. In no event shall Pace Analytical Services be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Pace Analytical Services.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581
EPA 624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625.1: alpha-Terpineol
EPA 8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol, Azobenzene; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
SM 2540D: TSS.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
MADEP-APH.
Nonpotable Water: EPA RSK-175 Dissolved Gases
Biological Tissue Matrix: EPA 3050B

Mansfield Facility – 120 Forbes Blvd. Mansfield, MA 02048
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Nonpotable Water: EPA RSK-175 Dissolved Gases

The following test method is not included in our New Jersey Secondary NELAP Scope of Accreditation:

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (via Alpha SOP 23528)

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 524.2: THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables).
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

Certification IDs:

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581
CT PH-0826, IL 200077, IN C-MA-03, KY JY98045, ME MA00086, MD 348, MA M-MA086, NH 2064, NJ MA935, NY 11148, NC (DW) 25700, NC (NPW/SCM) 666, OR MA-1316, PA 68-03671, RI LAO00065, TX T104704476, VT VT-0935, VA 460195

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
CT PH-0825, ANAB/DoD L2474, IL 200081, IN C-MA-04, KY KY98046, LA 3090, ME MA00030, MI 9110, MN 025-999-495, NH 2062, NJ MA015, NY 11627, NC (NPW/SCM) 685, OR MA-0262, PA 68-02089, RI LAO00299, TX T-104704419, VT VT-0015, VA 460194, WA C954

Mansfield Facility – 120 Forbes Blvd. Mansfield, MA 02048
ANAB/DoD L2474, ME MA01156, MN 025-999-498, NH 2249, NJ MA025, NY 12191, OR 4203, TX T104704583, VA 460311, WA C1104.

For a complete listing of analytes and methods, please contact your Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 4/17/25

ALPHA Job #: L2523741

ALPHA ANALYTICAL
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Client Information

Client: H2Olson Engineering, Inc.
Address: 10 Riverside Dr, Suite 103, Lakeville, MA 02347
Phone: 508-375-7067
Email: sco@h2olsonengineering.com

Project Information

Project Name: Well 3 & 4 pilot study
Project Location: 1680 Bayannough Rd, Barnstable, MA
Project #: 12725.01
Project Manager: Stephen C. Olson, P.E.
ALPHA Quote #:

Report Information - Data Deliverables

☐ ADEx ☑ EMAIL

Billing Information

☑ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☑ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☑ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☑ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☑ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved)
Date Due:

Additional Project Information:

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH - ☐ Quant Only ☐ Fingerprint
Turbidity, Alkalinity
Total Metals, Fe, Mn
Color, UV-245
TOC
PH
CO2

SAMPLE INFO

Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

Sample Comments

TOTAL # BOTTLES

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials
23741-01	R1-RW	4/17	1:30 pm	DW	RAT
-02	R1-T1-F1	4/17	1:30 pm	DW	RAT
-03	R1-T1-F2	4/17	1:30 pm	DW	RAT
-04	R1-T2-F3	4/17	1:30 pm	DW	RAT
-05	R1-T1-TRT	4/17	1:30 pm	DW	RAT
-06	R1-T2-TRT	4/17	1:30 pm	DW	RAT

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Container Type																							
Preservative																							

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	4/17/25 1336	[signature] ML	4/17 13:56
[signature] ML	4/17 18:30		4/17/25 1830

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

ANALYTICAL REPORT

Lab Number:	L2524631
Client:	H2Olson Engineering, Inc. 10 Riverside Drive, Suite 103 Lakeville, MA 02347
ATTN:	Stephen Olson
Phone:	(508) 375-7007
Project Name:	WELL 3&4 PILOT STUDY
Project Number:	127.25.01
Report Date:	05/07/25

The original project report/data package is held by Pace Analytical Services. This report/data package is paginated and should be reproduced only in its entirety. Pace Analytical Services holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0826), IL (200077), IN (C-MA-03), KY (KY98045), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), OR (MA-1316), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #525-23-122-91930A1).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Lab Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2524631-01	R2-RW	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-02	R2-T1-F1	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-03	R2-T2-F2	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-04	R2-T2-F3	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-05	R2-T1-TRT	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-06	R2-T2-TRT	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-07	R1-BW-RES	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25
L2524631-08	R1-BW-SUP	DW	1680 B LAYANNOUGH RD, BARNSTABLE, MA	04/22/25 11:30	04/22/25

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Pace Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments and solids are reported on a dry weight basis unless otherwise noted. Tissues are reported "as received" or on a wet weight basis, unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Pace's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Pace Project Manager and made arrangements for Pace to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Case Narrative (continued)

Report Submission

May 07, 2025: This final report includes the results of all requested analyses.

May 07, 2025: This is a preliminary report.

The analyses of Volatile Organics and Asbestos were subcontracted. Copies of the laboratory reports are included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

Sample Receipt

L2524631-01, -02, -03, and -04: The analysis of Subcontract Perchlorate by 331 was requested on the Chain of Custody; however, sample containers were not received. This was verified by the client.

Perfluorinated Alkyl Acids by EPA 537.1

L2524631-04R and WG2061152-2R: The sample was re-analyzed due to QC failures in the original analysis. The results of the re-analysis are reported.

Total Metals

L2524631-01: The sample has an elevated detection limit for chromium due to the prep dilution required by the limited sample volume available for digestion.

The WG2060685-1 Method Blank associated with L2524631-02, -03, -04, and -07 has a concentration above the reporting limit for Chromium. Since the associated sample concentrations are either greater than 10x the blank concentration or non-detect to the RL for this target analyte, no corrective action is required. Any results detected below the reporting limit are qualified with a "B".

The WG2060686-3 MS recovery performed on L2524631-01 is outside the acceptance criteria for potassium (129%). A post digestion spike was performed and was within acceptance criteria.

The WG2060685-4 Laboratory Duplicate RPD performed on L2524631-01 is outside the acceptance criteria for nickel (41%) due to the non-homogeneous nature of the native sample.

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Case Narrative (continued)

The WG2060686-4 Laboratory Duplicate RPD performed on L2524631-01 is outside the acceptance criteria for iron (21%) due to the non-homogeneous nature of the native sample.

Fluoride

WG2060376: An LCS/LCSD was performed in lieu of a Matrix Spike and Laboratory Duplicate due to insufficient sample volume available for analysis.

Anions by Ion Chromatography

The WG2060381-3 MS recovery performed on L2524631-01 does not apply for chloride (76%) because the sample concentration is greater than four times the spike amount added.

Carbon Dioxide

The WG2057496-1 Laboratory Duplicate RPD performed on L2524631-01 is outside the acceptance criteria for carbon dioxide (29%) due to the non-homogeneous nature of the native sample.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Tiffani Morrissey - Tiffani Morrissey

Title: Technical Director/Representative Date: 05/07/25

ORGANICS

SEMIVOLATILES

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-01
Client ID: R2-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 05/04/25 18:44
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--	1
Perfluorooctanesulfonic Acid (PFOS)	3.50		ng/l	2.00	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--	1
PFAS, Total (6)	3.50		ng/l	2.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	98		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	82		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	111		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	93		70-130

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-02
Client ID: R2-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 05/04/25 18:52
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--	1
Perfluorooctanesulfonic Acid (PFOS)	4.37		ng/l	2.00	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--	1
PFAS, Total (6)	4.37		ng/l	2.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	87		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	74		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	100		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	98		70-130

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-03
Client ID: R2-T2-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 05/04/25 19:30
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--	1
Perfluorooctanesulfonic Acid (PFOS)	3.92		ng/l	2.00	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--	1
PFAS, Total (6)	3.92		ng/l	2.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	98		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	80		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	116		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	96		70-130

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-04 R
Client ID: R2-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw
Analytical Method: 133,537.1
Analytical Date: 05/04/25 21:09
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab						
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--	1
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--	1
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--	1
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--	1
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--	1
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--	1
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--	1
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--	1
Perfluorooctanesulfonic Acid (PFOS)	4.12		ng/l	2.00	--	1
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--	1
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--	1
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--	1
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--	1
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--	1
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--	1
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--	1
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--	1
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--	1
PFAS, Total (6)	4.12		ng/l	2.00	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	85		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	73		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	109		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	102		70-130

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

Method Blank Analysis
Batch Quality Control

Analytical Method: 133,537.1
Analytical Date: 05/04/25 16:58
Analyst: RSB

Extraction Method: EPA 537.1
Extraction Date: 05/01/25 11:22

Parameter	Result	Qualifier	Units	RL	MDL
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab for sample(s): 01-04 Batch: WG2061152-1					
Perfluorobutanesulfonic Acid (PFBS)	ND		ng/l	2.00	--
Perfluorohexanoic Acid (PFHxA)	ND		ng/l	2.00	--
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ND		ng/l	2.00	--
Perfluoroheptanoic Acid (PFHpA)	ND		ng/l	2.00	--
Perfluorohexanesulfonic Acid (PFHxS)	ND		ng/l	2.00	--
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND		ng/l	2.00	--
Perfluorooctanoic Acid (PFOA)	ND		ng/l	2.00	--
Perfluorononanoic Acid (PFNA)	ND		ng/l	2.00	--
Perfluorooctanesulfonic Acid (PFOS)	ND		ng/l	2.00	--
Perfluorodecanoic Acid (PFDA)	ND		ng/l	2.00	--
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND		ng/l	2.00	--
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND		ng/l	2.00	--
Perfluoroundecanoic Acid (PFUnA)	ND		ng/l	2.00	--
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND		ng/l	2.00	--
Perfluorododecanoic Acid (PFDoA)	ND		ng/l	2.00	--
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND		ng/l	2.00	--
Perfluorotridecanoic Acid (PFTrDA)	ND		ng/l	2.00	--
Perfluorotetradecanoic Acid (PFTA)	ND		ng/l	2.00	--
PFAS, Total (6)	ND		ng/l	2.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	96		70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	74		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	100		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	91		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 Batch: WG2061152-2								
Perfluorobutanesulfonic Acid (PFBS)	79		-		70-130	-		30
Perfluorohexanoic Acid (PFHxA)	82		-		70-130	-		30
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	76		-		70-130	-		30
Perfluoroheptanoic Acid (PFHpA)	90		-		70-130	-		30
Perfluorohexanesulfonic Acid (PFHxS)	73		-		70-130	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	95		-		70-130	-		30
Perfluorooctanoic Acid (PFOA)	80		-		70-130	-		30
Perfluorononanoic Acid (PFNA)	99		-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	73		-		70-130	-		30
Perfluorodecanoic Acid (PFDA)	102		-		70-130	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	71		-		70-130	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	82		-		70-130	-		30
Perfluoroundecanoic Acid (PFUnA)	101		-		70-130	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	88		-		70-130	-		30
Perfluorododecanoic Acid (PFDoA)	104		-		70-130	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	73		-		70-130	-		30
Perfluorotridecanoic Acid (PFTrDA)	110		-		70-130	-		30
Perfluorotetradecanoic Acid (PFTA)	116		-		70-130	-		30

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 Batch: WG2061152-2								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	86				70-130
Tetrafluoro-2-heptafluoropropoxy-[13C3]-propanoic acid (13C3-HFPO-DA)	78				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	94				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	92				70-130

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2061152-3 QC Sample: L2524345-01 Client ID: MS Sample												
Perfluorobutanesulfonic Acid (PFBS)	ND	34.8	33.7	97		-	-		70-130	-		30
Perfluorohexanoic Acid (PFHxA)	ND	39.2	34.9	89		-	-		70-130	-		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	39.2	30.2	77		-	-		70-130	-		30
Perfluoroheptanoic Acid (PFHpA)	ND	39.2	39.1	100		-	-		70-130	-		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	35.8	33.6	94		-	-		70-130	-		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	37	37.0	100		-	-		70-130	-		30
Perfluorooctanoic Acid (PFOA)	ND	39.2	34.4	88		-	-		70-130	-		30
Perfluorononanoic Acid (PFNA)	ND	39.2	39.1	100		-	-		70-130	-		30
Perfluorooctanesulfonic Acid (PFOS)	ND	36.4	31.4	86		-	-		70-130	-		30
Perfluorodecanoic Acid (PFDA)	ND	39.2	39.0	99		-	-		70-130	-		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	36.6	34.6	95		-	-		70-130	-		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	39.2	36.7	94		-	-		70-130	-		30
Perfluoroundecanoic Acid (PFUnA)	ND	39.2	41.5	106		-	-		70-130	-		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	39.2	33.9	86		-	-		70-130	-		30
Perfluorododecanoic Acid (PFDoA)	ND	39.2	40.8	104		-	-		70-130	-		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	37	33.2	90		-	-		70-130	-		30
Perfluorotridecanoic Acid (PFTrDA)	ND	39.2	42.5	108		-	-		70-130	-		30
Perfluorotetradecanoic Acid (PFTA)	ND	39.2	43.2	110		-	-		70-130	-		30

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2061152-3 QC Sample: L2524345-01 Client ID: MS Sample												

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	81				70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	101				70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	97				70-130
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	88				70-130

Lab Duplicate Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2061152-4 QC Sample: L2524345-02 Client ID: DUP Sample						
Perfluorobutanesulfonic Acid (PFBS)	ND	ND	ng/l	NC		30
Perfluorohexanoic Acid (PFHxA)	ND	ND	ng/l	NC		30
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	ND	ND	ng/l	NC		30
Perfluoroheptanoic Acid (PFHpA)	ND	ND	ng/l	NC		30
Perfluorohexanesulfonic Acid (PFHxS)	ND	ND	ng/l	NC		30
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	ND	ND	ng/l	NC		30
Perfluorooctanoic Acid (PFOA)	ND	ND	ng/l	NC		30
Perfluorononanoic Acid (PFNA)	ND	ND	ng/l	NC		30
Perfluorooctanesulfonic Acid (PFOS)	ND	ND	ng/l	NC		30
Perfluorodecanoic Acid (PFDA)	ND	ND	ng/l	NC		30
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	ND	ND	ng/l	NC		30
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND	ND	ng/l	NC		30
Perfluoroundecanoic Acid (PFUnA)	ND	ND	ng/l	NC		30
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND	ND	ng/l	NC		30
Perfluorododecanoic Acid (PFDoA)	ND	ND	ng/l	NC		30
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	ND	ND	ng/l	NC		30
Perfluorotridecanoic Acid (PFTrDA)	ND	ND	ng/l	NC		30
Perfluorotetradecanoic Acid (PFTA)	ND	ND	ng/l	NC		30

Lab Duplicate Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits

Perfluorinated Alkyl Acids by EPA 537.1 - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2061152-4 QC Sample: L2524345-02 Client ID: DUP Sample

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
Perfluoro-n-[1,2-13C2]hexanoic Acid (13C-PFHxA)	84		84		70-130
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-13C3-Propanoic Acid (M3HFPO-DA)	78		75		70-130
Perfluoro-n-[1,2-13C2]decanoic Acid (13C-PFDA)	93		91		70-130
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d5-NEtFOSAA)	89		103		70-130

METALS

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-01
Client ID: R2-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Barium, Total	0.0074		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Calcium, Total	5.84		mg/l	0.100	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Chromium, Total	ND		mg/l	0.0020	--	1	05/01/25 12:15	05/01/25 20:14	EPA 3005A	3,200.8	BLR
Iron, Total	0.330		mg/l	0.0500	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Magnesium, Total	3.77		mg/l	0.100	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Manganese, Total	0.0178		mg/l	0.0100	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 15:43	EPA 245.1	3,245.1	CME
Nickel, Total	0.0045		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Potassium, Total	ND		mg/l	2.50	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Sodium, Total	18.2		mg/l	2.00	--	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:00	EPA 3005A	3,200.8	BLR
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	30.1		mg/l	0.660	NA	1	04/30/25 12:40	05/02/25 08:08	EPA 3005A	19,200.7	DMC

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-02
Client ID: R2-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Barium, Total	0.0123		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Calcium, Total	5.61		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Chromium, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Iron, Total	ND		mg/l	0.0500	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Magnesium, Total	3.85		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Manganese, Total	ND		mg/l	0.0100	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 15:53	EPA 245.1	3,245.1	CME
Nickel, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Potassium, Total	43.4		mg/l	2.50	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Sodium, Total	18.6		mg/l	2.00	--	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:31	EPA 3005A	3,200.8	BLR
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	29.8		mg/l	0.660	NA	1	04/30/25 12:40	05/03/25 17:22	EPA 3005A	19,200.7	EFM

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-03
Client ID: R2-T2-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Barium, Total	0.0167		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Calcium, Total	5.60		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Chromium, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Iron, Total	ND		mg/l	0.0500	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Magnesium, Total	3.85		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Manganese, Total	ND		mg/l	0.0100	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 15:56	EPA 245.1	3,245.1	CME
Nickel, Total	0.0025		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Potassium, Total	36.3		mg/l	2.50	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Sodium, Total	18.8		mg/l	2.00	--	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:35	EPA 3005A	3,200.8	BLR
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	29.8		mg/l	0.660	NA	1	04/30/25 12:40	05/03/25 17:26	EPA 3005A	19,200.7	EFM

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-04
Client ID: R2-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Barium, Total	0.0190		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Calcium, Total	5.60		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Chromium, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Iron, Total	ND		mg/l	0.0500	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Magnesium, Total	3.84		mg/l	0.100	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Manganese, Total	ND		mg/l	0.0100	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 16:06	EPA 245.1	3,245.1	CME
Nickel, Total	0.0026		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Potassium, Total	37.7		mg/l	2.50	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Sodium, Total	18.8		mg/l	2.00	--	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:38	EPA 3005A	3,200.8	BLR
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	29.8		mg/l	0.660	NA	1	04/30/25 12:40	05/03/25 16:31	EPA 3005A	19,200.7	EFM

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-07
Client ID: R1-BW-RES
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Arsenic, Total	0.0047		mg/l	0.0010	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Barium, Total	0.0546		mg/l	0.0010	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Cadmium, Total	0.0005		mg/l	0.0002	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Chromium, Total	ND		mg/l	0.0020	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Lead, Total	0.0066		mg/l	0.0010	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 16:09	EPA 245.1	3,245.1	CME
Selenium, Total	ND		mg/l	0.0050	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR
Silver, Total	ND		mg/l	0.0004	--	1	05/01/25 09:18	05/01/25 16:02	EPA 3005A	3,200.8	BLR

Project Name: WELL 3&4 PILOT STUDY
Lab Number: L2524631
Project Number: 127.25.01
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-08
Client ID: R1-BW-SUP
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Iron, Total	0.172		mg/l	0.0500	--	1	05/01/25 16:35	05/01/25 22:24	EPA 3005A	19,200.7	JTS
Manganese, Total	0.167		mg/l	0.0100	--	1	05/01/25 16:35	05/01/25 22:24	EPA 3005A	19,200.7	JTS

Project Name: WELL 3&4 PILOT STUDY **Lab Number:** L2524631

Project Number: 127.25.01 **Report Date:** 05/07/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04,07 Batch: WG2060685-1										
Antimony, Total	ND		mg/l	0.0040	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Arsenic, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Barium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Beryllium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Cadmium, Total	ND		mg/l	0.0002	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Chromium, Total	0.0041		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Lead, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Nickel, Total	ND		mg/l	0.0020	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Selenium, Total	ND		mg/l	0.0050	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Silver, Total	ND		mg/l	0.0004	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR
Thallium, Total	ND		mg/l	0.0010	--	1	04/30/25 12:40	05/01/25 10:24	3,200.8	BLR

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04 Batch: WG2060686-1										
Calcium, Total	ND		mg/l	0.100	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Iron, Total	ND		mg/l	0.0500	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Magnesium, Total	ND		mg/l	0.100	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Manganese, Total	ND		mg/l	0.0100	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Potassium, Total	ND		mg/l	2.50	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC
Sodium, Total	ND		mg/l	2.00	--	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC

Prep Information

Digestion Method: EPA 3005A

Project Name: WELL 3&4 PILOT STUDY **Lab Number:** L2524631

Project Number: 127.25.01 **Report Date:** 05/07/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab for sample(s): 01-04 Batch: WG2060686-1										
Hardness	ND		mg/l	0.660	NA	1	04/30/25 12:40	05/02/25 07:37	19,200.7	DMC

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01-04,07 Batch: WG2061054-1										
Mercury, Total	ND		mg/l	0.0002	--	1	05/01/25 10:04	05/04/25 15:36	3,245.1	CME

Prep Information

Digestion Method: EPA 245.1

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG2061179-1										
Chromium, Total	ND		mg/l	0.0010	--	1	05/01/25 12:15	05/01/25 19:56	3,200.8	BLR

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 08 Batch: WG2061276-1										
Iron, Total	ND		mg/l	0.0500	--	1	05/01/25 16:35	05/01/25 22:17	19,200.7	JTS
Manganese, Total	ND		mg/l	0.0100	--	1	05/01/25 16:35	05/01/25 22:17	19,200.7	JTS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

Method Blank Analysis
Batch Quality Control

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 Batch: WG2060685-2								
Antimony, Total	96		-		85-115	-		
Arsenic, Total	94		-		85-115	-		
Barium, Total	103		-		85-115	-		
Beryllium, Total	98		-		85-115	-		
Cadmium, Total	104		-		85-115	-		
Chromium, Total	97		-		85-115	-		
Lead, Total	98		-		85-115	-		
Nickel, Total	101		-		85-115	-		
Selenium, Total	104		-		85-115	-		
Silver, Total	101		-		85-115	-		
Thallium, Total	100		-		85-115	-		
Total Metals - Mansfield Lab Associated sample(s): 01-04 Batch: WG2060686-2								
Calcium, Total	109		-		85-115	-		
Iron, Total	112		-		85-115	-		
Magnesium, Total	105		-		85-115	-		
Manganese, Total	111		-		85-115	-		
Potassium, Total	114		-		85-115	-		
Sodium, Total	111		-		85-115	-		

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01-04 Batch: WG2060686-2					
Hardness	107	-	85-115	-	
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 Batch: WG2061054-2					
Mercury, Total	102	-	85-115	-	
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG2061179-2					
Chromium, Total	92	-	85-115	-	
Total Metals - Mansfield Lab Associated sample(s): 08 Batch: WG2061276-2					
Iron, Total	104	-	85-115	-	
Manganese, Total	101	-	85-115	-	

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2060685-3 QC Sample: L2524631-01 Client ID: R2-RW												
Antimony, Total	ND	0.5	0.4831	97		-	-		70-130	-		20
Arsenic, Total	ND	0.12	0.1197	100		-	-		70-130	-		20
Barium, Total	0.0074	2	2.063	103		-	-		70-130	-		20
Beryllium, Total	ND	0.05	0.0488	98		-	-		70-130	-		20
Cadmium, Total	ND	0.053	0.0546	103		-	-		70-130	-		20
Lead, Total	ND	0.53	0.5288	100		-	-		70-130	-		20
Nickel, Total	0.0045	0.5	0.5161	102		-	-		70-130	-		20
Selenium, Total	ND	0.12	0.1281	107		-	-		70-130	-		20
Silver, Total	ND	0.05	0.0503	101		-	-		70-130	-		20
Thallium, Total	ND	0.12	0.1223	102		-	-		70-130	-		20

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery		MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2060685-5 QC Sample: L2524631-07 Client ID: R1-BW-RES										
Antimony, Total	ND	0.5	0.5072	101		-	-	70-130	-	20
Arsenic, Total	0.0047	0.12	0.1200	96		-	-	70-130	-	20
Barium, Total	0.0546	2	2.090	102		-	-	70-130	-	20
Beryllium, Total	ND	0.05	0.0456	91		-	-	70-130	-	20
Cadmium, Total	0.0005	0.053	0.0542	101		-	-	70-130	-	20
Chromium, Total	ND	0.2	0.1924	96		-	-	70-130	-	20
Lead, Total	0.0066	0.53	0.5234	98		-	-	70-130	-	20
Nickel, Total	0.0136	0.5	0.4964	96		-	-	70-130	-	20
Selenium, Total	ND	0.12	0.1261	105		-	-	70-130	-	20
Silver, Total	ND	0.05	0.0504	101		-	-	70-130	-	20
Thallium, Total	ND	0.12	0.1139	95		-	-	70-130	-	20
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2060686-3 QC Sample: L2524631-01 Client ID: R2-RW										
Calcium, Total	5.84	10	15.6	98		-	-	75-125	-	20
Iron, Total	0.330	1	1.28	95		-	-	75-125	-	20
Magnesium, Total	3.77	10	14.2	104		-	-	75-125	-	20
Manganese, Total	0.0178	0.5	0.521	101		-	-	75-125	-	20
Potassium, Total	ND	10	12.9	**129**	Q	-	-	75-125	-	20
Sodium, Total	18.2	10	28.0	98		-	-	75-125	-	20
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2060686-3 QC Sample: L2524631-01 Client ID: R2-RW										
Hardness	30.1	66.2	97.2	101		-	-	75-125	-	20

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	MSD Found	MSD %Recovery	Recovery Limits	RPD	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2061054-3 QC Sample: L2524631-01 Client ID: R2-RW									
Mercury, Total	ND	0.005	0.0048	97	-	-	70-130	-	20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG2061179-3 QC Sample: L2525763-01 Client ID: MS Sample									
Chromium, Total	ND	0.2	0.1968	98	-	-	70-130	-	20
Total Metals - Mansfield Lab Associated sample(s): 08 QC Batch ID: WG2061276-3 QC Sample: L2524631-08 Client ID: R1-BW-SUP									
Iron, Total	0.172	1	1.18	101	-	-	75-125	-	20
Manganese, Total	0.167	0.5	0.652	97	-	-	75-125	-	20
Total Metals - Mansfield Lab Associated sample(s): 08 QC Batch ID: WG2061276-7 QC Sample: L2524677-01 Client ID: MS Sample									
Iron, Total	ND	1	1.01	101	-	-	75-125	-	20
Manganese, Total	ND	0.5	0.487	97	-	-	75-125	-	20

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2524631

Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2060685-4 QC Sample: L2524631-01 Client ID: R2-RW						
Antimony, Total	ND	ND	mg/l	NC		20
Arsenic, Total	ND	ND	mg/l	NC		20
Barium, Total	0.0074	0.0074	mg/l	0		20
Beryllium, Total	ND	ND	mg/l	NC		20
Cadmium, Total	ND	ND	mg/l	NC		20
Nickel, Total	0.0045	0.0029	mg/l	**41**	Q	20
Selenium, Total	ND	ND	mg/l	NC		20
Thallium, Total	ND	ND	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2060685-6 QC Sample: L2524631-07 Client ID: R1-BW-RES						
Arsenic, Total	0.0047	0.0052	mg/l	10		20
Barium, Total	0.0546	0.0560	mg/l	3		20
Cadmium, Total	0.0005	0.0005	mg/l	2		20
Chromium, Total	ND	ND	mg/l	NC		20
Lead, Total	0.0066	0.0070	mg/l	6		20
Selenium, Total	ND	ND	mg/l	NC		20
Silver, Total	ND	ND	mg/l	NC		20

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2524631

Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD		RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2060686-4 QC Sample: L2524631-01 Client ID: R2-RW						
Calcium, Total	5.84	5.88	mg/l	1		20
Iron, Total	0.330	0.268	mg/l	**21**	Q	20
Magnesium, Total	3.77	3.72	mg/l	1		20
Manganese, Total	0.0178	0.0181	mg/l	2		20
Potassium, Total	ND	ND	mg/l	NC		20
Sodium, Total	18.2	18.4	mg/l	1		20
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG2060686-4 QC Sample: L2524631-01 Client ID: R2-RW						
Hardness	30.1	30.0	mg/l	0		20
Total Metals - Mansfield Lab Associated sample(s): 01-04,07 QC Batch ID: WG2061054-4 QC Sample: L2524631-01 Client ID: R2-RW						
Mercury, Total	ND	ND	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 08 QC Batch ID: WG2061276-4 QC Sample: L2524631-08 Client ID: R1-BW-SUP						
Iron, Total	0.172	0.168	mg/l	2		20
Manganese, Total	0.167	0.164	mg/l	2		20

INORGANICS
&
MISCELLANEOUS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-01
Client ID: R2-RW
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.77		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
Color, Apparent	ND		A.P.C.U.	5.0	--	1	-	04/23/25 01:40	121,2120B	CAR
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
Alkalinity, Total	19.0		mg CaCO3/L	2.00	NA	1	-	04/23/25 12:06	121,2320B	MKT
Carbon Dioxide	320		mg/l	2.0	--	1	-	04/23/25 08:17	121,4500CO2-D	MRM
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
pH (H)	6.43		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 09:36	44,353.2	MRM
Nitrogen, Nitrate	1.1		mg/l	0.10	--	1	-	04/23/25 09:36	44,353.2	MRM
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/28/25 13:20	121,5310C	DEW
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Anions by Ion Chromatography - Westborough Lab										
Chloride	28.1		mg/l	0.500	--	1	-	04/29/25 19:46	44,300.0	AVT
Sulfate	10.6		mg/l	1.00	--	1	-	04/29/25 19:46	44,300.0	AVT

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-02
Client ID: R2-T1-F1
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.61		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
Color, Apparent	5.0		A.P.C.U.	5.0	--	1	-	04/23/25 01:40	121,2120B	CAR
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
Alkalinity, Total	68.9		mg CaCO3/L	2.00	NA	1	-	04/23/25 08:34	121,2320B	MKT
Carbon Dioxide	470		mg/l	2.0	--	1	-	04/23/25 08:17	121,4500CO2-D	MRM
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
pH (H)	6.86		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 09:37	44,353.2	MRM
Nitrogen, Nitrate	1.1		mg/l	0.10	--	1	-	04/23/25 09:37	44,353.2	MRM
Total Organic Carbon	0.502		mg/l	0.500	--	1	-	04/28/25 13:41	121,5310C	DEW
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Anions by Ion Chromatography - Westborough Lab										
Chloride	28.0		mg/l	0.500	--	1	-	04/29/25 19:57	44,300.0	AVT
Sulfate	10.4		mg/l	1.00	--	1	-	04/29/25 19:57	44,300.0	AVT

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-03
Client ID: R2-T2-F2
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.61		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
Color, Apparent	5.0		A.P.C.U.	5.0	--	1	-	04/23/25 01:40	121,2120B	CAR
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
Alkalinity, Total	60.1		mg CaCO3/L	2.00	NA	1	-	04/23/25 08:36	121,2320B	MKT
Carbon Dioxide	430		mg/l	2.0	--	1	-	04/23/25 08:17	121,4500CO2-D	MKT
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
pH (H)	6.83		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 09:42	44,353.2	MRM
Nitrogen, Nitrate	1.1		mg/l	0.10	--	1	-	04/23/25 09:42	44,353.2	MRM
Total Organic Carbon	0.585		mg/l	0.500	--	1	-	04/28/25 16:03	121,5310C	DEW
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Anions by Ion Chromatography - Westborough Lab										
Chloride	28.4		mg/l	0.500	--	1	-	04/29/25 20:08	44,300.0	AVT
Sulfate	10.4		mg/l	1.00	--	1	-	04/29/25 20:08	44,300.0	AVT

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-04
Client ID: R2-T2-F3
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	0.65		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
Color, Apparent	ND		A.P.C.U.	5.0	--	1	-	04/23/25 01:40	121,2120B	CAR
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
Alkalinity, Total	61.6		mg CaCO3/L	2.00	NA	1	-	04/23/25 08:39	121,2320B	MKT
Carbon Dioxide	450		mg/l	2.0	--	1	-	04/23/25 08:17	121,4500CO2-D	MKT
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
pH (H)	6.81		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 09:44	44,353.2	MRM
Nitrogen, Nitrate	1.1		mg/l	0.10	--	1	-	04/23/25 09:44	44,353.2	MRM
Total Organic Carbon	0.516		mg/l	0.500	--	1	-	04/28/25 16:24	121,5310C	DEW
Bacteria in Water - Westborough Lab										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Anions by Ion Chromatography - Westborough Lab										
Chloride	28.4		mg/l	0.500	--	1	-	04/29/25 20:19	44,300.0	AVT
Sulfate	10.5		mg/l	1.00	--	1	-	04/29/25 20:19	44,300.0	AVT

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-05
Client ID: R2-T1-TRT
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
pH (H)	7.00		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-06
Client ID: R2-T2-TRT
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
pH (H)	7.29		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-07
Client ID: R1-BW-RES
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Sample Depth:
Matrix: Dw

Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total Suspended	100		mg/l	25	NA	5	-	04/24/25 07:20	121,2540D	BAY

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01
Lab Number: L2524631
Report Date: 05/07/25

SAMPLE RESULTS

Lab ID: L2524631-08
Client ID: R1-BW-SUP
Sample Location: 1680 B LAYANNOUGH RD, BARNSTABLE, MA
Date Collected: 04/22/25 11:30
Date Received: 04/22/25
Field Prep: Not Specified

Sample Depth:
Matrix: Dw

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total Suspended	ND		mg/l	5.0	NA	1	-	04/24/25 07:20	121,2540D	BAY
pH (H)	6.68		SU	-	NA	1	-	04/22/25 21:27	121,4500H+-B	AAS

Project Name: WELL 3&4 PILOT STUDY **Lab Number:** L2524631

Project Number: 127.25.01 **Report Date:** 05/07/25

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab for sample(s): 01 Batch: WG2057303-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Bacteria in Water - Westborough Lab for sample(s): 02-04 Batch: WG2057304-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
Escherichia Coli	Negative		col/100ml	-	NA	1	-	04/22/25 21:47	121,9223B	MAW
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057305-1										
Turbidity	ND		NTU	0.20	--	1	-	04/22/25 21:40	44,180.1	AAS
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057346-1										
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	04/23/25 03:01	44,353.2	MRM
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057347-1										
Nitrogen, Nitrate	ND		mg/l	0.10	--	1	-	04/23/25 02:58	44,353.2	MRM
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057376-1										
UV Absorbance @ 254nm	ND		Abs/cm	0.005	NA	1	-	04/23/25 05:05	121,5910B	DMO
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2057497-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	04/23/25 08:20	121,2320B	MKT
General Chemistry - Westborough Lab for sample(s): 07-08 Batch: WG2057979-1										
Solids, Total Suspended	ND		mg/l	5.0	NA	1	-	04/24/25 07:20	121,2540D	BAY
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2059374-1										
Total Organic Carbon	ND		mg/l	0.500	--	1	-	04/28/25 05:01	121,5310C	DEW
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG2060376-1										
Fluoride	ND		mg/l	0.20	--	1	-	04/30/25 05:13	121,4500F-C	DTH
Anions by Ion Chromatography - Westborough Lab for sample(s): 01-04 Batch: WG2060381-1										
Chloride	ND		mg/l	0.500	--	1	-	04/29/25 17:35	44,300.0	AVT
Sulfate	ND		mg/l	1.00	--	1	-	04/29/25 17:35	44,300.0	AVT

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057305-2								
Turbidity	102		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-06,08 Batch: WG2057306-1								
pH	99		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057346-2								
Nitrogen, Nitrite	100		-		90-110	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057347-2								
Nitrogen, Nitrate	96		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057376-2								
UV Absorbance @ 254nm	89		-			-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2057497-2								
Alkalinity, Total	110		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 07-08 Batch: WG2057979-2								
Solids, Total Suspended	93		-		80-120	-		

Lab Control Sample Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2059374-2					
Total Organic Carbon	98	-	90-110	-	
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG2060376-2 WG2060376-3					
Fluoride	94	94	90-110	0	
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01-04 Batch: WG2060381-2					
Chloride	102	-	90-110	-	
Sulfate	100	-	90-110	-	

Matrix Spike Analysis
Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057346-4 QC Sample: L2524548-01 Client ID: MS Sample												
Nitrogen, Nitrite	ND	4	3.9	98		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057346-6 QC Sample: L2524610-02 Client ID: MS Sample												
Nitrogen, Nitrite	ND	4	4.1	102		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057347-4 QC Sample: L2524548-01 Client ID: MS Sample												
Nitrogen, Nitrate	5.0	4	8.9	98		-	-		83-113	-		6
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057347-6 QC Sample: L2524610-02 Client ID: MS Sample												
Nitrogen, Nitrate	ND	4	3.8	95		-	-		83-113	-		6
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057497-4 QC Sample: L2524631-01 Client ID: R2-RW												
Alkalinity, Total	19.0	100	129	110		-	-		86-116	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2059374-4 QC Sample: L2524047-01 Client ID: MS Sample												
Total Organic Carbon	3.39	16	20.7	108		-	-		85-115	-		15
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2059374-6 QC Sample: L2524047-02 Client ID: MS Sample												
Total Organic Carbon	4.00	16	20.8	105		-	-		85-115	-		15
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2060381-3 QC Sample: L2524631-01 Client ID: R2-RW												
Chloride	28.1	4	31.1	**76**	Q	-	-		90-110	-		18
Sulfate	10.6	8	18.4	98		-	-		90-110	-		20

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057305-3 QC Sample: L2524631-04 Client ID: R2-T2-F3						
Turbidity	0.65	0.62	NTU	5		13
General Chemistry - Westborough Lab Associated sample(s): 01-06,08 QC Batch ID: WG2057306-2 QC Sample: L2524526-01 Client ID: DUP Sample						
pH	6.91	6.90	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057346-3 QC Sample: L2524548-01 Client ID: DUP Sample						
Nitrogen, Nitrite	ND	ND	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057346-5 QC Sample: L2524610-02 Client ID: DUP Sample						
Nitrogen, Nitrite	ND	ND	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057347-3 QC Sample: L2524548-01 Client ID: DUP Sample						
Nitrogen, Nitrate	5.0	5.0	mg/l	0		6
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057347-5 QC Sample: L2524610-02 Client ID: DUP Sample						
Nitrogen, Nitrate	ND	ND	mg/l	NC		6
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057355-1 QC Sample: L2524631-01 Client ID: R2-RW						
Color, Apparent	ND	ND	A.P.C.U.	NC		
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057376-3 QC Sample: L2524631-04 Client ID: R2-T2-F3						
UV Absorbance @ 254nm	ND	ND	Abs/cm	NC		
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057496-1 QC Sample: L2524631-01 Client ID: R2-RW						
Carbon Dioxide	320	240	mg/l	**29**	Q	26

Lab Duplicate Analysis

Batch Quality Control

Project Name: WELL 3&4 PILOT STUDY

Project Number: 127.25.01

Lab Number: L2524631

Report Date: 05/07/25

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2057497-3 QC Sample: L2524631-01 Client ID: R2-RW					
Alkalinity, Total	19.0	18.8	mg CaCO3/L	1	10
General Chemistry - Westborough Lab Associated sample(s): 07-08 QC Batch ID: WG2057979-3 QC Sample: L2524631-07 Client ID: R1-BW-RES					
Solids, Total Suspended	100	100	mg/l	0	32
General Chemistry - Westborough Lab Associated sample(s): 07-08 QC Batch ID: WG2057979-4 QC Sample: L2524990-01 Client ID: DUP Sample					
Solids, Total Suspended	200	200	mg/l	0	32
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2059374-3 QC Sample: L2524047-01 Client ID: DUP Sample					
Total Organic Carbon	3.39	3.34	mg/l	1	15
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2059374-5 QC Sample: L2524047-02 Client ID: DUP Sample					
Total Organic Carbon	4.00	3.96	mg/l	1	15
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG2060381-4 QC Sample: L2524631-01 Client ID: R2-RW					
Chloride	28.1	28.5	mg/l	1	18
Sulfate	10.6	10.6	mg/l	0	20

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

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Report Date: 05/07/25

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent
C	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2524631-01A	Vial HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-01B	Vial HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-01C	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-01D	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-01E	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),NO3-353(2),PH-4500(.01)
L2524631-01F	Plastic 120ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),NO3-353(2),PH-4500(.01)
L2524631-01G	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		CD-2008T(180),CA-UI(180),NI-2008T(180),K-UI(180),BE-2008T(180),HARDU(180),FE-UI(180),MG-UI(180),SE-2008T(180),HG-U(28),AS-2008T(180),BA-2008T(180),MN-UI(180),NA-UI(180),SB-2008T(180),TL-2008T(180),CR-2008T(180)
L2524631-01H	Plastic 500ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14),CO2(1)
L2524631-01I	Amber 500ml unpreserved	A	7	7	4.9	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2524631-01J	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-01K	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-01L	Plastic 500ml unpreserved	C	7	7	3.1	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),NO3-353(2),PH-4500(.01)
L2524631-01M	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-01N	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2524631-01Y	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-01Z	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-02A	Vial HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-02B	Vial HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-02C	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-02D	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-02E	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),PH-4500(.01),NO3-353(2)
L2524631-02F	Plastic 120ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),PH-4500(.01),NO3-353(2)
L2524631-02G	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		CD-2008T(180),CA-UI(180),NI-2008T(180),BE-2008T(180),K-UI(180),HARDU(180),FE-UI(180),MG-UI(180),HG-U(28),AS-2008T(180),SE-2008T(180),NA-UI(180),BA-2008T(180),MN-UI(180),SB-2008T(180),CR-2008T(180),TL-2008T(180)
L2524631-02H	Plastic 500ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14),CO2(1)
L2524631-02I	Amber 500ml unpreserved	A	7	7	4.9	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2524631-02J	Bacteria Cup Na2S2O3 preserved	B	NA		2.1	Y	Absent		T-COLI-C(1.25)
L2524631-02K	Bacteria Cup Na2S2O3 preserved	B	NA		2.1	Y	Absent		T-COLI-C(1.25)
L2524631-02L	Plastic 500ml unpreserved	C	7	7	3.1	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),PH-4500(.01),NO3-353(2)
L2524631-02M	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-02N	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-02Y	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-02Z	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-03A	Vial Ascorbic Acid/HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-03B	Vial Ascorbic Acid/HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-03C	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-03D	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)

*Values in parentheses indicate holding time in days

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2524631-03E	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),PH-4500(.01),NO3-353(2)
L2524631-03F	Plastic 120ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),PH-4500(.01),NO3-353(2)
L2524631-03G	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		CD-2008T(180),CA-UI(180),NI-2008T(180),K-UI(180),BE-2008T(180),MG-UI(180),HARDU(180),FE-UI(180),SE-2008T(180),HG-U(28),AS-2008T(180),BA-2008T(180),NA-UI(180),MN-UI(180),SB-2008T(180),TL-2008T(180),CR-2008T(180)
L2524631-03H	Plastic 500ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14),CO2(1)
L2524631-03I	Amber 500ml unpreserved	A	7	7	4.9	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2524631-03J	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-03K	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-03L	Plastic 500ml unpreserved	C	7	7	3.1	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),NO2-353(2),TURB-180(2),PH-4500(.01),NO3-353(2)
L2524631-03M	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-03N	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-03Y	Amber 1L unpreserved	C	7	7	3.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-03Z	Amber 1L unpreserved	C	7	7	3.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-04A	Vial Ascorbic Acid/HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-04B	Vial Ascorbic Acid/HCl preserved	B	NA		2.1	Y	Absent		SUB-524.2(14)
L2524631-04C	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-04D	Vial H2SO4 preserved	A	NA		4.9	Y	Absent		TOC-5310(28)
L2524631-04E	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),NO3-353(2),PH-4500(.01)
L2524631-04F	Plastic 120ml unpreserved	A	7	7	4.9	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),NO3-353(2),PH-4500(.01)

*Values in parentheses indicate holding time in days

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2524631-04G	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		CD-2008T(180),CA-UI(180),NI-2008T(180),BE-2008T(180),K-UI(180),FE-UI(180),HARDU(180),MG-UI(180),SE-2008T(180),HG-U(28),AS-2008T(180),BA-2008T(180),MN-UI(180),NA-UI(180),CR-2008T(180),SB-2008T(180),TL-2008T(180)
L2524631-04H	Plastic 500ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14),CO2(1)
L2524631-04I	Amber 500ml unpreserved	A	7	7	4.9	Y	Absent		UV-254(2),COLOR-A-2120(1)
L2524631-04J	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-04K	Bacteria Cup Na2S2O3 preserved	C	NA		3.1	Y	Absent		T-COLI-C(1.25)
L2524631-04L	Plastic 500ml unpreserved	B	7	7	2.1	Y	Absent		F-4500(28),SO4-300(28),CL-300(28),TURB-180(2),NO2-353(2),NO3-353(2),PH-4500(.01)
L2524631-04M	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-04N	Plastic 250ml Trizma preserved	C	NA		3.1	Y	Absent		A2-MA-537.1(14)
L2524631-04Y	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-04Z	Amber 1L unpreserved	B	7	7	2.1	Y	Absent		SUB-ASBESTOS-TEM(2)
L2524631-05A	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		PH-4500(.01)
L2524631-06A	Plastic 60ml unpreserved	A	7	7	4.9	Y	Absent		PH-4500(.01)
L2524631-07A	Plastic 250ml HNO3 preserved	B	<2	<2	2.1	Y	Absent		CD-2008T(180),AG-2008T(180),AS-2008T(180),HG-U(28),SE-2008T(180),BA-2008T(180),CR-2008T(180),PB-2008T(180)
L2524631-07B	Plastic 950ml unpreserved	B	7	7	2.1	Y	Absent		TSS-2540(7)
L2524631-08A	Plastic 60ml unpreserved	B	7	7	2.1	Y	Absent		PH-4500(.01)
L2524631-08B	Plastic 250ml HNO3 preserved	B	<2	<2	2.1	Y	Absent		FE-UI(180),MN-UI(180)
L2524631-08C	Plastic 950ml unpreserved	C	7	7	3.1	Y	Absent		TSS-2540(7)

*Values in parentheses indicate holding time in days

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
PERFLUOROALKYL CARBOXYLIC ACIDS (PFCAs)		
Perfluorooctadecanoic Acid	PFODA	16517-11-6
Perfluorohexadecanoic Acid	PFHxDA	67905-19-5
Perfluorotetradecanoic Acid	PFTA/PFTeDA	376-06-7
Perfluorotridecanoic Acid	PFTrDA	72629-94-8
Perfluorododecanoic Acid	PFDoA	307-55-1
Perfluoroundecanoic Acid	PFUnA	2058-94-8
Perfluorodecanoic Acid	PFDA	335-76-2
Perfluorononanoic Acid	PFNA	375-95-1
Perfluorooctanoic Acid	PFOA	335-67-1
Perfluoroheptanoic Acid	PFHpA	375-85-9
Perfluorohexanoic Acid	PFHxA	307-24-4
Perfluoropentanoic Acid	PFPeA	2706-90-3
Perfluorobutanoic Acid	PFBA	375-22-4
PERFLUOROALKYL SULFONIC ACIDS (PFSAs)		
Perfluorododecanesulfonic Acid	PFDoDS/PFDoS	79780-39-5
Perfluorodecanesulfonic Acid	PFDS	335-77-3
Perfluorononanesulfonic Acid	PFNS	68259-12-1
Perfluorooctanesulfonic Acid	PFOS	1763-23-1
Perfluoroheptanesulfonic Acid	PFHpS	375-92-8
Perfluorohexanesulfonic Acid	PFHxS	355-46-4
Perfluoropentanesulfonic Acid	PFPeS	2706-91-4
Perfluorobutanesulfonic Acid	PFBS	375-73-5
Perfluoropropanesulfonic Acid	PFPrS	423-41-6
FLUOROTELOMERS		
1H,1H,2H,2H-Perfluorododecanesulfonic Acid	10:2FTS	120226-60-0
1H,1H,2H,2H-Perfluorodecanesulfonic Acid	8:2FTS	39108-34-4
1H,1H,2H,2H-Perfluorooctanesulfonic Acid	6:2FTS	27619-97-2
1H,1H,2H,2H-Perfluorohexanesulfonic Acid	4:2FTS	757124-72-4
PERFLUOROALKANE SULFONAMIDES (FASAs)		
Perfluorooctanesulfonamide	FOSA/PFOSA	754-91-6
N-Ethyl Perfluorooctane Sulfonamide	NEtFOSA	4151-50-2
N-Methyl Perfluorooctane Sulfonamide	NMeFOSA	31506-32-8
PERFLUOROALKANE SULFONYL SUBSTANCES		
N-Ethyl Perfluorooctanesulfonamido Ethanol	NEtFOSE	1691-99-2
N-Methyl Perfluorooctanesulfonamido Ethanol	NMeFOSE	24448-09-7
N-Ethyl Perfluorooctanesulfonamidoacetic Acid	NEtFOSAA	2991-50-6
N-Methyl Perfluorooctanesulfonamidoacetic Acid	NMeFOSAA	2355-31-9
PER- and POLYFLUOROALKYL ETHER CARBOXYLIC ACIDS		
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid	HFPO-DA	13252-13-6
4,8-Dioxa-3h-Perfluorononanoic Acid	ADONA	919005-14-4
CHLORO-PERFLUOROALKYL SULFONIC ACIDS		
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid	11Cl-PF3OUdS	763051-92-9
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid	9Cl-PF3ONS	756426-58-1
PERFLUOROETHER SULFONIC ACIDS (PFESAs)		
Perfluoro(2-Ethoxyethane)Sulfonic Acid	PFEESA	113507-82-7
PERFLUOROETHER/POLYETHER CARBOXYLIC ACIDS (PFPCAs)		
Perfluoro-3-Methoxypropanoic Acid	PFMPA	377-73-1
Perfluoro-4-Methoxybutanoic Acid	PFMBA	863090-89-5
Nonafluoro-3,6-Dioxaheptanoic Acid	NFDHA	151772-58-6

Project Name: WELL 3&4 PILOT STUDY
Project Number: 127.25.01

Lab Number: L2524631
Report Date: 05/07/25

PFAS PARAMETER SUMMARY

Parameter	Acronym	CAS Number
FLUOROTELOMER CARBOXYLIC ACIDS (FTCAs)		
3-Perfluoroheptyl Propanoic Acid	7:3FTCA	812-70-4
2H,2H,3H,3H-Perfluorooctanoic Acid	5:3FTCA	914637-49-3
3-Perfluoropropyl Propanoic Acid	3:3FTCA	356-02-5

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: Data Usability Report

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

Report Format: Data Usability Report

Project Name:	WELL 3&4 PILOT STUDY	**Lab Number:**	L2524631
Project Number:	127.25.01	**Report Date:**	05/07/25

Data Qualifiers

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Project Name: WELL 3&4 PILOT STUDY **Lab Number:** L2524631

Project Number: 127.25.01 **Report Date:** 05/07/25

REFERENCES

3 Methods for the Determination of Metals in Environmental Samples, Supplement I. EPA/600/R-94/111. May 1994.

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

133 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). EPA Method 537.1, EPA/600/R-20/006. Version 2.0, March 2020.

MCL References

The following links provide the most up-to-date Maximum Contaminant Levels (MCL) or Maximum Residual Disinfectant Levels (MRDL) from the EPA's National Primary Drinking Water Regulations (NPDWR) and the MassDEP's Drinking Water Standards and Guidelines.

EPA

https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

MassDEP

https://www.mass.gov/guides/drinking-water-standards-and-guidelines

LIMITATION OF LIABILITIES

Pace Analytical Services performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Pace Analytical Services shall be to re-perform the work at it's own expense. In no event shall Pace Analytical Services be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Pace Analytical Services.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581
EPA 624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625.1: alpha-Terpineol
EPA 8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol, Azobenzene; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
SM 2540D: TSS.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
MADEP-APH.
Nonpotable Water: EPA RSK-175 Dissolved Gases
Biological Tissue Matrix: EPA 3050B

Mansfield Facility – 120 Forbes Blvd. Mansfield, MA 02048
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Nonpotable Water: EPA RSK-175 Dissolved Gases

The following test method is not included in our New Jersey Secondary NELAP Scope of Accreditation:

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (via Alpha SOP 23528)

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 524.2: THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables).
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

Certification IDs:

Westborough Facility – 8 Walkup Dr. Westborough, MA 01581
CT PH-0826, IL 200077, IN C-MA-03, KY JY98045, ME MA00086, MD 348, MA M-MA086, NH 2064, NJ MA935, NY 11148, NC (DW) 25700, NC (NPW/SCM) 666, OR MA-1316, PA 68-03671, RI LAO00065, TX T104704476, VT VT-0935, VA 460195

Mansfield Facility – 320 Forbes Blvd. Mansfield, MA 02048
CT PH-0825, ANAB/DoD L2474, IL 200081, IN C-MA-04, KY KY98046, LA 3090, ME MA00030, MI 9110, MN 025-999-495, NH 2062, NJ MA015, NY 11627, NC (NPW/SCM) 685, OR MA-0262, PA 68-02089, RI LAO00299, TX T-104704419, VT VT-0015, VA 460194, WA C954

Mansfield Facility – 120 Forbes Blvd. Mansfield, MA 02048
ANAB/DoD L2474, ME MA01156, MN 025-999-498, NH 2249, NJ MA025, NY 12191, OR 4203, TX T104704583, VA 460311, WA C1104.

For a complete listing of analytes and methods, please contact your Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 2

Date Rec'd in Lab: 4/22/25

ALPHA Job #: L2524631

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: H2Olson Engineering, Inc
Address: 10 Riverside Dr, suite 103, Lakeville, MA 02347
Phone: 508-375-7007
Email: sco@h2olsonengineering.com

Project Information

Project Name: Well 3 & 4 Pilot Study
Project Location: 1680 & Layannough RD Bonstable MA
Project #: 127.25.01
Project Manager: Stephen C. Olson, P.E.
ALPHA Quote #:

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved)
Date Due:

Report Information - Data Deliverables

☐ ADEx ☑ EMAIL

Billing Information

☑ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☑ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☑ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☑ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☑ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Additional Project Information:

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH: ☐ Quant Only ☐ Fingerprint
Turbidity
Alkalinity
Total Metals, Fe, Mn
Color, UV-254
TOC
PH,
CO2

SAMPLE INFO
Filtration ☐ Field ☐ Lab to do
Preservation ☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	Sample Comments	TOTAL # BOTTLES
24631-01	R2-RW	4/22	11:30	DW	RAT		7
02	$R_2 - T_1 - F_1$	4/22	11:30	DW	RAT		7
03	$R_2 - T_2 - F_2$	4/22	11:30	DW	RAT		7
04	$R_2 - T_2 - F_3$	4/22	11:30	DW	RAT		7
05	$R_2 - T_1 - TRT$	4/22	11:30	DW	RAT		1
06	$R_2 - T_2 - TRT$	4/22	11:30	DW	RAT		1

Container Type
Preservative

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	4/22 13:16		4/22/25 13:20
	4/22/25 17:22		4/22/25 1722

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

CHAIN OF CUSTODY

PAGE 2 OF 2

Date Rec'd in Lab: 4/22/25

ALPHA Job #: L2524631

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: Hydrolom Engineering, Inc
Address: 10 Riverside Dr, Suite 103, Lakeville, MA 02347
Phone: 508-375-7007
Email: sue@Hydrolomengineering.com

Additional Project Information:

Project Information

Project Name: Well 3 & 4 pilot study
Project Location: 1680 B Lovanough RD Barnstable MA
Project #: 127.25.01
Project Manager: Stephan C. Olsen, P.E.
ALPHA Quote #:

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved)
Date Due:

Report Information - Data Deliverables

☐ ADEx ☑ EMAIL

Billing Information

☑ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☑ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☑ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☑ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	~~☐ PCB ☐ PEST~~ TSS	~~TPH: ☐ Quant Only ☐ Fingerprint~~ PH	Total Col:Coli	VOCs (EPA 524.2)	PFAS (A2-537.1) sixty group (Ca, Cl, Mg, K, Na, SO4 Hardness)	IOCs (F, Alkalinity, Ag, Ba, Cd, Cr, Hg Ni, Mo, Sb, Se, Be, Cu, Mn, Tl, Cl, SO4)	Total Metals (Fe, Mn)	SAMPLE INFO Filtration ☐ Field ☐ Lab to do Preservation ☐ Lab to do Sample Comments	TOTAL # BOTTLES
24631-01	R2-RW	4/22	11:30	DW	RAT									✓	✓	✓	✓	✓		9
-02	R2-T1-F1	4/22	11:30	DW	RAT									✓	✓	✓	✓	✓		9
-03	R2-T2-F2	4/22	11:30	DW	RAT									✓	✓	✓	✓	✓		9
-04	R2-T2-F3	4/22	11:30	DW	RAT									✓	✓	✓	✓	✓		9
-07	R1-BW-Res	4/22	11:30	DW	RAT			✓			✓									2
-08	R1-BW-Sup	4/22	11:30	DW	RAT						✓	✓						✓		3

Container Type																				
Preservative																				

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H= $Na_2S_2O_3$
I= Ascorbic Acid
J= NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	4/22 13:18		4/22/25 13:20
	4/22/25 17:22		4/22/25 1722

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

Pace

Subcontract Chain of Custody

Pace New England
39 Spruce St
East Longmeadow, MA 01028

Pace Job Number
L2524631

Page 1

Client Information

Client: Pace Analytical Labs
Address: Eight Walkup Drive
Westborough, MA 01581-1019

Report To:west.subreports@pacelabs.com
Bill To:invoices@pacelabs.coupahost.com

Phone: 716.427.5228
Email: Jennifer.Byrnes@pacelabs.com

Project Information

Project Location: MA
Project Manager: Jennifer Byrnes

Turnaround & Deliverables Information

Due Date:
Deliverables:

Regulatory Requirements/Report Limits

State/Federal Program:
Regulatory Criteria:

Report to RL

Project Specific Requirements and/or Report Requirements

Reference following Pace Job Number on final report/deliverables: L2524631 Report to include Method and/or Regulatory required batch QC

Additional Comments:

Lab ID	Pace ID	Client ID	Collection Date/Time	Sample Matrix	Analysis	Sample Level Comments	Sample Specific QC	Container Count
	L2524631-01	R2-RW	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-02	R2-T1-F1	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-03	R2-T2-F2	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-04	R2-T2-F3	04-22-25 11:30	DW	VOCs - EPA 524.2			2

Relinquished By:	Date/Time:	Received By:	Date/Time:
[illegible] 4/28 (4/23)	4/23/25 0508	Robert DAVIS	4-23-25 5:08

Form No: AL_subcoc

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

April 28, 2025

Jennifer Byrnes
Pace Analytical Services - Westborough, MA
8 Walkup Drive
Westborough, MA 01581

Project Location: L2524631
Client Job Number:
Project Number: L2524631
Laboratory Work Order Number: 25D1812

Enclosed are results of analyses for samples as received by the laboratory on April 23, 2025. If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Rebecca Faust
Project Manager

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Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Pace Analytical Services - Westborough, MA
8 Walkup Drive
Westborough, MA 01581
ATTN: Jennifer Byrnes

REPORT DATE: 4/28/2025

PURCHASE ORDER NUMBER:

PROJECT NUMBER: L2524631

ANALYTICAL SUMMARY

WORK ORDER NUMBER: 25D1812

The results of analyses performed on the following samples submitted to Pace Analytical Services, LLC - East Longmeadow, Ma, are found in this report.

PROJECT LOCATION: L2524631

FIELD SAMPLE #	LAB ID:	MATRIX	SAMPLE DESCRIPTION	TEST	SUB LAB
R2-RW	25D1812-01	Drinking Water		EPA 524.2	
R2-T1-F1	25D1812-02	Drinking Water		EPA 524.2	
R2-T2-F2	25D1812-03	Drinking Water		EPA 524.2	
R2-T2-F3	25D1812-04	Drinking Water		EPA 524.2	

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

CASE NARRATIVE SUMMARY

All reported results are within defined laboratory quality control objectives unless listed below or otherwise qualified in this report.

EPA 524.2

Qualifications:

L-01

Laboratory fortified blank/laboratory control sample recovery outside of control limits. Data validation is not affected since all results are "not detected" for all samples in this batch for this compound and bias is on the high side.

Analyte & Samples(s) Qualified:

1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)
B403726-BS1

Dichlorodifluoromethane (Freon 12)
B403726-BS1

Trichlorofluoromethane (Freon 11)
B403726-BS1

PR-08

pH of sample (pH 5) is outside of method specified preservation criteria.

Analyte & Samples(s) Qualified:

25D1812-03[R2-T2-F2], 25D1812-04[R2-T2-F3]

The results of analyses reported only relate to samples submitted to Pace Analytical Services, LLC - East Longmeadow, Ma, for testing.
I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.



Lisa A. Worthington
Technical Representative

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-RW Sampled: 4/22/2025 11:30

Sample ID: 25D1812-01

Sample Matrix: Drinking Water

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Acetone	ND	10	6300	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
tert-Amyl Methyl Ether (TAME)	ND	0.50	90	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Benzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromodichloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromoform	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Bromomethane	ND	0.50	10	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
2-Butanone (MEK)	ND	5.0	4000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
tert-Butyl Alcohol (TBA)	ND	5.0	120	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
n-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
sec-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
tert-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
tert-Butyl Ethyl Ether (TBEE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Carbon Disulfide	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Carbon Tetrachloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Chlorobenzene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Chloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Chloroform	1.9	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Chloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
2-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
4-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Dibromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dibromoethane (EDB)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Dibromomethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dichlorobenzene	ND	0.50	600	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,3-Dichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,4-Dichlorobenzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Dichlorodifluoromethane (Freon 12)	ND	0.50	1400	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1-Dichloroethane	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1-Dichloroethylene	ND	0.50	7	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
cis-1,2-Dichloroethylene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
trans-1,2-Dichloroethylene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2-Dichloropropane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,3-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
2,2-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
cis-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
trans-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,3-Dichloropropene (total)	ND	1.0	0.4	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Diethyl Ether	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Diisopropyl Ether (DIPE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH

Pace Analytical Services, LLC - East Longmeadow, Ma

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Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-RW Sampled: 4/22/2025 11:30

Sample ID: 25D1812-01

Sample Matrix: Drinking Water

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Ethylbenzene	ND	0.50	700	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Hexachlorobutadiene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
2-Hexanone (MBK)	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Isopropylbenzene (Cumene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
p-Isopropyltoluene (p-Cymene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Methyl tert-Butyl Ether (MTBE)	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Methylene Chloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
4-Methyl-2-pentanone (MIBK)	ND	5.0	350	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Naphthalene	ND	1.0	140	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
n-Propylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Styrene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Tetrachloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Tetrahydrofuran	ND	2.0	1300	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Toluene	ND	0.50	1000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2,4-Trichlorobenzene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,1-Trichloroethane	ND	0.50	200	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,2-Trichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Trichloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Trichlorofluoromethane (Freon 11)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2,3-Trichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	210000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Vinyl Chloride	ND	0.50	2	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
m&p-Xylene	ND	1.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
o-Xylene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH
Xylenes (total)	ND	1.5	10000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:30	EEH

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
4-Bromofluorobenzene	109	80-120		4/26/25 8:30
1,2-Dichlorobenzene-d4	110	80-120		4/26/25 8:30

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Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T1-F1 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-02

Sample Matrix: Drinking Water

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Acetone	ND	10	6300	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
tert-Amyl Methyl Ether (TAME)	ND	0.50	90	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Benzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromodichloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromoform	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Bromomethane	ND	0.50	10	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
2-Butanone (MEK)	ND	5.0	4000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
tert-Butyl Alcohol (TBA)	ND	5.0	120	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
n-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
sec-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
tert-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
tert-Butyl Ethyl Ether (TBEE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Carbon Disulfide	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Carbon Tetrachloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Chlorobenzene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Chloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Chloroform	1.9	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Chloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
2-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
4-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Dibromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dibromoethane (EDB)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Dibromomethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dichlorobenzene	ND	0.50	600	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,3-Dichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,4-Dichlorobenzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Dichlorodifluoromethane (Freon 12)	ND	0.50	1400	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1-Dichloroethane	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1-Dichloroethylene	ND	0.50	7	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
cis-1,2-Dichloroethylene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
trans-1,2-Dichloroethylene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2-Dichloropropane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,3-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
2,2-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
cis-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
trans-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,3-Dichloropropene (total)	ND	1.0	0.4	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Diethyl Ether	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Diisopropyl Ether (DIPE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH

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Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T1-F1 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-02

Sample Matrix: Drinking Water

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Ethylbenzene	ND	0.50	700	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Hexachlorobutadiene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
2-Hexanone (MBK)	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Isopropylbenzene (Cumene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
p-Isopropyltoluene (p-Cymene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Methyl tert-Butyl Ether (MTBE)	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Methylene Chloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
4-Methyl-2-pentanone (MIBK)	ND	5.0	350	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Naphthalene	ND	1.0	140	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
n-Propylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Styrene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Tetrachloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Tetrahydrofuran	ND	2.0	1300	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Toluene	ND	0.50	1000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2,4-Trichlorobenzene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,1-Trichloroethane	ND	0.50	200	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,2-Trichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Trichloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Trichlorofluoromethane (Freon 11)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2,3-Trichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	210000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Vinyl Chloride	ND	0.50	2	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
m&p-Xylene	ND	1.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
o-Xylene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH
Xylenes (total)	ND	1.5	10000	µg/L	1		EPA 524.2	4/25/25	4/26/25 8:55	EEH

Surrogates	% Recovery	Recovery Limits	Flag/Qual	
4-Bromofluorobenzene	113	80-120		4/26/25 8:55
1,2-Dichlorobenzene-d4	106	80-120		4/26/25 8:55

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T2-F2 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-03

Sample Matrix: Drinking Water

Sample Flags: PR-08

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Acetone	ND	10	6300	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
tert-Amyl Methyl Ether (TAME)	ND	0.50	90	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Benzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromodichloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromoform	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Bromomethane	ND	0.50	10	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
2-Butanone (MEK)	ND	5.0	4000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
tert-Butyl Alcohol (TBA)	ND	5.0	120	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
n-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
sec-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
tert-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
tert-Butyl Ethyl Ether (TBEE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Carbon Disulfide	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Carbon Tetrachloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Chlorobenzene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Chloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Chloroform	2.0	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Chloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
2-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
4-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Dibromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dibromoethane (EDB)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Dibromomethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dichlorobenzene	ND	0.50	600	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,3-Dichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,4-Dichlorobenzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Dichlorodifluoromethane (Freon 12)	ND	0.50	1400	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1-Dichloroethane	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1-Dichloroethylene	ND	0.50	7	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
cis-1,2-Dichloroethylene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
trans-1,2-Dichloroethylene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2-Dichloropropane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,3-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
2,2-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
cis-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
trans-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,3-Dichloropropene (total)	ND	1.0	0.4	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Diethyl Ether	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Diisopropyl Ether (DIPE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T2-F2 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-03

Sample Matrix: Drinking Water

Sample Flags: PR-08

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Ethylbenzene	ND	0.50	700	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Hexachlorobutadiene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
2-Hexanone (MBK)	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Isopropylbenzene (Cumene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
p-Isopropyltoluene (p-Cymene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Methyl tert-Butyl Ether (MTBE)	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Methylene Chloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
4-Methyl-2-pentanone (MIBK)	ND	5.0	350	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Naphthalene	ND	1.0	140	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
n-Propylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Styrene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Tetrachloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Tetrahydrofuran	ND	2.0	1300	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Toluene	ND	0.50	1000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2,4-Trichlorobenzene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,1-Trichloroethane	ND	0.50	200	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,2-Trichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Trichloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Trichlorofluoromethane (Freon 11)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2,3-Trichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	210000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Vinyl Chloride	ND	0.50	2	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
m&p-Xylene	ND	1.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
o-Xylene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH
Xylenes (total)	ND	1.5	10000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:21	EEH

Surrogates	% Recovery	Recovery Limits	Flag/Qual		
4-Bromofluorobenzene	109	80-120		4/26/25	9:21
1,2-Dichlorobenzene-d4	105	80-120		4/26/25	9:21

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T2-F3 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-04

Sample Matrix: Drinking Water

Sample Flags: PR-08

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Acetone	ND	10	6300	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
tert-Amyl Methyl Ether (TAME)	ND	0.50	90	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Benzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromodichloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromoform	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Bromomethane	ND	0.50	10	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
2-Butanone (MEK)	ND	5.0	4000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
tert-Butyl Alcohol (TBA)	ND	5.0	120	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
n-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
sec-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
tert-Butylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
tert-Butyl Ethyl Ether (TBEE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Carbon Disulfide	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Carbon Tetrachloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Chlorobenzene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Chloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Chloroform	2.0	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Chloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
2-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
4-Chlorotoluene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Dibromochloromethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dibromoethane (EDB)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Dibromomethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dichlorobenzene	ND	0.50	600	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,3-Dichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,4-Dichlorobenzene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Dichlorodifluoromethane (Freon 12)	ND	0.50	1400	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1-Dichloroethane	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1-Dichloroethylene	ND	0.50	7	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
cis-1,2-Dichloroethylene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
trans-1,2-Dichloroethylene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2-Dichloropropane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,3-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
2,2-Dichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
cis-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
trans-1,3-Dichloropropene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,3-Dichloropropene (total)	ND	1.0	0.4	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Diethyl Ether	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Diisopropyl Ether (DIPE)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Project Location: L2524631 Sample Description: Work Order: 25D1812

Date Received: 4/23/2025

Field Sample #: R2-T2-F3 Sampled: 4/22/2025 11:30

Sample ID: 25D1812-04

Sample Matrix: Drinking Water

Sample Flags: PR-08

Drinking Water Organics EPA 500 Series Methods

Analyte	Results	RL	MCL/SMCL MA ORSG	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Ethylbenzene	ND	0.50	700	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Hexachlorobutadiene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
2-Hexanone (MBK)	ND	5.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Isopropylbenzene (Cumene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
p-Isopropyltoluene (p-Cymene)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Methyl tert-Butyl Ether (MTBE)	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Methylene Chloride	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
4-Methyl-2-pentanone (MIBK)	ND	5.0	350	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Naphthalene	ND	1.0	140	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
n-Propylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Styrene	ND	0.50	100	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Tetrachloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Tetrahydrofuran	ND	2.0	1300	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Toluene	ND	0.50	1000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2,4-Trichlorobenzene	ND	0.50	70	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,1-Trichloroethane	ND	0.50	200	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,2-Trichloroethane	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Trichloroethylene	ND	0.50	5	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Trichlorofluoromethane (Freon 11)	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2,3-Trichloropropane	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	210000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Vinyl Chloride	ND	0.50	2	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
m&p-Xylene	ND	1.0		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
o-Xylene	ND	0.50		µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH
Xylenes (total)	ND	1.5	10000	µg/L	1		EPA 524.2	4/25/25	4/26/25 9:46	EEH

Surrogates	% Recovery	Recovery Limits	Flag/Qual		
4-Bromofluorobenzene	109	80-120		4/26/25	9:46
1,2-Dichlorobenzene-d4	107	80-120		4/26/25	9:46

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

Sample Extraction Data

Prep Method:EPA 524.2 **Analytical Method:EPA 524.2**

Lab Number [Field ID]	Batch	Initial [mL]	Final [mL]	Date
25D1812-01 [R2-RW]	B403726	5	5.00	04/25/25
25D1812-02 [R2-T1-F1]	B403726	5	5.00	04/25/25
25D1812-03 [R2-T2-F2]	B403726	5	5.00	04/25/25
25D1812-04 [R2-T2-F3]	B403726	5	5.00	04/25/25

Pace Analytical Services, LLC - East Longmeadow, Ma

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

QUALITY CONTROL

Drinking Water Organics EPA 500 Series Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B403726 - EPA 524.2										
Blank (B403726-BLK1)				Prepared: 04/24/25 Analyzed: 04/26/25						
Acetone	ND	10	µg/L							
tert-Amyl Methyl Ether (TAME)	ND	0.50	µg/L							
Benzene	ND	0.50	µg/L							
Bromobenzene	ND	0.50	µg/L							
Bromochloromethane	ND	0.50	µg/L							
Bromodichloromethane	ND	0.50	µg/L							
Bromoform	ND	0.50	µg/L							
Bromomethane	ND	0.50	µg/L							
2-Butanone (MEK)	ND	5.0	µg/L							
tert-Butyl Alcohol (TBA)	ND	5.0	µg/L							
n-Butylbenzene	ND	0.50	µg/L							
sec-Butylbenzene	ND	0.50	µg/L							
tert-Butylbenzene	ND	0.50	µg/L							
tert-Butyl Ethyl Ether (TBEE)	ND	0.50	µg/L							
Carbon Disulfide	ND	5.0	µg/L							
Carbon Tetrachloride	ND	0.50	µg/L							
Chlorobenzene	ND	0.50	µg/L							
Chloroethane	ND	0.50	µg/L							
Chloroform	ND	0.50	µg/L							
Chloromethane	ND	0.50	µg/L							
2-Chlorotoluene	ND	0.50	µg/L							
4-Chlorotoluene	ND	0.50	µg/L							
Dibromochloromethane	ND	0.50	µg/L							
1,2-Dibromo-3-chloropropane (DBCP)	ND	2.0	µg/L							
1,2-Dibromoethane (EDB)	ND	0.50	µg/L							
Dibromomethane	ND	0.50	µg/L							
1,2-Dichlorobenzene	ND	0.50	µg/L							
1,3-Dichlorobenzene	ND	0.50	µg/L							
1,4-Dichlorobenzene	ND	0.50	µg/L							
Dichlorodifluoromethane (Freon 12)	ND	0.50	µg/L							
1,1-Dichloroethane	ND	0.50	µg/L							
1,2-Dichloroethane	ND	0.50	µg/L							
1,1-Dichloroethylene	ND	0.50	µg/L							
cis-1,2-Dichloroethylene	ND	0.50	µg/L							
trans-1,2-Dichloroethylene	ND	0.50	µg/L							
1,2-Dichloropropane	ND	0.50	µg/L							
1,3-Dichloropropane	ND	0.50	µg/L							
2,2-Dichloropropane	ND	0.50	µg/L							
1,1-Dichloropropene	ND	0.50	µg/L							
cis-1,3-Dichloropropene	ND	0.50	µg/L							
trans-1,3-Dichloropropene	ND	0.50	µg/L							
Diethyl Ether	ND	0.50	µg/L							
Diisopropyl Ether (DIPE)	ND	0.50	µg/L							
Ethylbenzene	ND	0.50	µg/L							
Hexachlorobutadiene	ND	0.50	µg/L							
2-Hexanone (MBK)	ND	5.0	µg/L							
Isopropylbenzene (Cumene)	ND	0.50	µg/L							
p-Isopropyltoluene (p-Cymene)	ND	0.50	µg/L							
Methyl tert-Butyl Ether (MTBE)	ND	0.50	µg/L							
Methylene Chloride	ND	0.50	µg/L							
4-Methyl-2-pentanone (MIBK)	ND	5.0	µg/L							
Naphthalene	ND	1.0	µg/L							

Pace Analytical Services, LLC - East Longmeadow, Ma

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QUALITY CONTROL

Drinking Water Organics EPA 500 Series Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B403726 - EPA 524.2										
Blank (B403726-BLK1)				Prepared: 04/24/25 Analyzed: 04/26/25						
n-Propylbenzene	ND	0.50	µg/L							
Styrene	ND	0.50	µg/L							
1,1,1,2-Tetrachloroethane	ND	0.50	µg/L							
1,1,2,2-Tetrachloroethane	ND	0.50	µg/L							
Tetrachloroethylene	ND	0.50	µg/L							
Tetrahydrofuran	ND	2.0	µg/L							
Toluene	ND	0.50	µg/L							
1,2,3-Trichlorobenzene	ND	0.50	µg/L							
1,2,4-Trichlorobenzene	ND	0.50	µg/L							
1,1,1-Trichloroethane	ND	0.50	µg/L							
1,1,2-Trichloroethane	ND	0.50	µg/L							
Trichloroethylene	ND	0.50	µg/L							
Trichlorofluoromethane (Freon 11)	ND	0.50	µg/L							
1,2,3-Trichloropropane	ND	0.50	µg/L							
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND	0.50	µg/L							
1,2,4-Trimethylbenzene	ND	0.50	µg/L							
1,3,5-Trimethylbenzene	ND	0.50	µg/L							
Vinyl Chloride	ND	0.50	µg/L							
m&p-Xylene	ND	1.0	µg/L							
o-Xylene	ND	0.50	µg/L							
Surrogate: 4-Bromofluorobenzene	*27.4*		µg/L	25.00		109	80-120			
Surrogate: 1,2-Dichlorobenzene-d4	*26.7*		µg/L	25.00		107	80-120			
LCS (B403726-BS1)				Prepared: 04/24/25 Analyzed: 04/26/25						
Acetone	94	10	µg/L	100.0		94.5	70-130			
tert-Amyl Methyl Ether (TAME)	9.7	0.50	µg/L	10.00		97.2	70-130			
Benzene	11	0.50	µg/L	10.00		109	70-130			
Bromobenzene	10	0.50	µg/L	10.00		104	70-130			
Bromochloromethane	9.1	0.50	µg/L	10.00		91.3	70-130			
Bromodichloromethane	10	0.50	µg/L	10.00		103	70-130			
Bromoform	9.7	0.50	µg/L	10.00		96.6	70-130			
Bromomethane	10	0.50	µg/L	10.00		102	70-130			
2-Butanone (MEK)	78	5.0	µg/L	100.0		78.4	70-130			
tert-Butyl Alcohol (TBA)	90	5.0	µg/L	100.0		89.9	70-130			
n-Butylbenzene	9.9	0.50	µg/L	10.00		99.1	70-130			
sec-Butylbenzene	9.6	0.50	µg/L	10.00		96.2	70-130			
tert-Butylbenzene	10	0.50	µg/L	10.00		100	70-130			
tert-Butyl Ethyl Ether (TBEE)	9.9	0.50	µg/L	10.00		98.8	70-130			
Carbon Disulfide	110	5.0	µg/L	100.0		110	70-130			
Carbon Tetrachloride	13	0.50	µg/L	10.00		130	70-130			
Chlorobenzene	11	0.50	µg/L	10.00		109	70-130			
Chloroethane	11	0.50	µg/L	10.00		105	70-130			
Chloroform	11	0.50	µg/L	10.00		108	70-130			
Chloromethane	9.4	0.50	µg/L	10.00		94.3	70-130			
2-Chlorotoluene	10	0.50	µg/L	10.00		102	70-130			
4-Chlorotoluene	11	0.50	µg/L	10.00		106	70-130			
Dibromochloromethane	11	0.50	µg/L	10.00		107	70-130			
1,2-Dibromo-3-chloropropane (DBCP)	12	2.0	µg/L	10.00		118	70-130			
1,2-Dibromoethane (EDB)	11	0.50	µg/L	10.00		111	70-130			
Dibromomethane	11	0.50	µg/L	10.00		114	70-130			
1,2-Dichlorobenzene	10	0.50	µg/L	10.00		105	70-130			
1,3-Dichlorobenzene	10	0.50	µg/L	10.00		103	70-130			

Pace Analytical Services, LLC - East Longmeadow, Ma

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QUALITY CONTROL

Drinking Water Organics EPA 500 Series Methods - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC		%REC Limits	RPD	RPD Limit	Notes
Batch B403726 - EPA 524.2											
LCS (B403726-BS1)				Prepared: 04/24/25 Analyzed: 04/26/25							
1,4-Dichlorobenzene	10	0.50	µg/L	10.00		103		70-130			
Dichlorodifluoromethane (Freon 12)	15	0.50	µg/L	10.00		**155**	*	70-130			L-01
1,1-Dichloroethane	11	0.50	µg/L	10.00		107		70-130			
1,2-Dichloroethane	12	0.50	µg/L	10.00		116		70-130			
1,1-Dichloroethylene	12	0.50	µg/L	10.00		117		70-130			
cis-1,2-Dichloroethylene	11	0.50	µg/L	10.00		106		70-130			
trans-1,2-Dichloroethylene	10	0.50	µg/L	10.00		104		70-130			
1,2-Dichloropropane	10	0.50	µg/L	10.00		102		70-130			
1,3-Dichloropropane	11	0.50	µg/L	10.00		115		70-130			
2,2-Dichloropropane	9.1	0.50	µg/L	10.00		90.7		70-130			
1,1-Dichloropropene	13	0.50	µg/L	10.00		127		70-130			
cis-1,3-Dichloropropene	11	0.50	µg/L	10.00		106		70-130			
trans-1,3-Dichloropropene	11	0.50	µg/L	10.00		107		70-130			
Diethyl Ether	11	0.50	µg/L	10.00		111		70-130			
Diisopropyl Ether (DIPE)	9.1	0.50	µg/L	10.00		91.2		70-130			
Ethylbenzene	11	0.50	µg/L	10.00		112		70-130			
Hexachlorobutadiene	9.5	0.50	µg/L	10.00		94.8		70-130			
2-Hexanone (MBK)	89	5.0	µg/L	100.0		89.0		70-130			
Isopropylbenzene (Cumene)	11	0.50	µg/L	10.00		108		70-130			
p-Isopropyltoluene (p-Cymene)	9.5	0.50	µg/L	10.00		95.0		70-130			
Methyl tert-Butyl Ether (MTBE)	12	0.50	µg/L	10.00		116		70-130			
Methylene Chloride	9.3	0.50	µg/L	10.00		93.1		70-130			
4-Methyl-2-pentanone (MIBK)	86	5.0	µg/L	100.0		86.5		70-130			
Naphthalene	11	1.0	µg/L	10.00		107		70-130			
n-Propylbenzene	11	0.50	µg/L	10.00		108		70-130			
Styrene	11	0.50	µg/L	10.00		107		70-130			
1,1,1,2-Tetrachloroethane	11	0.50	µg/L	10.00		105		70-130			
1,1,2,2-Tetrachloroethane	10	0.50	µg/L	10.00		103		70-130			
Tetrachloroethylene	11	0.50	µg/L	10.00		113		70-130			
Tetrahydrofuran	7.5	2.0	µg/L	10.00		75.1		70-130			
Toluene	11	0.50	µg/L	10.00		109		70-130			
1,2,3-Trichlorobenzene	9.7	0.50	µg/L	10.00		96.9		70-130			
1,2,4-Trichlorobenzene	9.6	0.50	µg/L	10.00		96.1		70-130			
1,1,1-Trichloroethane	12	0.50	µg/L	10.00		119		70-130			
1,1,2-Trichloroethane	11	0.50	µg/L	10.00		107		70-130			
Trichloroethylene	12	0.50	µg/L	10.00		125		70-130			
Trichlorofluoromethane (Freon 11)	15	0.50	µg/L	10.00		**155**	*	70-130			L-01
1,2,3-Trichloropropane	11	0.50	µg/L	10.00		114		70-130			
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	13	0.50	µg/L	10.00		**132**	*	70-130			L-01
1,2,4-Trimethylbenzene	10	0.50	µg/L	10.00		104		70-130			
1,3,5-Trimethylbenzene	10	0.50	µg/L	10.00		104		70-130			
Vinyl Chloride	12	0.50	µg/L	10.00		123		70-130			
m&p-Xylene	21	1.0	µg/L	20.00		107		70-130			
o-Xylene	11	0.50	µg/L	10.00		114		70-130			
Surrogate: 4-Bromofluorobenzene	*27.7*		µg/L	25.00		111		80-120			
Surrogate: 1,2-Dichlorobenzene-d4	*26.4*		µg/L	25.00		106		80-120			

Pace Analytical Services, LLC - East Longmeadow, Ma

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FLAG/QUALIFIER SUMMARY

*	QC result is outside of established limits.
†	Wide recovery limits established for difficult compound.
‡	Wide RPD limits established for difficult compound.
#	Data exceeded client recommended or regulatory level
ND	Not Detected
RL	Reporting Limit is at the level of quantitation (LOQ)
DL	Detection Limit is the lower limit of detection determined by the MDL study
MCL	Maximum Contaminant Level
	Percent recoveries and relative percent differences (RPDs) are determined by the software using values in the calculation which have not been rounded.
	No results have been blank subtracted unless specified in the case narrative section.
L-01	Laboratory fortified blank/laboratory control sample recovery outside of control limits. Data validation is not affected since all results are "not detected" for all samples in this batch for this compound and bias is on the high side.
PR-08	pH of sample (pH 5) is outside of method specified preservation criteria.

Pace Analytical Services, LLC - East Longmeadow, Ma

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CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications
EPA 524.2 in Drinking Water	
tert-Amyl Methyl Ether (TAME)	NH
Benzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Bromobenzene	CT,MA,NH,NY,RI,VT-DW,NJ
Bromochloromethane	CT,MA,NH,NY,RI,VT-DW,NJ
Bromodichloromethane	MA,NH,NY,RI,ME,VA,VT-DW,NJ
Bromoform	CT,MA,NH,NY,RI,ME,VT-DW,NJ
Bromomethane	CT,MA,NH,NY,RI,VT-DW,NJ
2-Butanone (MEK)	NH
tert-Butyl Alcohol (TBA)	NH
n-Butylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
sec-Butylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
tert-Butylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
tert-Butyl Ethyl Ether (TBEE)	NH
Carbon Disulfide	NH
Carbon Tetrachloride	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Chlorobenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Chloroethane	CT,MA,NH,NY,RI,VT-DW,NJ
Chloroform	MA,NH,NY,RI,ME,VA,VT-DW,NJ
Chloromethane	CT,MA,NH,NY,RI,VT-DW,NJ
2-Chlorotoluene	CT,MA,NH,NY,RI,VT-DW,NJ
4-Chlorotoluene	CT,MA,NH,NY,RI,VT-DW,NJ
Dibromochloromethane	MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,2-Dibromo-3-chloropropane (DBCP)	NH
1,2-Dibromoethane (EDB)	NH
Dibromomethane	CT,MA,NH,NY,RI,VT-DW,NJ
1,2-Dichlorobenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,3-Dichlorobenzene	CT,MA,NH,NY,RI,VT-DW,NJ
1,4-Dichlorobenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Dichlorodifluoromethane (Freon 12)	CT,MA,NH,NY,RI,VT-DW,NJ
1,1-Dichloroethane	CT,MA,NH,NY,RI,VT-DW,NJ
1,2-Dichloroethane	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,1-Dichloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
cis-1,2-Dichloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
trans-1,2-Dichloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,2-Dichloropropane	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,3-Dichloropropane	CT,MA,NH,NY,RI,VT-DW,NJ
2,2-Dichloropropane	CT,MA,NH,NY,RI,VT-DW,NJ
1,1-Dichloropropene	CT,MA,NH,NY,RI,VT-DW,NJ
cis-1,3-Dichloropropene	CT,MA,NH,NY,RI,VT-DW,NJ
trans-1,3-Dichloropropene	CT,MA,NH,NY,RI,VT-DW,NJ
1,3-Dichloropropene (total)	CT,MA
Diethyl Ether	NH
Diisopropyl Ether (DIPE)	NH
Ethylbenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Hexachlorobutadiene	CT,MA,NH,NY,RI,VT-DW,NJ
2-Hexanone (MBK)	NH
Isopropylbenzene (Cumene)	CT,MA,NH,NY,RI,VT-DW,NJ

Pace Analytical Services, LLC - East Longmeadow, Ma

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CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications
EPA 524.2 in Drinking Water	
p-Isopropyltoluene (p-Cymene)	CT,MA,NH,NY,RI,VT-DW,NJ
Methyl tert-Butyl Ether (MTBE)	CT,MA,NH,NY,RI,ME,VT-DW,NJ
Methylene Chloride	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Naphthalene	NY,NJ
n-Propylbenzene	NY,VT-DW,NJ
Styrene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,1,1,2-Tetrachloroethane	CT,MA,NH,NY,RI,VT-DW,NJ
1,1,2,2-Tetrachloroethane	CT,MA,NH,NY,RI,VT-DW,NJ
Tetrachloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Tetrahydrofuran	NJ
Toluene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,2,3-Trichlorobenzene	CT,MA,NH,NY,RI,VT-DW,NJ
1,2,4-Trichlorobenzene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,1,1-Trichloroethane	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
1,1,2-Trichloroethane	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Trichloroethylene	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
Trichlorofluoromethane (Freon 11)	CT,MA,NH,NY,RI,VT-DW,NJ
1,2,3-Trichloropropane	CT,MA,NH,NY,RI,VT-DW,NJ
1,2,4-Trimethylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
1,3,5-Trimethylbenzene	CT,MA,NH,NY,RI,VT-DW,NJ
Vinyl Chloride	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ
m&p-Xylene	NH,VA
o-Xylene	NH,VA
Xylenes (total)	CT,MA,NH,NY,RI,ME,VA,VT-DW,NJ

Pace Analytical Services, LLC - East Longmeadow, Ma, operates under the following certifications and accreditations:

Code	Description	Number	Expires
MA	Massachusetts DEP	M-MA100	06/30/2025
CT	Connecticut Department of Public Health	PH-0821	12/31/2026
NY	New York State Department of Health	10899 NELAP	04/1/2026
NH	New Hampshire Environmental Lab	2516 NELAP	02/5/2026
RI	Rhode Island Department of Health	LAO00373	12/30/2025
NJ	New Jersey DEP	MA007 NELAP	06/30/2025
VT-DW	Vermont Department of Health Drinking Water	VT-255716	06/12/2025
ME	State of Maine	MA00100	06/9/2025
VA	Commonwealth of Virginia	460217	12/14/2025

250812

Pace

Subcontract Chain of Custody

Pace New England
39 Spruce St
East Longmeadow, MA 01028

Pace Job Number
L2524631

Page 1

Client Information	Project Information	Regulatory Requirements/Report Limits
Client: Pace Analytical Labs Address: Eight Walkup Drive Westborough, MA 01581-1019 Report To:west.subreports@pacelabs.com Bill To:invoices@pacelabs.coupahost.com Phone: 716.427.5228 Email: Jennifer.Byrnes@pacelabs.com	Project Location: MA Project Manager: Jennifer Byrnes **Turnaround & Deliverables Information** Due Date: Deliverables:	State/Federal Program: Regulatory Criteria: Report to RL

Project Specific Requirements and/or Report Requirements

Reference following Pace Job Number on final report/deliverables: L2524631 Report to include Method and/or Regulatory required batch QC

Additional Comments:

Lab ID	Pace ID	Client ID	Collection Date/Time	Sample Matrix	Analysis	Sample Level Comments	Sample Specific QC	Container Count
AGH	L2524631-01	R2-RW	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-02	R2-T1-F1	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-03	R2-T2-F2	04-22-25 11:30	DW	VOCs - EPA 524.2			2
	L2524631-04	R2-T2-F3	04-22-25 11:30	DW	VOCs - EPA 524.2			2

	Relinquished By:	Date/Time:	Received By:	Date/Time:
	[illegible] 4128 (4123)		Mark DAVIS 4-23-25	5:08
	4123125	0508	[illegible] 2.9	4123/25 635
	Mark DAVIS	4-23-25 0635		
Form No: AL_subcoc				

Serial_No:05072521:01

Pace	DC#_Title: ENV-FRM-ELON-0001 v08_Sample Receiving Checklist
	Effective Date: 06/11/2024

Log In Back-Sheet

Client PaCE

Project L2524631

MCP/RCP Required MA MA

Deliverable Package Requirement

Location MA

PWSID# (When Applicable) MA

Arrival Method:

Courier ☑ Fed Ex ☐ Walk In ☐ Other ☐

Received By / Date / Time LA 4/23/25 635

Back-Sheet By / Date / Time LA 4-23-25 837

Temperature Method gun # 6

WV samples: Yes (see note*) / (No) (follow normal procedure)

Temp ✓ < 6° C Actual Temperature 2.9

Rush Samples: Yes / (No) Notify

Short Hold: Yes / (No) Notify

Notes regarding Samples/COC outside of SOP:

Login Sample Receipt Checklist – (Rejection Criteria Listing – Using Acceptance Policy) Any False statement will be brought to the attention of the Client – True or False

	True	False
Received on Ice	☑	☐
Received in Cooler	☑	☐
Custody Seal: DATE TIME	☐	☑
COC Relinquished	☑	☐
COC/Samples Labels Agree	☑	☐
All Samples in Good Condition	☑	☐
Samples Received within Holding Time	☑	☐
Is there enough Volume	☑	☐
Proper Media/Container Used	☑	☐
Splitting Samples Required	☐	☑
MS/MSD	☐	☑
Trip Blanks	☐	☑
Lab to Filters	☐	☑
COC Legible	☑	☐

COC Included: (Check all included)

Client	☑	Analysis	☑	Sampler Name	☐
Project	☑	IDs	☑	Collection Date/Time	☑

All Samples Proper pH: (N/A) ☐ ☐

Additional Container Notes

Note: West Virginia requires all samples to have their temperature taken. Note any outliers.

Qualtrax ID: 120836

Pace ANALYTICAL SERVICES	DC#_Title: ENV-FRM-ELON-0001 v08_Sample Receiving Checklist
	Effective Date: 06/11/2024

Sample			
16oz Amb/Clear	Soils Jars (Circle Amb/Clear)		
8oz Amb/Clear			
4oz Amb/Clear			
2oz Amb/Clear			
Unpreserved	Ambers	1 Liter	
HCL			
Sulfuric			
Sulfuric		250mL	
Phosphoric			
HCl			
Unpreserved		100mL	
Unpreserved	Plastics	1 Liter	
Sulfuric			
Unpreserved		500mL	
Sulfuric			
Unpreserved		250mL	
Trizma			
Sulfuric			
Nitric			
NaOH			
Ammonium Acetate			
NaOH/Zinc			
Unpreserved	VOA Vials		
HCl			
MeOH			
D.I. Water			
BiSulfate			
Col/Bact	Other / Fill in		

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Unpreserved			(PV)																	
HCl				X																
Col/Bact			1	2																

2

Qualtrax ID: 120836

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order ID: 042507675
Customer ID: ALPH55A
Customer PO: I2524631
Project ID:

Attn: Results
Pace Analytical Labs
8 Walkup Drive
Westborough, MA 01581

Phone: (508) 898-9220
Fax: (508) 898-9193
Received: 04/23/2025
Analyzed: 05/07/2025

Proj: L2524631

Test Report: Determination of Asbestos Structures >10µm in Drinking Water Performed by the 100.2 Method (EPA 600/R-94/134)

Sample ID / Client / EMSL	Sample Filtration Date/Time	Original Sample Vol. Filtered (ml)	Effective Filter Area (mm²)	Area Analyzed (mm²)	ASBESTOS: Asbestos Types	Fibers Detected	Analytical Sensitivity	Concentration	Confidence Limits
								MFL (million fibers per liter)	
L2524631-01 042507675-0001	4/23/2025 04:57 PM	100	1336	0.0786	None Detected	ND	0.17	<0.17	0.00 - 0.63
Collection Date/Time:	*04/22/2025 11:30 AM*								
L2524631-02 042507675-0002	4/23/2025 05:03 PM	100	1336	0.0786	None Detected	ND	0.17	<0.17	0.00 - 0.63
Collection Date/Time:	*04/22/2025 11:30 AM*								
L2524631-03 042507675-0003	4/23/2025 05:10 PM	100	1336	0.0786	None Detected	ND	0.17	<0.17	0.00 - 0.63
Collection Date/Time:	*04/22/2025 11:30 AM*								
L2524631-04 042507675-0004	4/23/2025 05:15 PM	100	1336	0.0786	None Detected	ND	0.17	<0.17	0.00 - 0.63
Collection Date/Time:	*04/22/2025 11:30 AM*								

Bottles supplied by client.

Analyst(s)
Sarah Richey (4)

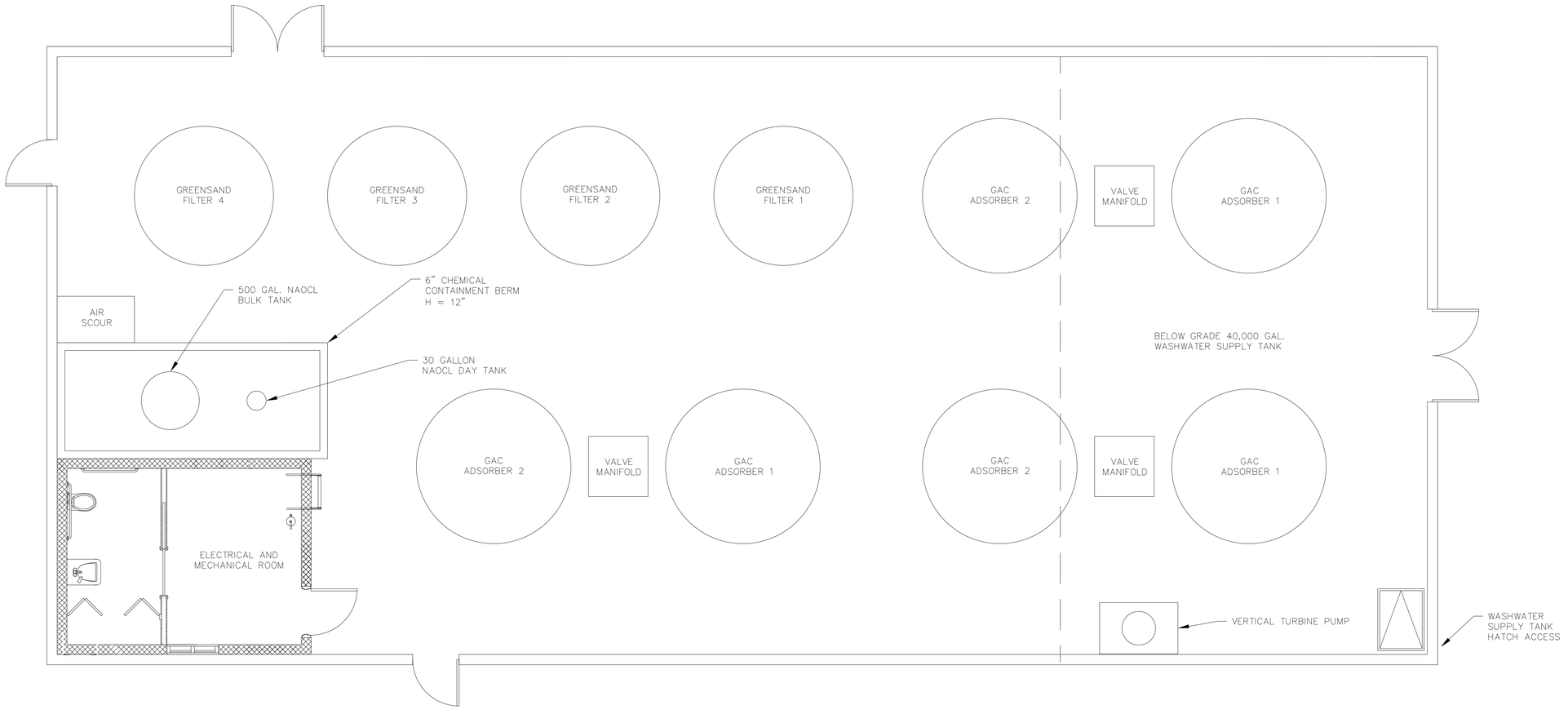
Samantha Rundstrom, Laboratory Manager
or Other Approved Signatory

Any questions please contact Samantha Rundstrom-Cruz.

Initial report from: 05/07/2025 12:44:51

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. Estimation of uncertainty is available on request. Sample collection performed by the client. Pre-cleaned sample containers are available for purchase from EMSL. Note if sample containers are provided by the client, acceptable bottle blank level is defined as ≤0.01MFL for >=10um fibers. ND=None Detected. No Fibers Detected: the value will be reported as less than 369% of the concentration equivalent to one fiber. 1 to 4 fibers: The result will be reported as less than the corresponding upper 95% confidence limit (Poisson),5 to 30 fibers: Mean and 95% confidence intervals will be reported on the basis of the Poisson assumption. When more than 30 fibers are counted, both the Gaussian 95% confidence interval and the Poisson 95% confidence interval will be calculated. The large of these two intervals will be selected for data reporting. When the Gaussian 95% confidence interval is selected for data reporting, the Poisson will also be noted.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAC NYS ELAP 10872, NJ DEP 03036, FL DOH E87975, PA ID# 68-00367



CONCEPTUAL FLOOR PLAN

SCALE: 1/4" = 1'

CONCEPTUAL

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JULY 2025
SCALE:	1/4" = 1'
DESIGNED BY:	RAT
CHECKED BY:	RAT
DRAWN BY:	GAC
APPROVED BY:	SCO

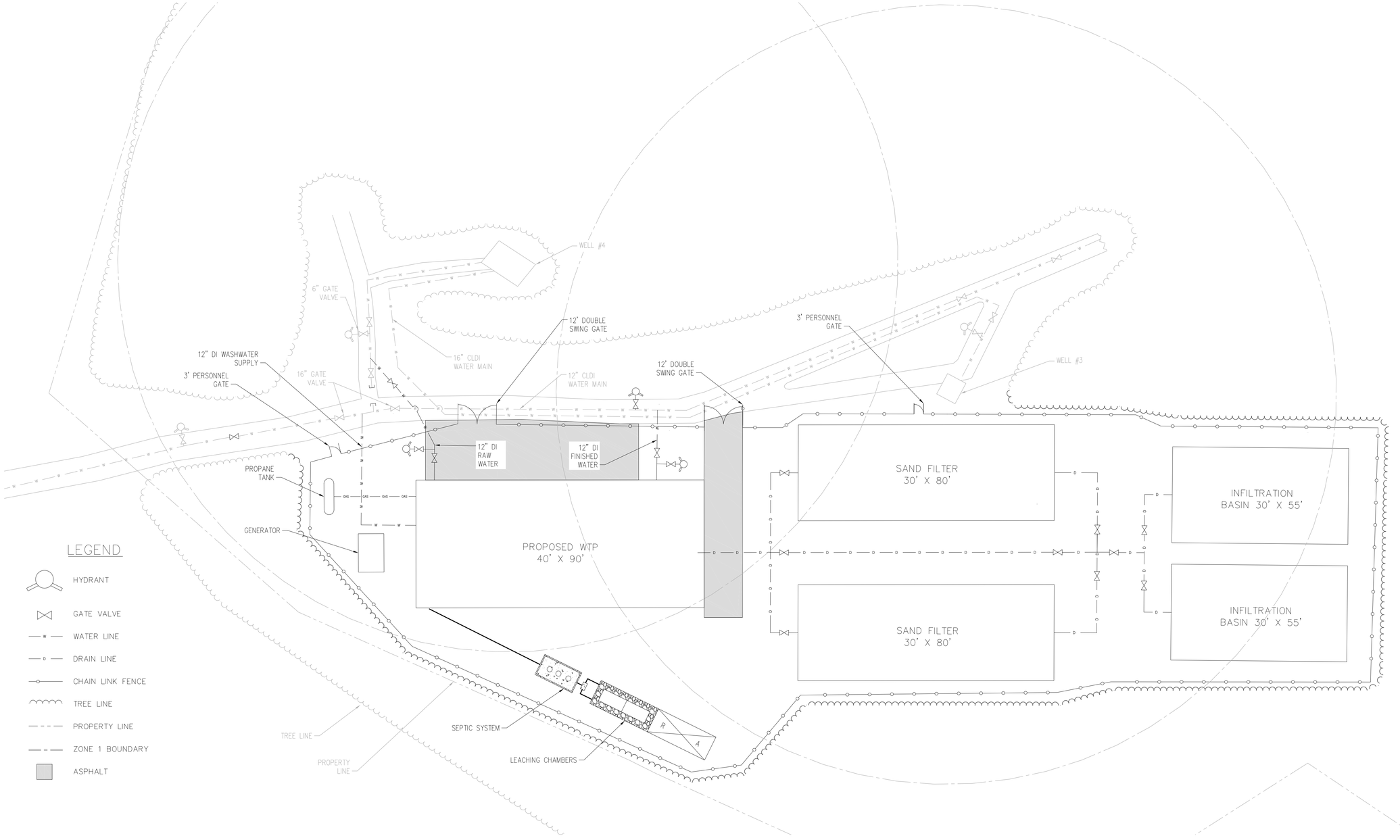
BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CONCEPTUAL FLOOR PLAN

DRAWING NO.:
B-1

SHEET NO. ___ OF 1

C:\Users\Ryan\H2Olson Engineering, Inc\H2O - Documents\03 Projects\127 - Barnstable Fire District\127.25.01 - Well 3 & 4 Pilot Study\03 Conceptual Design\M Sheets.dwg



PLAN VIEW

SCALE: 1"=16'

CONCEPTUAL

H2Olson Engineering, Inc.
DRINKING WATER PROFESSIONALS
www.h2olsonengineering.com
(508) 375-7007

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT NO.:	127.25.01
DATE:	JULY 2025
SCALE:	1" = 16'
DESIGNED BY:	RAT
CHECKED BY:	RAT
DRAWN BY:	GAC
APPROVED BY:	SCO

BARNSTABLE FIRE DISTRICT
WELL 3 AND 4 WTP
BARNSTABLE, MASSACHUSETTS

DRAWING TITLE:
CONCEPTUAL SITE PLAN

DRAWING NO.:
C-1

SHEET NO. ___ OF 1

C:\Users\Ryan\H2Olson Engineering, Inc\H2O - Documents\03 Projects\127 - Barnstable Fire District\127.25.01 - Well 3 & 4 Pilot Study\03 Conceptual Design\C Sheets.dwg

Barnstable Fire District Well 3 and 4
Well 3 and 4 WTP
Capacity 1,500 gpm
Engineer's Opinion of Probable Construction Costs - Preliminary Design

Work Item Description	Unit of Measure	Quantity	Unit Cost	Estimated Cost
Site Clearing and Preparation	LS	1	$250,000	$250,000
Environmental Protection	LF	1,500	$15	$22,500
Earthwork (excavation and backfill)	LS	1	$200,000	$200,000
Sand Filters	EA	2	$500,000	$1,000,000
Infiltration System	EA	2	$150,000	$300,000
Septic System	LS	1	$50,000	$50,000
Site Yard Piping	LF	500	$150	$75,000
Fencing and Gates	LF	800	$125	$100,000
Bituminous Pavement	Tons	200	$150	$30,000
Stormwater Management	LS	1	$50,000	$50,000
Final Site Restoration	LS	1	$100,000	$100,000
Concrete Slab/Foundation	LS	1	$300,000	$300,000
Pre-engineered Metal Building	SF	3,600	$375	$1,350,000
Process Equipment (Greensand Filter System)	LS	1	$1,500,000	$1,500,000
Process Equipment (GAC System)	LS	1	$2,000,000	$2,000,000
Process Equipment (Chemical Feed Systems)	LS	1	$75,000	$75,000
Interior Process Piping & Valves	LF	300	$500	$150,000
Site Generator and Propane Tanks	EA	1	$150,000	$150,000
Washwater Supply Tank	GAL	40,000	$5	$200,000
Upgrade Well Pumps	EA	2	$75,000	$150,000
Backwash Pump	LS	1	$20,000	$20,000
Bathroom	LS	1	$150,000	$150,000
			Subtotal	$8,222,500
Instrumentation & Controls	ALLOW	5%		$411,125
HVAC & Plumbing	ALLOW	5%		$411,125
Electrical	ALLOW	10%		$822,250
			Subtotal	$1,644,500
			Construction Total	$9,870,000
			20% Contractor (OH/Profit/Bonds/Insurance)	$1,974,000
			5% Escalation, Supply Chain, and Bid Market Conditions	$493,500
			25% Engineering (Design, Permitting, Bidding, & Construction Services)	$2,467,500
			Design & Construction Total	$14,805,000
			20% Project Contingencies	$2,960,000
			Total Project Cost	**$17,770,000**

Date of Estimate: 7/23/2025

H2Olson Engineering, Inc.

Appendix F: Expanded Environmental Notification Form Secretary's Certificate

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900, Boston, MA 02114
www.Mass.gov/EEA | **Tel:** (617) 626-1000 | **Fax:** (617) 626-1081

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

July 31, 2026

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
EXPANDED ENVIRONMENTAL NOTIFICATION FORM AND
PROPOSED ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Barnstable Fire District Wells 3& 4 Water Treatment Plant
PROJECT MUNICIPALITY	: Barnstable
PROJECT WATERSHED	: Cape Cod
EEA NUMBER	: 17080
PROJECT PROPONENT	: Barnstable Fire District Water Department
DATE NOTICED IN MONITOR	: June 24, 2026

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G.L. c. 30, ss. 61- 62L) and Section 11.06 of the MEPA regulations (301 CMR 11.00), I have reviewed the Expanded Environmental Notification Form (EENF), and hereby determine that this project **requires** the submission of an Environmental Impact Report (EIR). In accordance with 301 CMR 11.06(13), the Proponent has submitted a Proposed EIR with a request that I allow a Rollover EIR in lieu of the usual two-stage Draft and Final EIR process. The Proponent also requested that, if a rollover EIR were not granted, a Single EIR be allowed to be submitted in accordance with 301 CMR 11.06(8). I hereby grant the request for a Rollover EIR, and, therefore, I will publish notice in the next Environmental Monitor that the Proposed EIR shall be reviewed as a Final EIR pursuant to Section 11.06(14) and shall be subject to a 30-day public comment period.

Project Description

As described in the EENF and Proposed EIR (EENF/Proposed EIR), the purpose of the project is to address high levels of per- and polyfluoroalkyl substances (PFAS), iron, and manganese in two of the Barnstable Fire District's[1] (District's) drinking water supply wells (Wells 3 and 4). According to the EENF/Proposed EIR, water from these wells is not in compliance with current United States

[1] https://www.barnstablefiredistrict.com/

Environmental Protection Agency (USEPA) maximum contaminant levels (MCLs) for PFAS. Because of this, the District has reduced production for Wells 3 and 4 to lower the concentration of PFAS in the distribution system. The permitted withdrawal at Well 3 and Well 4 is 0.77 million gallons per day (mgd) and 0.67 mgd, respectively. However, average daily flow from Well 3 and 4 has been substantially lower, as reported in the District's 2024 Annual Statistical Report (ASR) at only 173,051 and 111,243 gallons per day (gpd), respectively.

The project includes construction of a new water treatment facility (WTF) to remove PFAS, iron and manganese from water withdrawn at Wells 3 and 4 in order to comply with EPA and Massachusetts Department of Environmental Protection (MassDEP) drinking water regulatory requirements. The new WTF will consist of a of a 4,040-square foot (sf) single-story building that will contain three 10.5-foot diameter Greensand contactors and associated process mechanical valves and piping for the removal of source water iron and manganese; six 10-foot diameter granular activated carbon (GAC) contactors and associated process mechanical valves and piping for the removal of PFAS; and other related chemical storage, feed, and handling facilities.

In addition to the WTF itself, the project also includes a paved driveway to the new building, two sand filters and two infiltration basins for the treatment of water treatment residuals, a septic system for the facility bathroom, best management practices (BMPs) for the treatment and infiltration of stormwater, new yard piping to deliver water to and from the building, two new generators, three new propane tanks, yard fencing, and three new water hydrants.

Project Site

The 71.77-acre project site where the new WTF will be constructed is located on a portion of District-owned land currently in use for public water supply located at 1650 Iyannough Road/Route 132 in Barnstable, Massachusetts. The site currently consists of Wells 3 and 4, a paved access road, the Well 4 Pump House and water treatment facility. The existing property is predominantly woodlands with undeveloped forest to the north, Hathaway's Pond Recreation Area to the east, and the Hyannis Golf Club to the south and west. The existing paved access road runs east to west, connecting the site to Iyannough Road/Route 132.

Currently, water from Wells 3 and 4is pumped to the Well 4 Pump House and water treatment facility, where water from both wells is chemically treated before being pumped to the distribution system. The current facility has a capacity of 1,500 gallons per minute (gpm). The Well 4 Pump House will remain on site and continue to treat water with potassium hydroxide for pH adjustment and sodium hypochlorite for disinfection.

There are no wetland resources located on the project site. According to the Massachusetts Natural Heritage and Endangered Species Program (NHESP) Atlas (15th Edition), the site is not located within Priority or Estimated Habitat of Rare Species. The site is also not located within an Area of Critical Environmental Concern (ACEC). The site does not contain any structures listed in the State Register of Historic Places or the Massachusetts Historical Commission's (MHC) Inventory of Historic and Archaeological Assets of the Commonwealth. The project site is not located within a 100-year floodplain as mapped by Federal Emergency Management Agency (FEMA). The site is located within the Wellhead Protection Overlay District.

The project site is located within one mile of three Environmental Justice (EJ) populations designated as Minority (2) and Minority and Income (1) in Barnstable.[2] There are 15 additional EJ populations within five miles of the site.

Environmental Impacts and Mitigation

Potential environmental impacts associated with the project include alteration of 2.1 acres of land, the majority of which involves tree clearing; creation of 0.18 acres of impervious area; and generation of 303 gpd of wastewater associated with a bathroom within the WTF

The purpose of the project is to provide safe drinking water by providing PFAS and other chemical treatment for water drawn from Wells 3 and 4. Measures to avoid, minimize, and mitigate environmental impacts include construction of a new stormwater management system, the use of erosion and sedimentation controls during project construction, the restoration of temporarily disturbed areas following construction, and planting of 55 trees.

Jurisdiction and Permitting

This project is subject to MEPA review because it requires an Agency Action and meets/exceeds the threshold at 301 CMR 11.03(4)(b)(4) (Construction of a New drinking water treatment plant with a Capacity of 1,000,000 or more gpd). The project requires the preparation of an EIR pursuant to 301 CMR 11.06(7)(b) because it is located within a DGA (1 mile) around one or more EJ Populations. The project will require BRP-WS 24 (Approval to Construct a Facility to Treat 1,000,000 Gallons per Day or Greater) permit from MassDEP.

The project requires a National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP) from the EPA. Comments from the Cape Cod Commission (CCC) indicate that the project is considered a Development of Regional Impact (DRI) and in turn requires an application with the Commission.

The project is not seeking Financial Assistance from an Agency. Therefore, MEPA jurisdiction for EIR review is limited to those aspects of the project that are within the subject matter of any required or potentially required Agency Actions and that may cause Damage to the Environment, as defined in the MEPA regulations.

Request for Rollover EIR or Single EIR

The EENF/Proposed EIR included a request that I allow a Rollover EIR in accordance with 301 CMR 11.06(13) or alternatively, a Single EIR in accordance with 301 CMR 11.06(8).

The MEPA regulations provide that for projects required to submit an EIR under 301 CMR 11.06(7)(b), the Proponent may submit an EENF with a request that I allow a Rollover EIR in accordance with 301 CMR 11.06(13). To support this request, the EENF must be accompanied by a

[2] "Environmental Justice Population" is defined in M.G.L. c. 30, § 62 under four categories: Minority, Income, English Isolation, and a combined category of Minority and Income.

Proposed EIR, which, if the request for Rollover EIR is granted, would be published as a Final EIR in a subsequent Environmental Monitor in lieu of the typical two-stage Draft and Final EIR process.

In order to allow a Rollover EIR, I must find that the dual EENF and Proposed EIR:

1. presents a complete and definitive description and analysis of the project and its alternatives, and an assessment of its potential environmental and public health impacts and mitigation measures sufficient to allow a Participating Agency to fulfill its obligations in accordance with M.G.L. c. 30, §§ 61 and 62K and 301 CMR 11.12(5);
2. demonstrates that the project will not materially exacerbate any existing unfair or inequitable Environmental Burden and related public health consequences impacting an EJ population, and will not result in a disproportionate adverse effect or increased climate change effects on an EJ population;
3. describes measures taken to provide meaningful opportunities for public involvement by EJ populations prior to filing the dual ENF and Proposed EIR, including any changes made to the project to address concerns raised by or on behalf of EJ populations;
4. shows that comments received on the dual ENF and Proposed EIR do not raise substantial issues not previously considered by the Proponent; and
5. shows that no substantive issues remain to be resolved.

The MEPA regulations at 301 CMR 11.06(8) indicate that a Single EIR may be allowed provided I find that the EENF:

a. describes and analyzes all aspects of the project and all feasible alternatives, regardless of any jurisdictional or other limitation that may apply to the Scope;
b. provides a detailed baseline in relation to which potential environmental impacts and mitigation measures can be assessed; and,
c. demonstrates that the planning and design of the project use all feasible means to avoid potential environmental impacts.

For any project for which an EIR is required in accordance with 301 CMR 11.06(7)(b), I must also find that the EENF:

d. describes and analyzes all aspects of the Project that may affect Environmental Justice Populations located in whole or in part within the Designated Geographic Area around the Project; describes measures taken to provide meaningful opportunities for public involvement by Environmental Justice Populations prior to filing the expanded ENF, including any changes made to the Project to address concerns raised by or on behalf of Environmental Justice Populations; and provides a detailed baseline in relation to any existing unfair or inequitable Environmental Burden and related public health consequences impacting Environmental Justice Populations in accordance with 301 CMR 11.07(6)(n)1.

Consistent with these requests, the EENF/Proposed EIR was subject to an extended comment period under 301 CMR 11.05(9).

Review of the EENF/Proposed EIR

The EENF/Proposed EIR included a project description, an alternatives analysis, plans of existing and proposed conditions, and identification of measures to avoid, minimize and mitigate environmental impacts. Consistent with the MEPA Interim Protocol on Climate Change Adaptation and Resiliency, the EENF/Proposed EIR contained an output report from the Climate Resilience Design Standards Tool prepared by the Resilient Massachusetts Action Team (RMAT) (the "MA Resilience Design Tool"),[3] together with information on climate resilience strategies to be undertaken by the project. Comments submitted by CCC are generally supportive of the project and recommend that the Proponent schedule a pre-application meeting with CCC prior to filing development plans at the local/regional level to discuss the application requirements and the DRI review process.

Alternatives Analysis

The EENF/Proposed EIR evaluated a No Build Alternative, Decommission of Wells 3 and 4 Alternative, a Water Treatment Plant Addition Alternative and a New Water Treatment Plant Construction Alternative (Preferred Alternative). The No Build Alternative would continue the use of the existing Well 4 Pump House, which provides pH adjustment for corrosion control and disinfection, but does not treat PFAS, iron or manganese. Because this alternative does not address the goal of the project of providing treatment for these contaminants to improve drinking water quality, it was dismissed.

The District also evaluated decommissioning Well 3 and Well 4. This alternative eliminates the District's source water contaminant issues. However, this alternative does not address the District's existing and future water supply needs. According to the EENF/Proposed EIR, decommissioning Wells 3 and 4 would put a large strain on the District's remaining three wells, and the District would not meet its current water demand, especially in the summer months when demands increase significantly due to population increases. As such, this alternative was dismissed.

A third alternative considered constructing an addition to the Well 4 Pump House, where water is currently being treated for pH adjustment and disinfection. This pump house addition would include both GAC media pressure vessels and greensand media filters to treat the raw water. According to the EENF/Proposed EIR, this alternative addresses both the District's source water contaminant issues and its need for a restored water capacity. However, the Well 4 Pump House is located in a small depression on the land, which makes it difficult to place all required elements of the project (structures for the treatment of water treatment residuals, stormwater BMPs, etc) in this area without significant earth work to change the topography of the existing site. Additionally, the current pump house is near the center of the Zone I Wellhead Protection Area, which in turn, requires the construction of a longer septic line (415 feet) to place the septic system that supports the WTF outside of the Zone I. According to the EENF/Proposed EIR, the longer septic line presents a higher risk of a leak within the Zone I. For these reasons, the District dismissed this alternative.

The Preferred Alternative consists of the construction of a new building for the treatment of water from Wells 3 and 4. Like the previous alternative, this alternative addresses both the District's source water contaminant issues and its need for a restored water capacity. However, according to the

[3] Available at: https://resilientma.mass.gov/rmat_home/designstandards/

EENF/Proposed EIR, the area proposed for this alternative requires less site grading than the previous alternative. Additionally, the Preferred Alternative places the new WTF closer to the edge of the Zone I when compared to Alternative 3 resulting in a shorter septic line (150 feet). For the reasons described above, this alternative was selected as the preferred alternative.

Environmental Justice

As noted above, the project area is located within one mile of three EJ populations designated as Minority (2) and Minority and Income (1) in Barnstable. Within the DGA containing the above EJ populations, there is one language (Portuguese or Portuguese Creole) spoken by 5% of more of residents who also identify as not speaking English very well.

Effective January 1, 2022, all new projects in a DGA (as defined in 301 CMR 11.02) around EJ Populations are subject to new requirements imposed by the Chapter 8 of the Acts of 2021: *An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy* (the "Climate Roadmap Map") and amended MEPA regulations at 301 CMR 11.00. Two related MEPA protocols—the MEPA Public Involvement Protocol for Environmental Justice Populations (the "MEPA EJ Public Involvement Protocol") and MEPA Interim Protocol for Analysis of project Impacts on Environmental Justice populations (the "MEPA Interim Protocol for Analysis of EJ Impacts")—are also in effect for new projects filed on or after January 1, 2022. Under the new regulations and protocols, all projects located in a DGA around one or more EJ populations must take steps to enhance public involvement opportunities for EJ populations and must submit analysis of impacts to such EJ populations in the form of an EIR.

Community Engagement

Consistent with the MEPA EJ Public Involvement Protocol, the Proponent sent advance notification of the project in the form of an EJ Screening Form to the "EJ Reference List" developed based on a list provided by the MEPA Office and consisting of Community Based Organizations (CBOs) and tribes/indigenous organizations. According to the EENF/Proposed EIR, no responses to the EJ Screening Form were received. The District held an in-person public meeting on May 13, 2026, at which the project received general support according to the filing.

After filing the EENF/Proposed EIR, a MEPA remote site visit/consultation session was held on July 9, 2026. The notice for the meeting was translated into Portuguese or Portuguese Creole with an offer to provide translation services, no requests were made. According to the EENF/Proposed EIR, additional public meetings will be held through the local permitting process.

Baseline Conditions Assessment / Project Impacts

The EENF/Proposed EIR included a baseline assessment of any existing "unfair or inequitable Environmental Burden and related public health consequences" impacting the identified EJ populations in accordance with 301 CMR 11.07(6)(n)(1) and the MEPA Interim Protocol for Analysis of EJ Impacts. The baseline assessment included a review of the data provided by the Department of Public Health (DPH) EJ Tool applicable to the DGA regarding "vulnerable health EJ criteria"; this term is defined in the DPH EJ Tool to include any one of four environmentally related health indicators that are measured

to be 110% above statewide rates based on a five-year rolling average. According to the EENF/Proposed EIR, the data surveyed indicate that no municipalities or census block groups within the DGA exceed 110% of the statewide rates of any of the four vulnerable health EJ criteria, which include Childhood Lead Exposure, Childhood Asthma Emergency Department Visits, Low Birth Weight and Heart Attack Hospitalizations.

The EENF/Proposed EIR indicated that the following sources of potential pollution exist within the DGA, based on data available in the DPH EJ Tool:

- MassDEP Major Air and Waste Facilities: 3
- Tier II toxics use reporting facilities: 11
- Underground storage tanks (USTs): 4
- Municipal Buildings and Healthcare Facilities: 2
- Road Infrastructure: 6
- MBTA Bus and Rapid Transit: 8
- Energy generation and supply: 3

According to the output report from the MA Resilience Design Tool included in the EENF/Proposed EIR, the project site has a high exposure to extreme precipitation (stormwater flooding) and to extreme heat. EJ populations near the site are likely also exposed to these climate risks. According to the EENF/Proposed EIR, the project will not exacerbate climate risks within the DGA because the project is limited to construction of the WTF, which is not proposed to be located within the floodplain. The project is unlikely to exacerbate extreme heat in EJ populations because the project does not propose significant new impervious area or land alteration exceeding MEPA review thresholds (minimum of 5 or more acres of impervious area and 25 or more acres of land alteration), is located on a largely undisturbed site which is forested and otherwise covered by vegetation. In addition, the project proposes to plant 55 trees.

According to the EENF/Proposed EIR, the project will not have disproportionate adverse effects on EJ populations because there will be minimal air emissions associated with the construction and operation of the project; the project will cause a minimal increase in traffic during operations and have minimal traffic impacts during the construction period; and stormwater runoff will be managed on-site. The purpose of the project is to protect the public health of all residents served by the water from Wells 3 and 4, including residents in EJ populations, by constructing a treatment facility that will ensure that the drinking water from the wells meets drinking water standards, including limits for PFAS as well as treating for iron and manganese. In addition, the project also includes two sand filters and two infiltration basins, which is designed to hold 55,000 gallons of backwash waste, for the treatment of water treatment residuals. Comments from MassDEP note that the project's plan for treating residuals is consistent with other drinking water treatment plants.

Impervious Area and Stormwater

As noted above, the project will result in the direct alteration of 2.1 acres of land (the majority of which will require tree clearing). The EENF/Proposed EIR states that 55 trees will be planted on the project site as mitigation. Comments from CCC note that the EENF/Proposed EIR references

planting Bermuda Grass on the site. Comments state that Bermuda grass is not native to the region and recommend planting only a native blend of fescue grasses and wildflowers.

In addition, the project will create 0.18 acres of impervious surfaces. The project includes the construction of a stormwater management system to mitigate this impact. As described in the EENF/Proposed EIR, stormwater runoff generated by the project will be collected and treated through a combination of best management practices (BMPs), including deep sump catch basins, an oil/grit separator, a sediment forebay, an infiltration basin, a rain garden and dry wells. The system will be capable of attenuating the present-day 100-year storm event (24-hr precipitation depth of 7.41 inches), and will provide 44% total suspended solids (TSS) removal prior to infiltration, and a minimum of 80% TSS removal prior to discharge. The filing states that the stormwater management system can be upgraded to accommodate future storms, as further discussed below.

Water Supply

Under its existing Water Management Act (WMA) Permit, the permitted withdrawal at Well 3 and Well 4 is 0.77 mgd and 0.67 mgd (1.44 mgd total), respectively. The project does not propose to increase the District's water supply nor groundwater withdrawal. However, because of concentration of PFAS above the USEPA's MCL, the District has reduced production for Wells 3 and 4 to lower the concentration of PFAS in the distribution system to average daily flows 173,051 gpd for Well 3 and 111,243 gpd for Well 4. As noted above, the proposed WTF will treat groundwater from the District's Wells 3 and 4 in order to comply with EPA and MassDEP drinking water regulatory requirements and allow both wells to reach their full production. The treatment facility will remove iron and manganese using Greensand contactors and will remove PFAS using granular activated carbon contactors following chemical pre-treatment at the current Well 4 Pump House. As noted above, the project will require a WS24 permit from MassDEP for the construction of the treatment facility. Comments from MassDEP strongly supports the project and note that its successful implementation will provide safe drinking water to the customers of the Barnstable Fire District.

Climate Change

Effective October 1, 2021, all MEPA projects are required to submit an output report from the MA Resilience Design Tool to assess the climate risks of the project. Based on the output report, the new WTF has a "High" exposure rating based on the site's location for stormwater and riverine flooding due to extreme precipitation and to extreme heat. Based on the 30-year useful life and the self-assessed criticality identified for the project, the MA Resilience Design Tool recommends a planning horizon of 2070 and a return period associated with a 50-year (2% annual chance) storm event when designing the WTF for extreme precipitation. The MA Resilience Design Tool recommends planning for the 90th percentile with respect to extreme heat (which indicates an increase in extremely hot days as compared to a historical baseline).

The MA Resilience Design Tool output indicates that the maximum annual daily rainfall exceeds 10" within the overall project's useful life and the project is creating impervious area. In addition, the project site is anticipated to have more than a 30 day increase in days over 90 degrees Fahrenheit within project's useful life and existing trees are being removed as part of the proposed project. These two series of factors, respectively, are indicated in the MA Resilience Design Tool as contributing to the

"High" exposures for the extreme precipitation (stormwater flooding) and extreme heat climate parameters. According to MA Resilience Design Tool output, the projected 24-hour precipitation depth associated with a 2070 50-year storm event is 8.7 inches. Therefore, it appears that the stormwater system, which is designed to attenuate the current 100-year storm event (7.41 inches), would not be resilient to future climate conditions as recommended by the MA Resilience Design Tool. The EENF/Proposed EIR states that there is sufficient space to add more BMPs to upgrade the stormwater system to adapt to future storms. I encourage the Proponent to continue to evaluate ways to improve the capacity of the stormwater management system to accommodate larger storm events under future climate conditions.

To mitigate for extreme heat, the project proposes to plant 55 trees. In addition, EENF/Proposed EIR indicates that the project was designed to minimize tree clearing to the greatest extent possible, specifically, by utilizing the existing access road.

GHG Emissions

According to the EENF/Proposed EIR, the project's total emissions from water treatment processes and heating, cooling, and ventilation of conditioned spaces will be approximately 5.9 tons per year (tpy). Because this project does not exceed any mandatory EIR thresholds and is required to submit an EIR only because it is located within a DGA of EJ populations, a GHG analysis was not required because the project's GHG emissions from conditioned spaces will be less than 2,000 tpy.

Construction Period

According to the EENF/Proposed EIR, the project will commence in the Winter of 2027 and be completed by the Fall of 2028. All construction and demolition (C&D) activities should be managed in accordance with applicable MassDEP regulations regarding Air Pollution Control (310 CMR 7.01, 7.09-7.10), and Solid Waste Facilities (310 CMR 16.00 and 310 CMR 19.00, including the waste ban provision at 310 CMR 19.017). The project should include measures to reduce construction period impacts (e.g., noise, dust, odor, solid waste management, etc.) and emissions of air pollutants from equipment, including anti-idling measures in accordance with the Air Quality regulations (310 CMR 7.11). I encourage the Proponent to require that its contractors use construction equipment with engines manufactured to Tier 4 federal emission standards, or select project contractors that have installed retrofit emissions control devices or vehicles that use alternative fuels to reduce emissions of volatile organic compounds (VOCs), carbon monoxide (CO) and particulate matter (PM) from diesel-powered equipment. Off-road vehicles are required to use ultra-low sulfur diesel fuel (ULSD). If oil and/or hazardous materials are found during construction, the Proponent should notify MassDEP in accordance with the Massachusetts Contingency Plan (MCP; 310 CMR 40.0000). All construction activities should be undertaken in compliance with the conditions of all State and local permits. I encourage the Proponent to reuse or recycle C&D debris to the maximum extent.

Mitigation & Section 61 Findings

The Proposed EIR includes a separate chapter summarizing proposed mitigation measures and includes draft Section 61 Findings. It contains commitments to implement these mitigation measures, identifies the parties responsible for implementation, and includes a schedule for implementation. As

described in the EENF/Proposed EIR, the Proponent has committed to implement the following measures to avoid, minimize and mitigate Damage to the Environment:

Environmental Justice/Public Health

- Provide drinking water to all residents, including residents in EJ populations, that meets drinking water standards
- Construct a new stormwater management system that designed to comply with the SMS to minimize potential off-site flooding
- Plant 55 native trees to minimize heat island effect

Stormwater Management

- Construct a new stormwater management system that will be designed to comply with the SMS, including requirements to treat and convey the present-day 100-year storm event (24-hour precipitation depth of 7.41 inches).
- Install sedimentation and erosion controls around work areas and other stormwater management measures required by the Storm Water Pollution Prevention Plan (SWPPP) prepared in accordance with the NPDES General Permit.

Water Supply

- There is no increase in District water supply nor groundwater withdrawal. The permitted withdrawal at the project site is 1.44 MGD.
- The project includes two sand filters and two infiltration basins, which is designed to hold 55,000 gallons of backwash waste, for the treatment of water treatment residuals. Comments from MassDEP note that the project's plan for treating residuals is consistent with other drinking water treatment plants.

Climate Change

- Plant 55 native trees at the site.
- Construct a new stormwater management system that will be designed to comply with the SMS, including requirements to treat and convey the present-day 100-year storm event (24-hour precipitation depth of 7.41 inches). The EENF/Proposed EIR states that there is sufficient space to add more BMPs to upgrade the stormwater system to adapt to future storms.

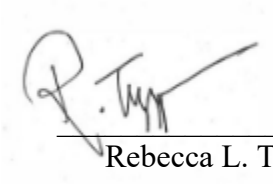
Construction Period

- Tree protection is proposed at trees that are to remain on site
- Contract specifications will require the contractor to comply with the provisions of MGL Chapter 90, section 16A and the DEP Anti-Idling Regulations (310 CMR 7.11(b)).
- The contractor shall also abide by the MassDOT diesel retrofit specification.
- Install and maintain sedimentation and erosion controls around work areas and implement other stormwater management measures in accordance with the SWPPP.

- Notify MassDEP if any contaminated soil and groundwater is encountered during construction.

Conclusion

Based on a review of the EENF and Proposed EIR and consultation with Agencies, I find that the Proposed EIR meets the standard for a Rollover EIR under 301 CMR 11.06(13)-(14). Accordingly, I will publish notice in the next *Environmental Monitor* that the Proposed EIR shall be reviewed as a Final EIR pursuant to the provisions at 11.06(14); the Final EIR shall be subject to a 30-day public comment period.



July 31, 2026
Date

Rebecca L. Tepper

Comments received:

07/24/2026 Cape Cod Commission (CCC)
07/27/2026 Massachusetts Department of Environmental Protection (MassDEP)/Southeast Regional Office (SERO)

RLT/NSP/nsp

3225 MAIN STREET • P.O. BOX 226
BARNSTABLE, MASSACHUSETTS 02630

(508) 362-3828 • Fax (508) 362-3136 • www.capecodcommission.org

CAPE COD COMMISSION

Via Email

July 24, 2026
Rebecca Tepper, Secretary of Energy and Environmental Affairs
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office, Nicholas Perry, MEPA Analyst
100 Cambridge Street, Suite 900, Boston, MA 02114

Re: Expanded Environmental Notification Form (EENF)
Proposed Environmental Impact Report (PEIR)
EEA No. 17080 (Cape Cod Commission File No. EENF-2026-015)
Barnstable Fire District Wells 3 and 4 Water Treatment Plant

Dear Secretary Tepper:

Thank you for the opportunity to provide comments on the above-referenced EENF/PEIR. The Cape Cod Commission ("Commission") supports municipal efforts, such as the above-referenced Project, to preserve or improve water quality. The Project is located within one mile of Environmental Justice (EJ) communities and exceeds the Environmental Notification Review Threshold for Construction of a new drinking water treatment plant with a capacity of 1,000,000 or more g.p.d. (301 CMR 11.03(4)(b)4.).

Located in the town of Barnstable, the proposed Project involves construction of a new water treatment plant for the treatment of drinking water from Wells 3 and 4 for the removal of PFAS, iron, and manganese. The proposed Project includes a new building (4,040 sf), paved driveway to the new building, two sand filters, two infiltration basins for treatment of water treatment residual (also known as backwash), a septic system for the facility bathroom, stormwater control measures (SCMs) for treatment and infiltration of stormwater, new yard piping to deliver water to and from the building, new underground utilities, two new generators, two new propane tanks, yard fencing, and three new water hydrants. The total area of disturbance is approximately 2.1 acres.

Any development for which the Secretary requires an EIR is deemed a Development of Regional Impact ("DRI") under § 12(i) of the Cape Cod Commission Act ("Act"), c. 716 of the Acts of 1989. Consistent with the 2025 Regional Policy Plan (RPP) and Technical Bulletins, Commission staff offer

the following comments for consideration as the proponent completes an EIR and prepares for DRI Review.

Water Resources

The RPP Water Resources Goal is to maintain a sustainable supply of high-quality drinking water and protect, preserve, or restore the ecological integrity of Cape Cod's fresh and marine surface water resources. The proposed project is located in areas mapped as MassDEP Approved Wellhead Protection Areas, the Barnstable Harbor embayment watershed, and Great Marsh subembayment watershed. It is not located in Lake Wequaquet or Hathaway Ponds watersheds or Contributing Areas to Ponds (CAPs).

The Applicant proposes to manage stormwater using control measures designed to catch, treat, and infiltrate stormwater. Post construction SCMs are divided into three treatment trains:

- Deep sump catch basins, oil/grit separator, sediment forebay, infiltration basin
- Filtering rain garden, sediment forebay, infiltration basin
- Dry wells which will receive roof runoff

The project plans also show 2 infiltration trenches, one alongside the road to well 4 and the other south of the water treatment building. These are not part of treatment trains; they are designed to capture stormwater to reduce flows on the project site.

While there is an increase in impervious areas, Commission staff appreciate the Applicant providing some impervious cover disconnection by routing much of the cleaner roof runoff to drywells and away from SCMs designed for runoff from paved surfaces. Seventy-one percent (71%) of the sites impervious area is being directed to and treated by infiltration SCMs. The Project meets the Town treatment requirements of 90% TSS and 60% total phosphorus removal by retaining the volume of runoff equivalent to 1.0 inch multiplied by the total amount of impervious area on the new development site. Commission staff recommend that the applicant clarify the amount of new impervious areas that the project is proposing as there are differing quantities offered throughout both the EENF and PEIR.

Commission staff recommend that the onsite septic system be an I/A enhanced nitrogen removal system to prevent contamination of the underlying aquifer, given its location within a Zone II and proximity to a Zone I Wellhead Protection Area.

The Additional Control Measures section in the PEIR indicates that the applicant will minimize hazardous materials stored on site. Because this project is located within Wellhead Protection Areas, staff recommend no hazardous materials be stored onsite. If necessary to store them onsite, 110% secondary containment plus additional volume to include the 100-yr, 24-hr storm event must be provided.

Natural Resources

The RPP goal for Wildlife and Plant Habitat is to protect, preserve, or restore wildlife and plant habitat to maintain the region's natural biodiversity. In addition, the RPP goal for Open Space seeks to conserve, preserve, or enhance a network of open space that contributes to the region's natural and community resources and systems.

The proposed site is an approximately two-acre wooded portion of a much larger (over 70-acre) wooded parcel permanently protected for water supply protection and adjacent to other large tracts of permanently protected conservation and recreation lands. It is mapped as protected open space (for water supply), BioMap Core Habitat, and Wellhead Protection Area. There are no wetlands or wetland buffers within the proposed limit of work/clearing, and the site is not within the floodplain. Other than the existing paved access road, well pump houses, and water treatment facility, the site is undeveloped. The two acres of land will be cleared to accommodate a proposed new water treatment plant.

The Applicant considered appropriate alternatives and proposes reasonable mitigation measures to minimize impacts to natural resources including stormwater BMPs and erosion and sedimentation controls. While some clearing of trees will be required, staff appreciates the applicant siting the new treatment plant close to the existing wells and where less grading is required. Although the proposed project impacts approximately two acres of wooded open space, it aligns with the Town's goal to protect its public water supplies and is appropriately sited close to existing wells within a public water supply protection area.

Regarding the Project's proposed Planting / Landscaping Plan, the project narrative references planting Bermuda Grass and native shrubs on the site. Bermuda grass is not native to the region. Commission staff recommend planting only a native blend of fescue grasses and wildflowers. Proposed shrubs and other grasses (*Carex pensylvanica* and *Panicum virgatum*) are appropriate. Staff recommend that the Applicant provide clarification on the proposed grass plantings and avoid the use of Bermuda grass.

Community Design

The RPP goal for Community Design is to protect and enhance the unique character of the region's built and natural environment based on the local context.

The Project will include a new 4,040 square foot building and associated infrastructure. The building is rectangular with two 100ft facades and two 40ft facades. The Commission typically recommends that for every 50 ft of facade there should be at least 10ft of facade variation to break up building mass and reduce building scale. However, staff suggest that the significant change in roof height and adequate screening from public ways is sufficient to address the Commission's Community Design Goal as it relates to building design.

The Massachusetts Historical Commission (MHC) reviewed the application in January 2026 where it was determined that the project is unlikely to affect significant historic or archeological resources. However, because the site has been undisturbed since at least the 1930s, staff suggest that the Applicant include a general discovery plan in case of unanticipated archeological

discoveries, and keep the MHC informed of any changes that may result in an increase of undisturbed woodland clearing. The Project site is not within a Local Historic District or National Historic District and is not in proximity to any historical buildings or structures.

Cape Cod Commission staff are available to answer any questions you may have about these comments. A pre-application meeting between the Applicant and Commission staff is strongly encouraged prior to filing development plans at the local level to discuss the application requirements and the DRI review process.

Sincerely,



Kristy Senatori
Executive Director

Cc: Project File
Stephen Olson, H2Olson Engineering, Inc., via email
James Kupfer, Director of Planning & Development, Town of Barnstable, via email
Barnstable Cape Cod Commission Representative, via email
Cape Cod Commission Chair, via email
Cape Cod Commission Committee on Planning and Regulation Chair, via email

Commonwealth of Massachusetts | Executive Office of Energy and Environmental Affairs

Department of Environmental Protection

Southeast Regional Office

Address: 20 Riverside Drive, Lakeville, MA 02347 | **Phone**: 508-946-2700

Maura T. Healey	**Kim Driscoll**	**Rebecca Tepper**	**Bonnie Heiple**
Governor	Lieutenant Governor	Secretary	Commissioner

July 24, 2026

Rebecca L. Tepper,
Secretary of Energy and Environment
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
ATTN: MEPA Office
Boston, MA 02114

RE: EENF Review EOEEA 17080.
BARNSTABLE. Barnstable Fire District Wells 3&4 at 1650 Iyannough Road/Route 132

Dear Secretary Tepper,

The Southeast Regional Office of the Department of Environmental Protection (MassDEP) has reviewed the Expanded Environmental Notification Form (EENF) for the Barnstable Fire District Wells 3&4 at 1650 Iyannough Road/Route 132, Barnstable, Massachusetts (EOEEA #17080). The Project Proponent provides the following information for the Project:

"The proposed project involves the construction of a new water treatment plant for the treatment of water from Well 3 and Well 4. Levels of PFAS in Well 3 and Well 4 have been identified to be over the maximum containment level (MCL) set by the United States Environmental Protection Agency (USEPA). A pilot scale treatability study conducted in April of 2025 recommended the use of granular activated carbon (GAC) media to remove PFAS and greensand media to remove source water iron and manganese. The complete Pilot Scale Treatability Study Report is presented in Attachment D. The proposed facility will be equipped with three (3) 10.5-foot diameter GreensandPlus™ media filters and associated process mechanical valves and piping, six (6) 10-foot diameter GAC media pressure vessels and associated process mechanical valves and piping, potassium hydroxide (KOH) storage, feed, and handling facilities, and sodium hypochlorite (NaOCl) storage, feed, and handling facilities.

Along with the 4,040 square foot building, the project consists of a paved driveway to the new building, two 2) sand filters and two (2) infiltration basins for the treatment of water treatment residuals, a septic system for the facility bathroom, best management practices (BMPs) for the treatment and infiltration of stormwater, new yard piping to deliver water to and from the building, new underground electrical lines to deliver power to the building, new underground fiberoptic lines to transmit SCADA information, two (2) new generators, three (3) new propane tanks, yard fencing, and three (3) new water hydrants, one located at the end of the paved access road. Refer to the Design Drawings included in Attachment A for exact locations."

Bureau of Water Resources (BWR) Comments:

Wetlands and Waterways Comments: As proposed, this Project does not affect wetlands or waterways protected resources and is therefore not subject to the Wetlands Protection Act or M.G.L. c, 91.

Drinking Water: The proposed Route 132 Treatment Facility will treat groundwater from the District's wells 3 and 4. The treatment facility will remove iron and manganese using Greensand contactors and will remove per- and polyfluoroalkyl substances (PFAS) using granular activated carbon contactors following chemical pre-treatment at the current Well 4 Pump station. This Project also proposes the construction of two (2) sand filters and two (2) infiltration basins for the management of water treatment residuals. The total water withdrawal from wells 3 and 4 will not increase. The disposal of the backwash and sanitary lavatory wastewater of the treatment facility is consistent with other drinking water treatment plants. The waste disposal plan will be included in the submittal for the construction permit review.

The Proponent has properly identified the need to submit a WS24 for the construction of this treatment facili**ty.** The MassDEP Southeast Region Drinking Water Program strongly supports this important project to provide safe drinking water to the customers of the Barnstable Fire District.

Water Management Act: The Project will have no effect on any Water Management Act authorizations, therefore, there are no comments.

Stormwater:

National Pollutant Discharge Elimination System (NPDES) Construction General Stormwater Permit:

The Project Proponent acknowledges that its activities will require filing a Notice of Intent (NOI) with the United States Environmental Protection Agency (US EPA). Access to information regarding the NPDES Stormwater requirements and an application for the Construction General Permit is obtained by completing and submitting a Notice of Intent (NOI) to EPA via the Stormwater Discharges from Construction Activities | National Pollutant Discharge Elimination System (NPDES) | US EPA.

The Proponent is advised to consult with Meridith Finegan at finegan.meridith@epa.gov or by phone at 617-918-1533 for questions regarding EPA's NPDES Construction General Permit requirements.

In addition, the Proponent is reminded that local Planning Boards (and/or other local authorities) may require stormwater controls beyond that of the Wetlands Protection Act. These controls are usually created to keep stormwater onsite so as not to create nuisance conditions offsite

Bureau of Waste Site Cleanup (BWSC) Comments:

Based upon the information provided, the Bureau of Waste Site Cleanup (BWSC) searched its databases for disposal sites and release notifications that have occurred at or might impact the proposed Project area. A disposal site is a location where there has been a release to the environment of oil and/or hazardous material that is regulated under M.G.L. c. 21E, and the Massachusetts Contingency Plan [MCP – 310 CMR 40.0000].

There are no listed MCP disposal sites located at or in the vicinity of the site that would appear to impact the proposed Project area.

Interested parties may view a map showing the location of BWSC disposal sites using the MassGIS data viewer at MassMapper. Under the Available Data Layers listed on the right sidebar, select "Regulated Areas", and then "DEP Tier Classified 21E Sites". MCP reports and the compliance status of specific disposal sites may be viewed using the BWSC Waste Sites/Reportable Release Lookup at: Search for Waste Site & Reportable Releases

The Project Proponent is advised that if oil and/or hazardous material are identified during the implementation of this Project, notification pursuant to the Massachusetts Contingency Plan (310 CMR 40.0000) must be made to MassDEP, if necessary. A Licensed Site Professional (LSP) should be retained to determine if notification is required and, if need be, to render appropriate opinions. The LSP may evaluate whether risk reduction measures are necessary if contamination is present. The BWSC may be contacted for guidance if questions arise regarding cleanup.

Oil and Hazardous Materials Spill Contingency Plan: The Project Proponent is advised that a spills contingency plan addressing prevention and management of potential releases of oil and/or hazardous materials from pre- and post-construction activities should be presented to workers at the site and enforced. The plan should include but not be limited to, refueling of machinery, storage of fuels, and potential on-site activity releases. Information related to spills prevention best practices may be obtained at the following web page: Spill Prevention?

Bureau of Air and Waste (BAW) Comments:

Air Quality: The Proponent should implement measures to alleviate dust, noise, and odor nuisance conditions, which may occur during the construction activities. Such measures must comply with MassDEP Bureau of Air and Waste Prevention (former BWP) Regulations 310 CMR 7.01, 7.09, and 7.10. To determine the appropriate requirements please refer to:

- 310 CMR 7.09 Dust, Odor, Construction, and Demolition
- 310 CMR 7.10 Noise

To comply with 310 CMR 7.09(2), the Proponent may be required to file a BWP AQ-06 notification form ten days prior to site activities. More information can be found here: BWP

AQ06 Notification Prior to Construction or Demolition and here: eDEP Online Filing System Screen-by-Screen Guidance for Completing the Detailed Notification Form

New Source Review:
MassDEP's Air/New Source Review Program reminds the Proponent of the following information:

Many industrial, commercial and institutional development activities have facility heating and supplemental or emergency power generation units associated with them that may require air quality permitting/plan approval from MassDEP before construction or operation. If required, such applicable equipment and/or activities must be certified through MassDEP's Environmental Results Program (ERP) at 310 CMR 7.26 or approved by MassDEP, prior to construction via the Plan Application program at 310 CMR 7.02, depending on equipment type, specifications, size, activities and/or emissions etc.

Smaller sized equipment/units such as engines (emergency and non-emergency), combined heat and power (CHP) units and boilers may not require an air quality permit/plan approval but instead may be subject to 310 CMR 7.26 performance standards and ERP certification. For example:

- 310 CMR 7.26(30) thru (37) – Boilers; and
- 310 CMR 7.26(40) thru (45) – Engines and Combustion Turbines (including Emergency Engines and Turbines)

Learn more about these provisions at Compliance Certification: Commercial, Industrial or Institutional Boiler and Submit a Compliance Certification: Stationary Engine or Turbine.

Some proposed facilities and/or activities may include process-related air emissions sources such as solvent cleaning, other disinfection, chemical reactors, solid or liquid material handling and storage. Equipment and/or activities and associated potential emissions that do not meet the applicability requirements of the ERP provisions, may require a plan approval pursuant to 310 CMR 7.02. Learn more about whether Plan Approval is required for your Project at MassDEP Air Plan Applications.

The Air Pollution Control Staff in MassDEP's Boston and Regional Offices can provide assistance regarding the applicability of MassDEP's regulations for any such equipment and/or activities planned.

Construction-Related Measures:

The Project Proponent reports: "*The contractor shall also abide by the MassDOT diesel retrofit specification, which states that any diesel-powered non-road construction equipment with engine horsepower ratings of 50 and above to be used for 30 or more days over the course of construction will either be EPA Tier 4-compliant or will be retrofitted with EPA-verified (or equivalent) emission control devices such as oxidation catalysts or other comparable technologies (to the extent that they are commercially available) installed on the exhaust system side of the diesel combustion engine.*"

MassDEP reminds the Project Proponent of the following: If a piece of equipment is not available in the Tier 4 configuration, then the Proponent should use construction equipment that has been retrofitted with appropriate emissions reduction equipment. Emission reduction equipment includes EPA-verified, CARB-verified, or MassDEP-approved diesel oxidation catalysts (DOCs) or Diesel Particulate Filters (DPFs). The Proponent should maintain a list of the engines, their emission tiers, and, if applicable, the best available control technology installed on each piece of equipment on file for Departmental review.

Massachusetts Anti-Idling Law:

The Project Proponent reports: "*Contract Specifications will require the contractor to comply with the provisions of MGL Chapter 90, section 16A and the DEP Anti-Idling Regulations (310 CMR 7.11(b)), which prohibit unnecessary engine idling and require engines to be shut down if the vehicle is stopped for more than five minutes.*"

MassDEP reminds the Proponent that unnecessary idling (i.e., in excess of five minutes), with limited exception, is not permitted during the construction and operations phase of the Project (310 CMR 7.11). Regarding construction period activity, typical methods of reducing idling include driver training, periodic inspections by site supervisors, and posting signage. In addition, to ensure compliance with this regulation once the Project is occupied, MassDEP requests that the Proponent install permanent signs limiting idling to five minutes or less on-site.

Solid Waste Management: The Proponent is proposing to construct a new water treatment plant for the removal of PFAS, iron, and manganese on a parcel of land owned by the District associated with the existing pump houses for Well 3 and Well 4.

The Project Proponent reports*: "The solid waste generated from this project may include asphaltic pavement, concrete, and/or metal associated with the construction of the new water treatment plant and associated structures. The disposal will be completed according to local, state, and federal regulations."*

MassDEP's Solid Waste Section provides the Proponent with the following information:

1. Should solid waste be discovered during earthen removal/excavation, the Project Proponent shall notify and contact the MassDEP's Solid Waste Management Section for guidance.

2. *Compliance with Waste Ban Regulation*s: Waste materials discovered during construction that are determined to be solid waste (e.g., construction and demolition waste) and/or recyclable material (e.g., metal, asphalt, brick, and concrete) shall be disposed, recycled, and/or otherwise handled in accordance with the Solid Waste Regulations including 310 CMR 19.017: Waste Bans. Waste Ban regulations prohibit the disposal, transfer for disposal, or contracting for disposal of certain hazardous, recyclable, or compostable items at solid waste facilities in Massachusetts, including, but not limited to, metal, wood, asphalt pavement, brick, concrete, and clean gypsum wallboard. The goals of the waste bans are to: promote reuse, waste reduction, or recycling; reduce the adverse impacts of solid waste management on the

environment; conserve capacity at existing solid waste disposal facilities; minimize the need for construction of new solid waste disposal facilities; and support the recycling industry by ensuring that large volumes of material are available on a consistent basis. Further guidance can be found at: MassDEP Waste Disposal Bans | Mass.gov

MassDEP recommends the Proponent consider source separation or separating different recyclable materials at the job site. Source separation may lead to higher recycling rates and lower recycling costs. Further guidance can be found at: Construction Materials - RecyclingWorks Massachusetts

For more information on how to prevent banned materials from entering the waste stream the Proponent should contact the RecyclingWorks in Massachusetts program at (888) 254-5525 or via email at info@recyclingworksma.com. RecyclingWorks in Massachusetts also provides a website that includes a searchable database of recycling service providers, available at Recyclingworks in Massachusetts - RecyclingWorks Massachusetts

3. *Asphalt, brick, and concrete (ABC) rubble*: such as the rubble generated during construction, must be handled in accordance with the Solid Waste regulations. These regulations allow, and MassDEP encourages, the recycling/reuse of ABC rubble. The Proponent should refer to MassDEP's Information Sheet, entitled " Using or Processing Asphalt Pavement, Brick and Concrete Rubble, Updated February 27, 2017 ", that answers commonly asked questions about ABC rubble and identifies the provisions of the solid waste regulations that pertain to recycling/reusing ABC rubble. This policy can be found on-line at the MassDEP website: Using or Processing Asphalt Pavement, Brick & Concrete Rubble . For more information on how to prevent banned materials from entering the waste stream the Proponent should contact the Recycling Works in Massachusetts program at (888) 254-5525 or via email at info@recyclingworksma.com. Recycling Works in Massachusetts also provides a website that includes a searchable database of recycling service providers, available at Recycling Works in Massachusetts.

4. *Tree removal/land clearing*: As defined in 310 CMR 16.02, clean wood means “discarded material consisting of trees, stumps and brush, including but limited to sawdust, chips, shavings, bark, and new or used lumber”...etc. Clean wood does not include wood from commingled construction and demolition waste, engineered wood products, and wood containing or likely to contain asbestos, chemical preservatives, paints, stains or other coatings, or adhesives. The Proponent should be aware that wood is not allowed to be buried or disposed of at the Site pursuant to 310 CMR 16.00 & 310 CMR 19.000 unless otherwise approved by MassDEP. Clean wood may be handled in accordance with 310 CMR 16.03(2)(c)7 which allows for the on-site processing (i.e., chipping) of wood for use at the Site (i.e., use as landscaping material) and/or the wood to be transported to a permitted facility (i.e., wood waste reclamation facility) or other facility that is permitted to accept and process wood.

If you have any questions regarding the Solid Waste Management Program comments above, please contact Michelle McCloud at Michelle.McCloud@mass.gov or Jennifer Wharff at Jennifer.Wharff@mass.gov.

Climate Change/Greenhouse Gas Emissions:

Drinking Water Treatment Facilities: The Proponent should consider the potential impacts

of climate change as part of the design and operation of the proposed drinking water treatment facility. Drinking water treatment plants are among the largest energy consumers in many cities and towns across Massachusetts. Therefore, minimizing the life-cycle operational costs and associated greenhouse gas emissions will have long-term economic and environmental benefits for the community and the Commonwealth.

MassDEP suggests review of the following resources, as well as any other governmental, industry, or research institute reports to identify GHG and energy reduction strategies, and climate resilience and adaptation measures that the Proponent, as feasible, should commit to implement or continue to explore upon completion of the MEPA review. The resources listed below under Implementation also include potential funding sources.

Planning and Design:

- EPA's Adaptation Strategies Guide for Water Utilities – 2015 https://www.epa.gov/sites/default/files/2015-04/documents/updated_adaptation_strategies_guide_for_water_utilities.pdf;
- *Assessment:*
- *EP*A's Strategies for Saving Energy at Public Water Systems - 2013 https://www.epa.gov/sites/default/files/2015-04/documents/epa816f13004.pdf
- EPA's Energy Efficiency in Water and Wastewater Facilities – 2013 Energy Efficiency in Water and Wastewater Facilities: A Guide to Developing and Implementing Greenhouse Gas Reduction Programs
- EPA's Climate Resilience Evaluation and Awareness Tool (CREAT) – 2016 Climate Resilience Evaluation & Awareness Tool (CREAT) | U.S. Climate Resilience Toolkit
- Massachusetts Municipal Vulnerability Preparedness Program - https://www.mass.gov/municipal-vulnerability-preparedness-program.

Implementation:

- EPA – Reducing Operating Costs and Energy Consumption at Water Utilities – 2017 https://www.epa.gov/sustainable-water-infrastructure/reducing-operating-costs-and-energy-consumption-water-utilities
- Massachusetts Clean Water and Drinking Water State Revolving Funds (SRF) Loan Assistance - https://www.mass.gov/state-revolving-fund-srf-loan-program;
- MA DOER's Green Communities Grant Program https://www.mass.gov/info-details/green-communities-grants
- The Massachusetts' Gap Energy Grant Program: An innovative funding model for realizing energy benefits in the water sector - The Massachusetts' Gap Energy Grant Program
- MassDEP's Clean Energy Results Program – Massachusetts' Return-on-Investment: A Gap Funding Model for Success – 2016 Massachusetts' Return on Investment: A Gap Funding Model for Success - Dibara - 2016 - Journal AWWA - Wiley Online Library

- EPA – Reducing Operating Costs and Energy Consumption at Water Utilities – 2017 https://www.epa.gov/sites/production/files/2017-04/documents/water_utility_heat_pump_brochure_508.pdf;
- Massachusetts Clean Water and Drinking Water State Revolving Funds (SRF) Loan Assistance - https://www.mass.gov/state-revolving-fund-srf-loan-program;
- Mass save® Municipal Energy Saving Program Mass Save | Municipal Energy Manager Grant
- MA DOER's Green Communities Grant Program https://www.mass.gov/green-communities-designation-grant-program; and
- USDA Rural Development Grant & Loan Assistance (Water & Wastewater) Water & Waste Disposal Loan & Grant Program in Connecticut, Massachusetts, and Rhode Island | Rural Development.

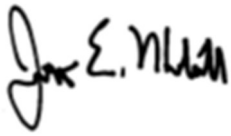
Proposed s.61 Findings:

The "Certificate of the Secretary of Energy and Environmental Affairs on the Expanded Environmental Notification Form" may indicate that this Project requires further MEPA review and the preparation of an Environmental Impact Report. Pursuant to MEPA Regulations 301 CMR 11.12(5)(d), the Proponent will prepare Proposed Section 61 Findings to be included in the EIR in a separate chapter updating and summarizing proposed mitigation measures. In accordance with 301 CMR 11.07(6)(k), this chapter should also include separate updated draft Section 61 Findings for each State agency that will issue permits for the Project. The draft Section 61 Findings should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation.

Other Comments/Guidance:

The MassDEP Southeast Regional Office appreciates the opportunity to comment on this EENF. If you have any questions regarding these comments, please contact George Zoto at George.Zoto@mass.gov or Jonathon Hobill at Jonathan.Hobill@mass.gov.

Very truly yours,



Jonathan E. Hobill,
Regional Engineer,
Bureau of Water Resources

JH/GZ

Cc: DEP/SERO

ATTN: Brian Harrington, Acting Regional Director
John Handrahan, Deputy Regional Director, BWSC
Mark Dakers, Acting Regional Director, BAW
Brian Harrington, Deputy Regional Director, BWR
Jennifer Viveiros, Deputy Regional Director, ADMIN
Jim McLaughin, Chief, Drinking Water, BWR
Chuyen Nguyen, Drinking Water, BWR
Michelle Regon, Drinking Water, BWR
Maissoun Reda Chief, Wetlands, BWR
Whitney McClees, Wetlands, BWR
Duane LeVangie, Chief, Water Management Act, BWR/Boston
Brendan Mullaney, Chief, Waterways, BWR
Jennifer Wharff, Acting Chief, Solid Waste Management, BAW
Michelle McCloud, Solid Waste Management, BAW
Matthew Ferris, Solid Waste Management, BAW
Angela Gallagher, Chief, Site Management, BWSC
Amanda Boustany, Site Management, BWSC

Appendix G: Final Environmental Impact Report Secretary's Certificate

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900, Boston, MA 02114
www.Mass.gov/EEA | **Tel:** (617) 626-1000 | **Fax:** (617) 626-1081

Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

September 14, 2026

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
FINAL ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Barnstable Fire District Wells 3& 4 Water Treatment Plant
PROJECT MUNICIPALITY	: Barnstable
PROJECT WATERSHED	: Cape Cod
EEA NUMBER	: 17080
PROJECT PROPONENT	: Barnstable Fire District Water Department
DATE NOTICED IN MONITOR	: August 7, 2026

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G.L. c. 30, ss. 61-62L) and Section 11.08 of the MEPA regulations (301 CMR 11.00), I have reviewed the Final Environmental Impact Report (FEIR) and hereby determine that it **adequately and properly** complies with MEPA and its implementing regulations. As noted in my Certificate on the Expanded Environmental Notification Form (EENF) and Proposed EIR (EENF/Proposed EIR) issued on June 15, 2026, the Proposed EIR was published for review as a FEIR pursuant to Section 11.06(14)(a) of the MEPA regulations and was subject to a 30-day public comment period during which time one comment was received from the Massachusetts Department of Environmental Protection (MassDEP) stating support for the project.

Project Description

As described in the FEIR, the purpose of the project is to address high levels of per- and polyfluoroalkyl substances (PFAS), iron, and manganese in two of the Barnstable Fire District's[1] (District's) drinking water supply wells (Wells 3 and 4). According to the FEIR, water from these wells is not in compliance with current United States Environmental Protection Agency (USEPA) maximum contaminant levels (MCLs) for PFAS. Because of this, the District has reduced production for Wells 3 and 4 to lower the concentration of PFAS in the distribution system. The permitted withdrawal at Well 3 and Well 4 is 0.77 million gallons per day (mgd) and 0.67 mgd, respectively. However, average daily

[1] https://www.barnstablefiredistrict.com/

flow from Well 3 and 4 has been substantially lower, as reported in the District's 2024 Annual Statistical Report (ASR) at only 173,051 and 111,243 gallons per day (gpd), respectively.

The project includes construction of a new water treatment facility (WTF) to remove PFAS, iron and manganese from water withdrawn at Wells 3 and 4 in order to comply with EPA and Massachusetts Department of Environmental Protection (MassDEP) drinking water regulatory requirements. The new WTF will consist of a 4,040-square foot (sf) single-story building that will contain three 10.5-foot diameter Greensand contactors and associated process mechanical valves and piping for the removal of source water iron and manganese; six 10-foot diameter granular activated carbon (GAC) contactors and associated process mechanical valves and piping for the removal of PFAS; and other related chemical storage, feed, and handling facilities.

In addition to the WTF itself, the project also includes a paved driveway to the new building, two sand filters and two infiltration basins for the treatment of water treatment residuals, a septic system for the facility bathroom, best management practices (BMPs) for the treatment and infiltration of stormwater, new yard piping to deliver water to and from the building, two new generators, three new propane tanks, yard fencing, and three new water hydrants.

Project Site

The 71.77-acre project site where the new WTF will be constructed is located on a portion of District-owned land currently in use for public water supply located at 1650 Iyannough Road/Route 132 in Barnstable, Massachusetts. The site currently consists of Wells 3 and 4, a paved access road, the Well 4 Pump House and water treatment facility. The existing property is predominantly woodlands with undeveloped forest to the north, Hathaway's Pond Recreation Area to the east, and the Hyannis Golf Club to the south and west. The existing paved access road runs east to west, connecting the site to Iyannough Road/Route 132.

Currently, water from Wells 3 and 4is pumped to the Well 4 Pump House and water treatment facility, where water from both wells is chemically treated before being pumped to the distribution system. The current facility has a capacity of 1,500 gallons per minute (gpm). The Well 4 Pump House will remain on site and continue to treat water with potassium hydroxide for pH adjustment and sodium hypochlorite for disinfection.

There are no wetland resources located on the project site. According to the Massachusetts Natural Heritage and Endangered Species Program (NHESP) Atlas (15th Edition), the site is not located within Priority or Estimated Habitat of Rare Species. The site is also not located within an Area of Critical Environmental Concern (ACEC). The site does not contain any structures listed in the State Register of Historic Places or the Massachusetts Historical Commission's (MHC) Inventory of Historic and Archaeological Assets of the Commonwealth. The project site is not located within a 100-year floodplain as mapped by Federal Emergency Management Agency (FEMA). The site is located within the Wellhead Protection Overlay District.

The project site is located within one mile of three Environmental Justice (EJ) populations

designated as Minority (2) and Minority and Income (1) in Barnstable.[2] There are 15 additional EJ populations within five miles of the site.

Environmental Impacts and Mitigation

Potential environmental impacts associated with the project include alteration of 2.1 acres of land, the majority of which involves tree clearing; creation of 0.18 acres of impervious area; and generation of 303 gpd of wastewater associated with a bathroom within the WTF

The purpose of the project is to provide safe drinking water by providing PFAS and other chemical treatment for water drawn from Wells 3 and 4. Measures to avoid, minimize, and mitigate environmental impacts include construction of a new stormwater management system, the use of erosion and sedimentation controls during project construction, the restoration of temporarily disturbed areas following construction, and planting of 55 trees.

Jurisdiction and Permitting

This project is subject to MEPA review because it requires an Agency Action and meets/exceeds the threshold at 301 CMR 11.03(4)(b)(4) (Construction of a New drinking water treatment plant with a Capacity of 1,000,000 or more gpd). The project requires the preparation of an EIR pursuant to 301 CMR 11.06(7)(b) because it is located within a DGA (1 mile) around one or more EJ Populations. The project will require BRP-WS 24 (Approval to Construct a Facility to Treat 1,000,000 Gallons per Day or Greater) permit from MassDEP.

The project requires a National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP) from the EPA. Comments from the Cape Cod Commission (CCC) on the EENF/Proposed EIR indicate that the project is considered a Development of Regional Impact (DRI) and in turn requires an application with the Commission.

The project is not seeking Financial Assistance from an Agency. Therefore, MEPA jurisdiction for EIR review is limited to those aspects of the project that are within the subject matter of any required or potentially required Agency Actions and that may cause Damage to the Environment, as defined in the MEPA regulations.

Review of the FEIR

The FEIR included a project description, an alternatives analysis, plans of existing and proposed conditions, and identification of measures to avoid, minimize and mitigate environmental impacts. Consistent with the MEPA Interim Protocol on Climate Change Adaptation and Resiliency, the FEIR contained an output report from the Climate Resilience Design Standards Tool prepared by the Resilient Massachusetts Action Team (RMAT) (the "CRDST"),[3] together with information on climate resilience strategies to be undertaken by the project. Comments submitted by CCC on the EENF/Proposed EIR were generally supportive of the project and recommended that the Proponent schedule a pre-application

[2] "Environmental Justice Population" is defined in M.G.L. c. 30, § 62 under four categories: Minority, Income, English Isolation, and a combined category of Minority and Income.
[3] Available at: https://resilientma.mass.gov/rmat_home/designstandards/

meeting with CCC prior to filing development plans at the local/regional level to discuss the application requirements and the DRI review process.

Alternatives Analysis

The FEIR evaluated a No Build Alternative, Decommission of Wells 3 and 4 Alternative, a Water Treatment Plant Addition Alternative and a New Water Treatment Plant Construction Alternative (Preferred Alternative). The No Build Alternative would continue the use of the existing Well 4 Pump House, which provides pH adjustment for corrosion control and disinfection, but does not treat PFAS, iron or manganese. Because this alternative does not address the goal of the project of providing treatment for these contaminants to improve drinking water quality, it was dismissed.

The District also evaluated decommissioning Well 3 and Well 4. This alternative eliminates the District's source water contaminant issues. However, this alternative does not address the District's existing and future water supply needs. According to the FEIR, decommissioning Wells 3 and 4 would put a large strain on the District's remaining three wells, and the District would not meet its current water demand, especially in the summer months when demands increase significantly due to population increases. As such, this alternative was dismissed.

A third alternative considered constructing an addition to the Well 4 Pump House, where water is currently being treated for pH adjustment and disinfection. This pump house addition would include both GAC media pressure vessels and greensand media filters to treat the raw water. According to the FEIR, this alternative addresses both the District's source water contaminant issues and its need for a restored water capacity. However, the Well 4 Pump House is located in a small depression on the land, which makes it difficult to place all required elements of the project (structures for the treatment of water treatment residuals, stormwater BMPs, etc) in this area without significant earth work to change the topography of the existing site. Additionally, the current pump house is near the center of the Zone I Wellhead Protection Area, which in turn, requires the construction of a longer septic line (415 feet) to place the septic system that supports the WTF outside of the Zone I. According to the FEIR, the longer septic line presents a higher risk of a leak within the Zone I. For these reasons, the District dismissed this alternative.

The Preferred Alternative consists of the construction of a new building for the treatment of water from Wells 3 and 4. Like the previous alternative, this alternative addresses both the District's source water contaminant issues and its need for a restored water capacity. However, according to the FEIR, the area proposed for this alternative requires less site grading than the previous alternative. Additionally, the Preferred Alternative places the new WTF closer to the edge of the Zone I when compared to Alternative 3 resulting in a shorter septic line (150 feet). For the reasons described above, this alternative was selected as the preferred alternative.

Environmental Justice

As noted above, the project area is located within one mile of three EJ populations designated as Minority (2) and Minority and Income (1) in Barnstable. Within the DGA containing the above EJ populations, there is one language (Portuguese or Portuguese Creole) spoken by 5% of more of residents who also identify as not speaking English very well.

Effective January 1, 2022, all new projects in a DGA (as defined in 301 CMR 11.02) around EJ Populations are subject to new requirements imposed by the Chapter 8 of the Acts of 2021: *An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy* (the "Climate Roadmap Map") and amended MEPA regulations at 301 CMR 11.00. Two related MEPA protocols—the MEPA Public Involvement Protocol for Environmental Justice Populations (the "MEPA EJ Public Involvement Protocol") and MEPA Interim Protocol for Analysis of project Impacts on Environmental Justice populations (the "MEPA Interim Protocol for Analysis of EJ Impacts")—are also in effect for new projects filed on or after January 1, 2022. Under the new regulations and protocols, all projects located in a DGA around one or more EJ populations must take steps to enhance public involvement opportunities for EJ populations and must submit analysis of impacts to such EJ populations in the form of an EIR.

Community Engagement

Consistent with the MEPA EJ Public Involvement Protocol, the Proponent sent advance notification of the project in the form of an EJ Screening Form to the "EJ Reference List" developed based on a list provided by the MEPA Office and consisting of Community Based Organizations (CBOs) and tribes/indigenous organizations. According to the FEIR, no responses to the EJ Screening Form were received. The District held an in-person public meeting on May 13, 2026, at which the project received general support according to the filing.

After filing the EENF/Proposed EIR, a MEPA remote site visit/consultation session was held on July 9, 2026. The notice for the meeting was translated into Portuguese or Portuguese Creole with an offer to provide translation services, no requests were made. According to the FEIR, additional public meetings will be held through the local permitting process.

Baseline Conditions Assessment / Project Impacts

The FEIR included a baseline assessment of any existing "unfair or inequitable Environmental Burden and related public health consequences" impacting the identified EJ populations in accordance with 301 CMR 11.07(6)(n)(1) and the MEPA Interim Protocol for Analysis of EJ Impacts. The baseline assessment included a review of the data provided by the Department of Public Health (DPH) EJ Tool applicable to the DGA regarding "vulnerable health EJ criteria"; this term is defined in the DPH EJ Tool to include any one of four environmentally related health indicators that are measured to be 110% above statewide rates based on a five-year rolling average. According to the FEIR, the data surveyed indicate that no municipalities or census block groups within the DGA exceed 110% of the statewide rates of any of the four vulnerable health EJ criteria, which include Childhood Lead Exposure, Childhood Asthma Emergency Department Visits, Low Birth Weight and Heart Attack Hospitalizations.

The FEIR indicated that the following sources of potential pollution exist within the DGA, based on data available in the DPH EJ Tool:

- MassDEP Major Air and Waste Facilities: 3
- Tier II toxics use reporting facilities: 11
- Underground storage tanks (USTs): 4

- Municipal Buildings and Healthcare Facilities: 2
- Road Infrastructure: 6
- MBTA Bus and Rapid Transit: 8
- Energy generation and supply: 3

According to the output report from the CRDST included in the FEIR, the project site has a high exposure to extreme precipitation (stormwater flooding) and to extreme heat. EJ populations near the site are likely also exposed to these climate risks. According to the FEIR, the project will not exacerbate climate risks within the DGA because the project is limited to construction of the WTF, which is not proposed to be located within the floodplain. The project is unlikely to exacerbate extreme heat in EJ populations because the project does not propose significant new impervious area or land alteration exceeding MEPA review thresholds (minimum of 5 or more acres of impervious area and 25 or more acres of land alteration), is located on a largely undisturbed site which is forested and otherwise covered by vegetation. In addition, the project proposes to plant 55 trees.

According to the FEIR, the project will not have disproportionate adverse effects on EJ populations because there will be minimal air emissions associated with the construction and operation of the project; the project will cause a minimal increase in traffic during operations and have minimal traffic impacts during the construction period; and stormwater runoff will be managed on-site. The purpose of the project is to protect the public health of all residents served by the water from Wells 3 and 4, including residents in EJ populations, by constructing a treatment facility that will ensure that the drinking water from the wells meets drinking water standards, including limits for PFAS as well as treating for iron and manganese. In addition, the project also includes two sand filters and two infiltration basins, which is designed to hold 55,000 gallons of backwash waste, for the treatment of water treatment residuals. Comments from MassDEP on the EENF/Proposed EIR noted that the project's plan for treating residuals is consistent with other drinking water treatment plants.

Impervious Area and Stormwater

As noted above, the project will result in the direct alteration of 2.1 acres of land (the majority of which will require tree clearing). The FEIR states that 55 trees will be planted on the project site as mitigation. Comments from CCC on the EENF/Proposed EIR note that the filing references planting Bermuda Grass on the site. Comments from CCC on the EENF/Proposed EIR stated that Bermuda grass is not native to the region and recommended planting only a native blend of fescue grasses and wildflowers.

In addition, the project will create 0.18 acres of impervious surfaces. The project includes the construction of a stormwater management system to mitigate this impact. As described in the FEIR, stormwater runoff generated by the project will be collected and treated through a combination of best management practices (BMPs), including deep sump catch basins, an oil/grit separator, a sediment forebay, an infiltration basin, a rain garden and dry wells. The system will be capable of attenuating the present-day 100-year storm event (24-hr precipitation depth of 7.41 inches), and will provide 44% total suspended solids (TSS) removal prior to infiltration, and a minimum of 80% TSS removal prior to discharge. The filing states that the stormwater management system can be upgraded to accommodate future storms, as further discussed below.

Water Supply

Under its existing Water Management Act (WMA) Permit, the permitted withdrawal at Well 3 and Well 4 is 0.77 mgd and 0.67 mgd (1.44 mgd total), respectively. The project does not propose to increase the District's water supply nor groundwater withdrawal. However, because of concentration of PFAS above the USEPA's MCL, the District has reduced production for Wells 3 and 4 to lower the concentration of PFAS in the distribution system to average daily flows of 173,051 gpd for Well 3 and 111,243 gpd for Well 4. As noted above, the proposed WTF will treat groundwater from the District's Wells 3 and 4 in order to comply with USEPA and MassDEP drinking water regulatory requirements and allow both wells to reach their full production. The treatment facility will remove iron and manganese using Greensand contactors and will remove PFAS using GAC contactors following chemical pre-treatment at the current Well 4 Pump House. As noted above, the project will require a WS24 permit from MassDEP for the construction of the treatment facility. Comments from MassDEP on both the EENF/Proposed EIR and the FEIR strongly support the project and note that its successful implementation will provide safe drinking water to the customers of the Barnstable Fire District.

Climate Change

Effective October 1, 2021, all MEPA projects are required to submit an output report from the CRDST to assess the climate risks of the project. Based on the output report, the new WTF has a "High" exposure rating based on the site's location for stormwater and riverine flooding due to extreme precipitation and to extreme heat. Based on the 30-year useful life and the self-assessed criticality identified for the project, the CRDST recommends a planning horizon of 2070 and a return period associated with a 50-year (2% annual chance) storm event when designing the WTF for extreme precipitation. The CRDST recommends planning for the 90th percentile with respect to extreme heat (which indicates an increase in extremely hot days as compared to a historical baseline).

The CRDST output indicates that the maximum annual daily rainfall exceeds 10 inches within the overall project's useful life and the project is creating impervious area. In addition, the project site is anticipated to have more than a 30 day increase in days over 90 degrees Fahrenheit within project's useful life and existing trees are being removed as part of the proposed project. These two series of factors, respectively, are indicated in the CRDST as contributing to the "High" exposures for the extreme precipitation (stormwater flooding) and extreme heat climate parameters. According to CRDST output, the projected 24-hour precipitation depth associated with a 2070 50-year storm event is 8.7 inches. Therefore, it appears that the stormwater system, which is designed to attenuate the current 100-year storm event (7.41 inches), would not be resilient to future climate conditions as recommended by the CRDST. The FEIR states that there is sufficient space to add more BMPs to upgrade the stormwater system to adapt to future storms. I encourage the Proponent to continue to evaluate ways to improve the capacity of the stormwater management system to accommodate larger storm events under future climate conditions.

To mitigate for extreme heat, the project proposes to plant 55 trees. In addition, the FEIR indicates that the project was designed to minimize tree clearing to the greatest extent possible, specifically, by utilizing the existing access road.

GHG Emissions

According to the FEIR, the project's total emissions from water treatment processes and heating, cooling, and ventilation of conditioned spaces will be approximately 5.9 tons per year (tpy). Because this project does not exceed any mandatory EIR thresholds and is required to submit an EIR only because it is located within a DGA of EJ populations, a GHG analysis was not required because the project's GHG emissions from conditioned spaces will be less than 2,000 tpy.

Construction Period

According to the FEIR, the project will commence in the Winter of 2027 and be completed by the Fall of 2028. All construction and demolition (C&D) activities should be managed in accordance with applicable MassDEP regulations regarding Air Pollution Control (310 CMR 7.01, 7.09-7.10), and Solid Waste Facilities (310 CMR 16.00 and 310 CMR 19.00, including the waste ban provision at 310 CMR 19.017). The project should include measures to reduce construction period impacts (e.g., noise, dust, odor, solid waste management, etc.) and emissions of air pollutants from equipment, including anti-idling measures in accordance with the Air Quality regulations (310 CMR 7.11). I encourage the Proponent to require that its contractors use construction equipment with engines manufactured to Tier 4 federal emission standards, or select project contractors that have installed retrofit emissions control devices or vehicles that use alternative fuels to reduce emissions of volatile organic compounds (VOCs), carbon monoxide (CO) and particulate matter (PM) from diesel-powered equipment. Off-road vehicles are required to use ultra-low sulfur diesel fuel (ULSD). If oil and/or hazardous materials are found during construction, the Proponent should notify MassDEP in accordance with the Massachusetts Contingency Plan (MCP; 310 CMR 40.0000). All construction activities should be undertaken in compliance with the conditions of all State and local permits. I encourage the Proponent to reuse or recycle C&D debris to the maximum extent.

Mitigation & Section 61 Findings

The FEIR includes a separate chapter summarizing proposed mitigation measures and includes draft Section 61 Findings. It contains commitments to implement these mitigation measures, identifies the parties responsible for implementation, and includes a schedule for implementation. As described in the FEIR, the Proponent has committed to implement the following measures to avoid, minimize and mitigate Damage to the Environment:

Environmental Justice/Public Health

- Provide drinking water to all residents, including residents in EJ populations, that meets drinking water standards
- Construct a new stormwater management system that designed to comply with the SMS to minimize potential off-site flooding
- Plant 55 native trees to minimize heat island effect

Stormwater Management

- Construct a new stormwater management system that will be designed to comply with the SMS, including requirements to treat and convey the present-day 100-year storm event (24-hour precipitation depth of 7.41 inches).
- Install sedimentation and erosion controls around work areas and other stormwater management measures required by the Storm Water Pollution Prevention Plan (SWPPP) prepared in accordance with the NPDES General Permit.

Water Supply

- There is no increase in District water supply nor groundwater withdrawal. The permitted withdrawal at the project site is 1.44 MGD.
- The project includes two sand filters and two infiltration basins, which is designed to hold 55,000 gallons of backwash waste, for the treatment of water treatment residuals. Comments from MassDEP on the EENF/Proposed EIR note that the project's plan for treating residuals is consistent with other drinking water treatment plants.

Climate Change

- Plant 55 native trees at the site.
- Construct a new stormwater management system that will be designed to comply with the SMS, including requirements to treat and convey the present-day 100-year storm event (24-hour precipitation depth of 7.41 inches). The FEIR states that there is sufficient space to add more BMPs to upgrade the stormwater system to adapt to future storms.

Construction Period

- Tree protection is proposed at trees that are to remain on site
- Contract specifications will require the contractor to comply with the provisions of MGL Chapter 90, section 16A and the DEP Anti-Idling Regulations (310 CMR 7.11(b)).
- The contractor shall also abide by the MassDOT diesel retrofit specification.
- Install and maintain sedimentation and erosion controls around work areas and implement other stormwater management measures in accordance with the SWPPP.
- Notify MassDEP if any contaminated soil and groundwater is encountered during construction.

Conclusion

Based on a review of the FEIR and consultation with Agencies, I find that the FEIR adequately and properly complies with MEPA and its implementing regulations. The project may proceed to permitting. Participating Agencies should forward copies of the final Section 61 Findings to the MEPA Office for publication in accordance with 301 CMR 11.12. As noted above, a PBD will be issued within 30 days of the issuance of this Certificate.

September 14, 2026
Date

Rebecca L. Tepper

Comments received on the FEIR:

09/08/2026 Massachusetts Department of Environmental Protection (MassDEP)/Southeast Regional Office (SERO)

Comments received on the EENF/Proposed EIR:

07/24/2026 Cape Cod Commission (CCC)
07/27/2026 Massachusetts Department of Environmental Protection (MassDEP)/Southeast Regional Office (SERO)

RLT/NSP/nsp

Commonwealth of Massachusetts | Executive Office of Energy and Environmental Affairs

Department of Environmental Protection

Southeast Regional Office

Address: 20 Riverside Drive, Lakeville, MA 02347 | **Phone**: 508-946-2700

Maura T. Healey	**Kim Driscoll**	**Rebecca Tepper**	**Bonnie Heiple**
Governor	Lieutenant Governor	Secretary	Commissioner

September 8, 2026

Rebecca L. Tepper,
Secretary of Energy and Environment
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
ATTN: MEPA Office
Boston, MA 02114

RE: FEIR - Rollover Review
EOEEA 15780. BARNSTABLE.
Barnstable Fire District Wells 3&4
Water Treatment Plant

Dear Secretary Tepper,

The Southeast Regional Office of the Department of Environmental Protection (MassDEP) has reviewed the Final Environmental Impact Report (FEIR) Rollover for the Barnstable Fire District Wells 3&4 Water Treatment Plant, Barnstable, Massachusetts (EOEEA #15780). The Project Proponent provides the following information for the Project:

"The District is proposing to construct a new water treatment plant for the removal of PFAS, iron, and manganese on a parcel of land owned by the District associated with the existing pump houses for Well 3 and Well 4 at 1650 Iyannough Road/Route 132 in Barnstable (the Site). The proposed facility will be equipped with three (3) 10.5-foot diameter GreensandPlus™ media filters and associated process mechanical valves and piping, six (6) 10-foot diameter GAC media pressure vessels and associated process mechanical valves and piping, potassium hydroxide (KOH) storage, feed, and handling facilities, and sodium hypochlorite (NaOCl) storage, feed, and handling facilities.

This project also involves the construction of two (2) sand filters and two (2) infiltration basins for the management of water treatment residuals, a paved driveway to the new building, a septic system for the facility bathroom, stormwater best management practices (BMPs), new yard piping to deliver water to and from the building, new underground electrical lines to deliver power to the building, new underground fiberoptic lines to transmit Supervisory Control and Data Acquisition (SCADA) information, two (2) new generators, three (3) new propane tanks, yard fencing, and three (3) new water hydrants, one located at the end of the paved access road.

The proposed project triggers review under the Massachusetts Environmental Policy Act (MEPA) as the proposed project requires one or more State Agency Activities and exceeds the following review threshold for an Environmental Notification Form (ENF): 301 CMR 11.03(4)(b)4.: Construction of a new drinking water treatment plant with a Capacity of 1,000,000 or more gpd.

While the proposed project does not exceed any mandatory Environmental Impact Report (EIR) thresholds, it is located within an Environmental Justice (EJ) Designated Geographic Area (DGA), as the proposed project is located within one mile of mapped EJ Communities. Given that the proposed project is located within the EJ DGA, an EIR is required in accordance with MEPA's Environmental Justice Protocols (effective January 1, 2022)."

Comments/Guidance:

MassDEP has reviewed the FEIR Rollover. Beyond the comments listed below, the Department has no further comments to add to those issued in the SERO EENF letter dated July 24, 2026.

Bureau of Water Resources (BWR) Comments:

Drinking Water: The Project includes construction of a new water treatment facility (WTF) to remove PFAS, iron and manganese from water withdrawn at Wells 3 and 4 in order to comply with the Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MassDEP) drinking water regulatory requirements. The new water treatment facility is located on a portion of District-owned land currently in use for public water supply located at 1650 Iyannough Road/Route 132 in Barnstable, Massachusetts. The site currently consists of Wells 3 and 4, a paved access road, the Well 4 Pump House and water treatment facility.

Four alternatives were considered for the Project. The preferred alternative consists of the construction of a new building for the treatment of water from Wells 3 and 4. The Project will result in the alteration of 2.1 acres of land and the planting of 55 trees on the site is proposed as mitigation. The Project does not propose to increase groundwater withdrawal.

The MassDEP Drinking Water Program supports the Project, that plans to deliver safe drinking water to the Barnstable Fire District community.

Bureau of Waste Site Cleanup (BWSC) Comment:

Based upon the information provided, the Bureau of Waste Site Cleanup (BWSC) searched its databases for disposal sites and release notifications that have occurred at or might impact the proposed project area. A disposal site is a location where there has been a

release to the environment of oil and/or hazardous material that is regulated under M.G.L. c. 21E, and the Massachusetts Contingency Plan [MCP – 310 CMR 40.0000].

BWSC finds the project proponent's responses to BWSC's comments accurate and acceptable. No additional releases have been reported in the vicinity of the project area since the submittal of the EENF. BWSC has no further comments or questions.

Interested parties may view a map showing the location of BWSC disposal sites using the MassGIS data viewer at MassMapper. Under the Available Data Layers listed on the right sidebar, select "Regulated Areas", and then "DEP Tier Classified 21E Sites". MCP reports and the compliance status of specific disposal sites may be viewed using the BWSC Waste Sites/Reportable Release Lookup at: Search for Waste Site & Reportable Releases

The Project Proponent is advised that if oil and/or hazardous material are identified during the implementation of this project, notification pursuant to the Massachusetts Contingency Plan (310 CMR 40.0000) must be made to MassDEP, if necessary. A Licensed Site Professional (LSP) should be retained to determine if notification is required and, if need be, to render appropriate opinions. The LSP may evaluate whether risk reduction measures are necessary if contamination is present. The BWSC may be contacted for guidance if questions arise regarding cleanup.

Bureau of Air and Waste (BAW) Comments:

Other Comments/Guidance

The MassDEP Southeast Regional Office appreciates the opportunity to comment on this FEIR. If you have any questions regarding these comments, please contact George Zoto at George.Zoto@mass.gov or Jonathon Hobill at Jonathan.Hobill@mass.gov.

Very truly yours,

Jonathan E. Hobill,
Regional Engineer,
Bureau of Water Resources

JH/GZ

Cc: DEP/SERO

ATTN: Brian Harrington, Regional Director
John Handrahan, Deputy Regional Director, BWSC
Mark Dakers, Acting Deputy Regional Director, BAW

Jennifer Viveiros, Deputy Regional Director, ADMIN
James McLaughlin, Chief, Drinking Water, BWR
Gillane Tardieu, Drinking Water, BWR
Chuyen Nguyen, Drinking Water, BWR
Michelle Regon, Drinking Water, BWR
Duane LeVangie, Water Management Act, BWR/Boston
Maissoun Reda Chief, Wetlands, BWR
Amy Walkey, Wetlands, BWR
Brendan Mullaney, Chief, Waterways, BWR
Jennifer Wharff, Acting Chief, Solid Waste Management, BAW
Michelle McCloud, Solid Waste Management, BAW
Matthew Ferris, Solid Waste Management, BAW
Christopher Redus, Air/New Source Review, BAW
Angela Gallagher, Chief, Site Management, BWSC
Amanda Boustany, Site Management, BWSC