ALTUS
ENGINEERING, INC.

Civil
Site Planning
Environmental
Engineering

133 Court Street
Portsmouth, NH
03801-4413

December 18, 2015

Mr. Ridgley Mauck, PE
NHDES Alteration of Terrain Program
29 Hazen Drive
Concord, New Hampshire 03302-0095

Re: **Wastewater Treatment Facility Upgrade**
200 Peirce Island Road
Portsmouth, NH
P-4507

Dear Mr. Mauck:

The City of Portsmouth, the applicant, is upgrading its existing wastewater treatment facility (WWTF) on Peirce Island to bring it into compliance with the U.S. Environmental Protection agency requirements. The Peirce Island Wastewater Treatment Facility, built in 1964 and upgraded in 1991 and 2002, is designed to treat 4.8 million gallons per day. Major proposed WWTF additions include new headworks, a new gravity thickener, replacement of the existing Administration Building with a new Solids Building, a new two-stage Biological Aerated Filter (BAF) system, replacement of the existing Solids Processing Building with a new Operations/Lab Building and associated site improvements. The project has received two (2) NHDES Wetlands Permit approvals: file #2015-01866, dated October 6, 2015 and file #2015-01878, dated October 9, 2015.

An Alteration of Terrain pre-application meeting was held in Concord on December 18, 2014 to discuss the project background and the significant site constraints impacting the design. As noted at the meeting, the WWTF improvements are confined within the existing 3.7 acre fenced yard, however with slope stabilization and temporary construction staging needed outside the fence, the total site disturbance will be approximate 8.1 acres.

Enclosed for your review and approval are the following documents associated with the NHDES Alteration of Terrain Application submittal:

- Application fee check in the amount of $2,250.00
- Set of project Site Plans (applicable drawings)
- Alteration of Terrain Permit Application including
  - Signed Application Form
  - Alteration of Terrain Permit Application Checklist
  - Drainage Analysis with pre- and post-development watershed plans
  - Additional supporting documents

Please feel free to contact us directly if you have any questions or require any additional supporting documentation. Thank you for your time and consideration.

Sincerely,

ALTUS ENGINEERING, INC.

Jeffrey K. Clifford, P.E.
Vice President

RMB/jkc/4507-00.AoT.CoverLetter.doc

Enclosures

cc: Terry Desmarais, City of Portsmouth City Engineer, w/encl.
Jon Pearson, AECOM, w/encl.

ALTERATION OF TERRAIN APPLICATION

FOR

Peirce Island
Wastewater Treatment Facility Upgrade

Tax Map 308 Lot 1

200 Peirce Island Road
Portsmouth, New Hampshire

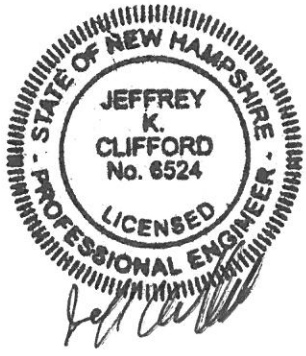
December 2015

Prepared For:

City of Portsmouth, Dept. of Public Works
680 Peverly Hill Road
Portsmouth, New Hampshire 03801

Prepared By:

ALTUS ENGINEERING, INC.
133 Court Street
Portsmouth, NH 03801-4413
Telephone: (603) 433-2335
Fax: (603) 433-4194



- Alteration of Terrain Permit Application with Checklist
- USGS map
- City of Portsmouth Tax Map 208
- Project Description
- Calculation Methods
- USGS map – Review of Potential Blasting Impacts Around Facility
- OneStop Program – Registered Water Wells
- OneStop Program – Surface Water Impairments
- OneStop Program – AoT screening layers
- NH Natural Heritage Bureau memorandum 6-11-2015
- NHDES Wetlands approval File #2015-01866, dated October 6, 2015
- NRCS – Soil Map
- Aerial Map
- Site Photos
- BMP Worksheet
- Appendix A: Supporting Calculations
    - Pre-Development
    - Post-Development
    - Erosion Control Calculations
- Appendix B: Hydrological Data
- Appendix C: Watershed Plans
- Appendix D: Site-Specific Soil Mapping Report
- Appendix E: SWPPP for Peirce Island Wastewater Treatment Plant
- Appendix F: Pre-Application Meeting Minutes

Attached full size drawings:

00 G-001, G-002 and G-005
00 C-001 through C-123
00 C-125 and C-126
99 C-501 through C-512
WS-1A and WS-2A (watershed plans)

NHDES-W-01-003

ALTERATION OF TERRAIN PERMIT APPLICATION

Water Division/ Alteration of Terrain Bureau/ Land Resources Management
Check the Status of your Application: http://des.nh.gov/onestop

RSA/ Rule: RSA 485-A:17, Env-Wq 1500

Administrative Use Only	Administrative Use Only	Administrative Use Only	File Number:
			Check No.
			Amount:
			Initials:

1. PROJECT LOCATION

PROJECT NAME: Peirce Island Wastewater Treatment Facility Upgrade

ADDRESS: 200 Peirce Island Road

TOWN/CITY: Portsmouth	COUNTY: Rockingham	STATE: NH	ZIPCODE:03801
TAX MAP: 208	BLOCK:	LOT NUMBER: 1	UNIT:
LOCATION COORDINATES: 43-04'-24" N 70-44'-28" W	☒ LATITUDE/LONGITUDE ☐ UTM ☐ STATE PLANE		

2. APPLICANT INFORMATION (DESIRED PERMIT HOLDER)

APPLICANT NAME: City of Portsmouth, Dept. of Public Works	CONTACT NAME: Mr. Terry Desmarais	
EMAIL: tldesmarais@cityofportsmouth.com	FAX:603-427-1539	PHONE: 603-766-1421
ADDRESS: 680 Peverly Hill Road		
TOWN/CITY: Portsmouth	STATE: NH	ZIPCODE: 03801

3. PROPERTY OWNER INFORMATION (IF DIFFERENT FROM APPLICANT)

PROPERTY OWNER: Same	CONTACT NAME:	
EMAIL:	FAX:	PHONE:
ADDRESS:		
TOWN/CITY:	STATE:	ZIPCODE:

4. AGENT INFORMATION

ENGINEERING FIRM: AECOM	CONTACT NAME: Jon R. Pearson, P.E	
EMAIL: Jon.Pearson@aecom.com	FAX: 978-905-2101	PHONE: 978-905-3158
ADDRESS: 250 Apollo Drive		
TOWN/CITY: Chelmsford	STATE: MA	ZIPCODE: 01864

5. PROJECT TYPE

☐ EXCAVATION	☐ COMMERCIAL	☐ SCHOOL	☐ AGRICULTURAL	☐ LANDFILL
☐ RESIDENTIAL	☐ GOLF COURSE	☒ MUNICIPAL	☐ LAND CONVERSION	☐ OTHER

6. BRIEF PROJECT DESCRIPTION (PLEASE DO NOT REPLY "SEE ATTACHED")

Improvements and upgrades to the City's Peirce Island Wastewater Treatment Facility.

7. IF APPLICABLE, DESCRIBE ANY WORK STARTED PRIOR TO RECEIVING PERMIT

N/A

8. REQUIRED QUESTIONS (PLEASE DO NOT LEAVE FIELDS BLANK. IF NOT APPLICABLE, STATE "N/A")

A. Date a copy of the *complete* application was sent to the municipality[1]: __/__/____. **(Attach proof of delivery)**

B. Total area of disturbance: 352,162 square feet

C. Additional impervious cover as a result of the project: 6,696 square feet (use the "-" symbol to indicate a net reduction in impervious coverage). Total impervious cover: 93,023 square feet. within fenced area of facility. All temporary impacts outside fence will be restored in-kind.

D. Total undisturbed cover: 0 square feet

E. Number of lots proposed: 0

F. Total length of roadway: 0 linear feet

G. Select plan type submitted: ☐ Land Conversion ☒ Detailed Development ☐ Excavation, Grading & Reclamation ☐ Steep Slope

H. Name of receiving waters: PISCATAQUA RIVER (TIDAL)

Using NHDES's Web GIS OneStop program (www2.des.state.nh.us/gis/onestop/), with the Surface Water Impairment layer turned on, list the impairments identified: NITROGEN, ENTEROCOCCUS (enter "NA" if no pollutants are listed).
For more guidance see: http://des.nh.gov/organization/divisions/water/wmb/tmdl/documents/onestop_gis_wgc_ref_guide.pdf

I. ☐ This project is within ¼ mi of a designated river (**River name:** _____) AND
I have notified the Local River Management Advisory Committee by providing them with a copy of the complete application[1], including all supporting materials, on **Month:** __ **Day:** __ **Year:** ____ **(Attach proof of delivery)**

☒ This project is **not** within ¼ mi of a designated river.

J. Name of species identified by the Natural Heritage Bureau as threatened or endangered or of concern: Marsh Elder

K. Cut volume 8 cubic feet and fill volume 255 cubic feet within the 100-year floodplain (enter "NA" if not within the floodplain) revetment work associated with riverbank stabilization.

L. Is the project within a Water Supply Intake Protection Area (WSIPA)? YES☐ NO☒
Is the project within a Groundwater Protection Area (GPA)? YES☐ NO☒
Are the well setbacks outlined in Env-Wq 1508.02 being met? YES☒ NO☐

Note: Guidance document titled "*Using DES's OneStop WebGIS to Locate Protection Areas*" is available online. For more details on the restrictions in these areas, read Chapter 3.1 in Volume 2 of the NH Stormwater Manual.

[1] In accordance with Env-Wq 1503.05 (c)(4), *provide proof* that a completed application form, checklist, plans and all other supporting materials have been sent or delivered to the governing body of each municipality in which the project is proposed. Env-Wq 1503.05 (c)(4) also requires the applicant to provide proof that a completed application form, checklist, plans and all other supporting materials have been sent or delivered to the Local River Advisory Committee, if the project is within 1/4 mi of a designated river.

8. REQUIRED QUESTIONS CONTINUED

M. Is the project a High Load area in accordance with Env-Wq 1502.26? YES☒ NO☐
If yes, specify type of high load land use or activity? Wastewater Treatment Plant

N. For each type of approval or permit, check "Yes" if the permit or approval type is required for your project and indicate the permit number / approval date. Indicate "Pending" if the application has been filed, but the permit has not yet been issued. Check "No" to indicate that the permit type is required, but not yet been filed with the Department. Check "N/A" if the permit or approval type is not required for your project.

1. Water Supply Approval	☐ Y	☐N	☒N/A	Permit number:	Pending	☐
2. Wetlands Permit	☒ Y	☐N	☐N/A	Permit number: 2015-01878 & 2015-01866	Pending	☐
3. Shoreland Permit	☐ Y	☐N	☒N/A	Permit number:	Pending	☐
4. UIC Registration	☐ Y	☐N	☒N/A	Registration date:	Pending	☐
5. Large/Small Community Well Approval	☐ Y	☐N	☒N/A	Approval letter date:	Pending	☐
6. Large Groundwater Withdrawal Permit	☐ Y	☐N	☒N/A	Permit number:	Pending	☐
7. Other:	☐ Y	☐N	☒N/A	Permit number:	Pending	☐

9. ADDITIONAL INFORMATION

A. If you have had a pre-application meeting with AoT staff, state his or her name(s):RIDGELEY MAUCK
Attach a copy of the meeting minutes.

B. Will blasting of bedrock be required? YES☒ NO☐ If yes, estimated quantity of blast rock: >5,000 cubic yards.
If yes, standard blasting BMP notes must be placed on the plans, available at:
http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-10-12.pdf
Per One Stop Program, there are no drinking wells within 2,000 feet of facility(see Figure A)

If greater than 5,000 cubic yards of blast rock will be generated, a groundwater monitoring program must be developed and submitted to DES. Contact the AoT Bureau for additional detail.

C. Indicate if the project will withdraw from, or directly discharge to, any of the following water sources *post-development* and, if "Yes", indicate its purpose:

1. Stream or Wetland Purpose: >Mimic existing conditions	YES ☒ Withdrawal ☐ Discharge ☒ NO ☐
2. Man-made pond created by impounding a stream or wetland Purpose:	YES ☐ Withdrawal ☐ Discharge ☐ NO ☒
3. Unlined pond dug into the water table Purpose:	YES ☐ Withdrawal ☐ Discharge ☐ NO ☒

10. CHECK ALL APPLICATION ATTACHMENTS THAT APPLY (SUBMIT WITH APPLICATION IN ORDER LISTED)

LOOSE:

☒ Signed application form: des.nh.gov/organization/divisions/water/aot/index.htm (with attached proof(s) of delivery)
☒ Check for the application fee: des.nh.gov/organization/divisions/water/aot/fees.htm
☒ Color copy of a USGS map with the property boundaries outlined (1" = 2,000' scale)
☒ A copy of the pre-application meeting minutes, if you had a pre-application meeting with AoT staff.

BIND IN A REPORT IN THE FOLLOWING ORDER:

☒ Copy of the signed application form & application checklist (des.nh.gov/organization/divisions/water/aot/index.htm)
☒ Copy of the check
☒ Copy of the USGS map with the property boundaries outlined (1" = 2,000' scale)
☒ Narrative of the project with a summary table of the peak discharge rate for the off-site discharge points
☒ Web GIS printout with the "Surface Water Impairments" layer turned on - www2.des.state.nh.us/gis/onestop/
☒ Web GIS printouts with the AoT screening layers turned on - www2.des.state.nh.us/gis/onestop/
☒ NHB letter using DataCheck Tool – www.nhdfl.org/about-forests-and-lands/bureaus/natural-heritage-bureau/
☒ The Web Soil Survey Map with project's watershed outlined – websoilsurvey.nrcs.usda.gov
☒ Aerial photograph (1" = 2,000' scale with the site boundaries outlined)
☒ Photographs representative of the site
☒ Groundwater Recharge Volume calculations (one worksheet for each permit application):
des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls
☒ BMP worksheets (one worksheet for each treatment system):
des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls

10. CHECK ALL APPLICATION ATTACHMENTS THAT APPLY (SUBMIT WITH APPLICATION IN ORDER LISTED)

☒ Drainage analysis, stamped by a professional engineer (see Application Checklist for details)
☒ Riprap apron or other energy dissipation or stability calculations
☒ Site Specific Soil Survey report, stamped and with a certification note prepared by the soil scientist that the survey was done in accordance with the Site Specific Soil Mapping standards, *Site-Specific Soil Mapping Standards for NH & VT, SSSNNE Special Publication No. 3.*
n/a ☐ Infiltration Feasibility Report (example online)
n/a ☐ Registration and Notification Form for Storm Water Infiltration to Groundwater (UIC Registration-for underground systems only, including drywells and trenches): (http://des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge)
n/a ☐ Inspection and maintenance manual with, if applicable, long term maintenance agreements exempt per Env-Wq 1507-08(f)2
n/a ☐ Source control plan exempt per Env-Wq 1504.08, Industrial Multi-Sector General Permit #NHR05BM26 (See Appendix E, Storm Water Pollution Prevention Plan for Peirce Island Wastewater Treatment Plan)

PLANS:

☒ One set of design plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details)
☒ Pre & post-development color coded soil plans on 11" x 17" (see Application Checklist for details)
☒ Pre & post-development drainage area plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details)

100-YEAR FLOODPLAIN REPORT:

n/a ☐ All information required in Env-Wq 1503.09, submitted as a separate report.

☒ **REVIEW APPLICATION FOR COMPLETENESS & CONFIRM INFORMATION LISTED ON THE APPLICATION IS INCLUDED WITH SUBMITTAL.**

11. REQUIRED SIGNATURES

☒ APPLICANT OR ☐ AGENT: SIGNATURE	Terry L. Desmarais PRINT NAME LEGIBLY	12/22/15 DATE
OWNER OR OWNER'S AGENT (IF DIFFERENT FROM APPLICANT): SIGNATURE	Jon R. Pearson, AECOM PRINT NAME LEGIBLY	/ / DATE

By initialing here, I understand that in accordance with Env-Wq 1503.20(e), within one week after permit approval, the applicant shall submit a copy of all approved documents to the department in PDF format on a CD. JW

ATTACHMENT A:
ALTERATION OF TERRAIN PERMIT APPLICATION CHECKLIST

Check the box to indicate the item has been provided or provide an explanation why the item does not apply.

DESIGN PLANS

☒ Plans printed on 34 - 36" by 22 - 24" white paper

☒ PE stamp

☒ Wetland delineation

☒ Temporary erosion control measures

☒ Treatment for all stormwater runoff from impervious surfaces such as roadways (including gravel roadways), parking areas, and non-residential roof runoff. Guidance on treatment BMPs can be found in Volume 2, Chapter 4 of the NH Stormwater Management Manual.

☒ Pre-existing 2-foot contours

☒ Proposed 2-foot contours

n/a ☐ Drainage easements protecting the drainage/treatment structures

☒ Compliance with the Wetlands Bureau, RSA 482- A http://des.nh.gov/organization/divisions/water/wetlands/index.htm. Note that artificial detention in wetlands is not allowed.

☒ Compliance with the Comprehensive Shoreland Protection Act, RSA 483-B. http://des.nh.gov/organization/divisions/water/wetlands/cspa

n/a ☐ Benches. Benching is needed if you have more than 20 feet change in elevation on a 2:1 slope, 30 feet change in elevation on a 3:1 slope, 40 feet change in elevation on a 4:1 slope.

n/a ☐ Check to see if any proposed ponds need state Dam permits. http://des.nh.gov/organization/divisions/water/dam/documents/damdef.pdf

DETAILS

n/a ☐ Typical roadway x-section

n/a ☐ Detention basin with inverts noted on the outlet structure

☒ Stone berm level spreader

☒ Outlet protection – riprap aprons

☒ A general installation detail for an erosion control blanket

☒ Silt fences or mulch berm

☒ Storm drain inlet protection. Note that since hay bales must be embedded 4 inches into the ground, they are not to be used on hard surfaces such as pavement.

☒ Hay bale barriers

n/a ☐ Stone check dams

☒ Gravel construction exit

☒ The treatment BMP's proposed

n/a ☐ Any innovative BMP's proposed

CONSTRUCTION SEQUENCE/EROSION CONTROL

☒ Note that the project is to be managed in a manner that meets the requirements and intent of RSA 430:53 and Chapter Agr 3800 relative to invasive species.

☒ Note that perimeter controls shall be installed prior to earth moving operations

☒ Note that ponds and swales shall be installed early on in the construction sequence (before rough grading the site)

☒ Note that all ditches and swales shall be stabilized prior to directing runoff to them

☒ Note that all roadways and parking lots shall be stabilized within 72 hours of achieving finished grade

☒ Note that all cut and fill slopes shall be seeded/loamed within 72 hours of achieving finished grade

☒ Note that all erosion controls shall be inspected weekly AND after every half-inch of rainfall

☒ Note the limits on the open area allowed, see Env-Wq 1505.02 for detailed information

Example note: The smallest practical area shall be disturbed during construction, but in no case shall exceed 5 acres at any one time before disturbed areas are stabilized

☒ Note the definition of the word "stable"

Example note: An area shall be considered stable if one of the following has occurred:

- Base course gravels have been installed in areas to be paved
- A minimum of 85 percent vegetated growth has been established
- A minimum of 3 inches of non-erosive material such stone or riprap has been installed
- Or, erosion control blankets have been properly installed.

☒ Note the limit of time an area may be exposed
Example note: All areas shall be stabilized within 45 days of initial disturbance

☒ Provide temporary and permanent seeding specifications. (Reed canary grass is listed in the Green Book; however, this is a problematic species according to the Wetlands Bureau and therefore should not be specified)

☒ Provide winter construction notes that meet or exceed our standards.

Standard Winter Notes:

- All proposed vegetated areas that do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized by seeding and installing erosion control blankets on slopes greater than 3:1, and seeding and placing 3 to 4 tons of mulch per acre, secured with anchored netting, elsewhere. The installation of erosion control blankets or mulch and netting shall not occur over accumulated snow or on frozen ground and shall be completed in advance of thaw or spring melt events.

- All ditches or swales which do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized temporarily with stone or erosion control blankets appropriate for the design flow conditions.

- After November 15, incomplete road or parking surfaces, where work has stopped for the winter season, shall be protected with a minimum of 3 inches of crushed gravel per NHDOT item 304.3.

n/a ☐ Note at the end of the construction sequence that "Lot disturbance, other than that shown on the approved plans, shall not commence until after the roadway has the base course to design elevation and the associated drainage is complete and stable". – This note is applicable to single/duplex family subdivisions, when lot development is not part of the permit.

DRAINAGE ANALYSES

Please double-side 8 ½" x 11" sheets where possible but, **do not** reduce the text such that more than one page fits on one side.

☒ PE stamp

☒ Rainfall amount obtained from the Northeast Regional Climate Center- http://precip.eas.cornell.edu/. Include extreme precipitation table as obtained from the above referenced website.

☒ Drainage analyses, in the following order:

- Pre-development analysis: Drainage diagram
- Pre-development analysis: Area Listing and Soil Listing
- Pre-development analysis: Node listing 1-year (if applicable), 2-year, 10-year and 50-year
- Pre-development analysis: Full summary of the 10-year storm
- Post-development analysis: Drainage diagram
- Post-development analysis: Area Listing and Soil Listing
- Post-development analysis: Node listing for the 2-year, 10-year and 50-year
- Post-development analysis: Full summary of the 10-year storm

☒ Review the Area Listing and Soil Listing reports

- Hydrologic soil groups (HSG) match the HSGs on the soil maps provided
- There is the same or less HSG A soil area after development (check for each HSG)
- There is the same or less "woods" cover in the post-development
- Undeveloped land was assumed to be in "good" condition
- The amount of impervious cover in the analyses is correct

Note: A good check is to subtract the total impervious area used in the pre analysis from the total impervious area used in the post-analysis. For residential projects without demolition occurring, a good check is to take this change in impervious area, subtract out the roadway and divide the remaining by the number of houses/units proposed. Do these numbers make sense?

n/a ☐ Check the storage input used to model the ponds

n/a ☐ Check to see if the artificial berms pass the 50-year storm, i.e., make sure the constructed berms on ponds are not overtopped

☒ Check the outlet structure proposed and make sure it matches that modeled

☒ Check to see if the total areas in the pre and post analyses are same

☒ Confirm the correct NRCS storm type was modeled (Coos, Carroll & Grafton counties are Type II, all others Type III)

PRE AND POST-DEVELOPMENT DRAINAGE AREA PLANS

☒ Plans printed on 34 - 36" by 22 - 24" on white paper

☒ Submit these plans separate from the soil plans

☒ A north arrow

☒ A scale

☒ Labeled subcatchments, reaches and ponds

☒ Tc lines

☒ A clear delineation of the subcatchment boundaries

n/a ☐ Roadway station numbers

☒ Culverts and other conveyance structures

PRE AND POST-DEVELOPMENT COLOR-CODED SOIL PLANS

☒ 11" x 17"sheets suitable, as long as it is readable

☒ Submit these plans separate from the drainage area plans

☒ A north arrow

☒ A scale

☒ Name of the soil scientist who performed the survey and date the soil survey took place

☒ 2-foot contours (5-foot contours if application is for a gravel pit) as well as other surveyed features

☒ Delineation of the soil boundaries and wetland boundaries

☒ Delineation of the subcatchment boundaries

☒ Soil series symbols (e.g., 26)

☒ A key or legend which identifies each soil series symbol and its associated soil series name (e.g., 26 = Windsor)

☒ The hydrologic soil group color coding (A = Green, B = yellow, C= orange, D=red, Water=blue, & Impervious = gray)

Please note that excavation projects (e.g., gravel pits) have similar requirements to that above, however the following are common exceptions/additions:

n/a ☐ Drainage report is not needed if site does not have off-site flow.

n/a ☐ 5 foot contours allowed rather than 2 foot.

n/a ☐ No PE stamp needed on the plans

n/a ☐ Add a note to the plans that the applicant must submit to the Department of Environmental Services a written update of the project and revised plans documenting the project status every five years from the date of the Alteration of Terrain permit.

n/a ☐ Add reclamation notes.

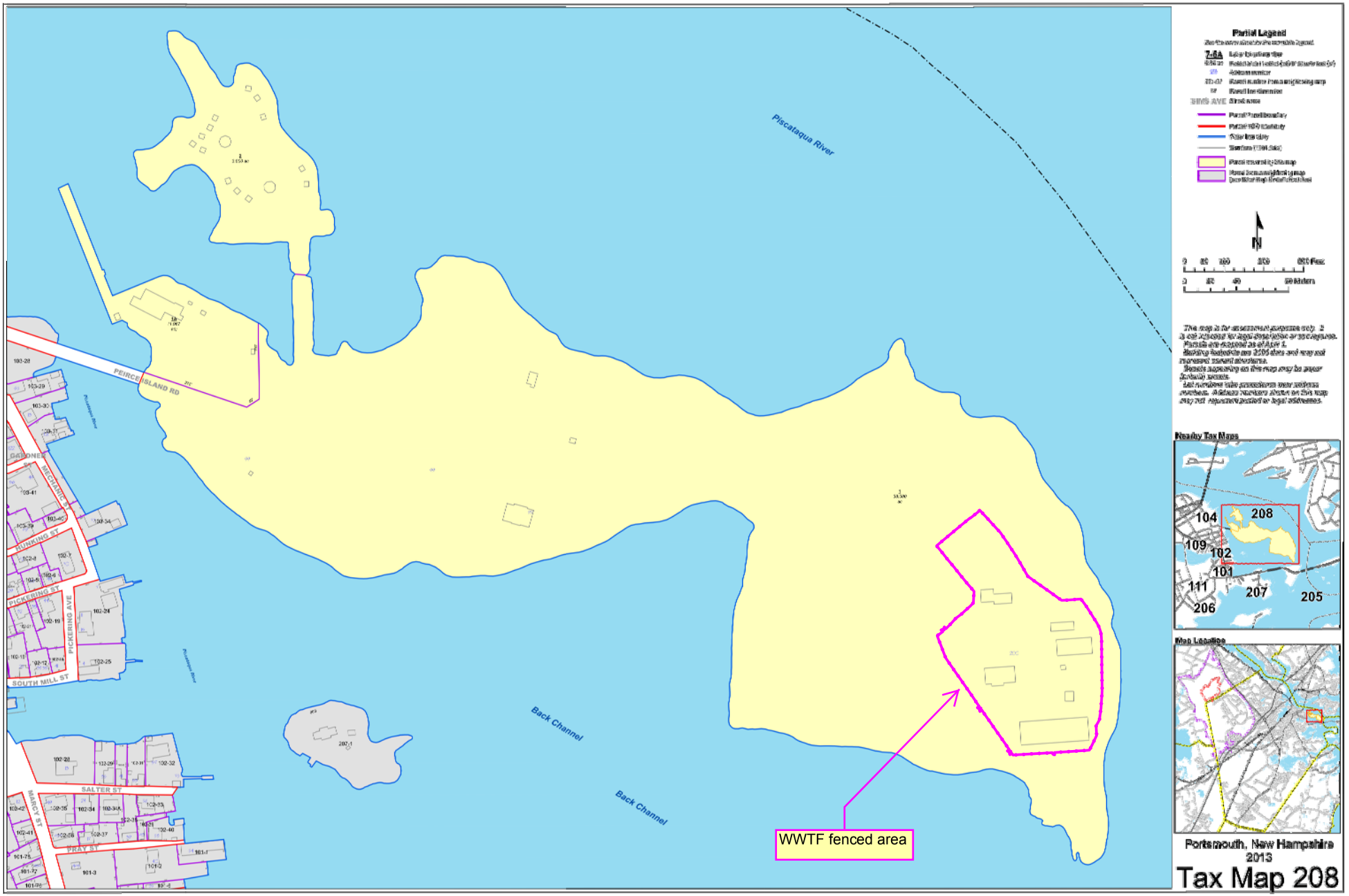
See NRCS publication titled: *Vegetating New Hampshire Sand and Gravel Pits* for a good resource, it is posted online at: http://des.nh.gov/organization/divisions/water/aot/categories/publications .

Map Name: KITTERY (NH)
Print Date: 05/07/14
Scale: 1 inch = 1,500 ft.

Map Center: 043° 04' 25.38" N 070° 44' 30.85" W
Horizontal Datum: NAD27

SCALE 1:18000

0 1000 2000 3000 4000 5000
FEET


Piscataqua River
PEIRCE ISLAND RD
GARDNER
MECHANIC ST
HUNKING ST
PICKERING ST
PICKERING AVE
SOUTH MILL ST
SALTER ST
MARCY ST
PRAY ST
Back Channel
Back Channel
WWTF fenced area
Partial Legend
Nearby Tax Maps
104
208
109
102
101
111
207
205
206
Map Location
Portsmouth, New Hampshire
2013
Tax Map 208

PROJECT DESCRIPTION

The project consists of upgrading the existing wastewater treatment facility (WWTF) on Peirce Island to bring it into compliance with the U.S. Environmental Protection agency requirements. Built in 1964 and upgraded in 1991 and 2002, the plant is designed to treat an average daily flow of 4.8 mgd. Due to changing regulatory standards, the EPA in 2007 declined to reissue a waiver allowing primary treatment and ordered the City to upgrade the WWTF to provide secondary treatment. The City is under a consent decree with EPA to upgrade the WWTF.

The project involves demolition of several buildings and construction of new facilities including a new headworks building; a new gravity thickener; replacement of the existing Administration Building with a new Solids Building; a new two-stage Biological Aerated Filter (BAF) system; demolition of the first floor of the existing Solids Processing Building and replacement with a new first floor superstructure of the Operations/Lab Building on the foundation of the former Solids Processing Building, and associated utility and site improvements within the fenced facility. Offsite improvements include a new water main and a new electric service from the pool to the WWTF with associated roadway repairs. Construction will take approximately three to four years and the facility will be operational throughout the duration of construction.

A pre-application meeting with NHDES was held in Concord on December 18, 2014 to discuss the project's complexities and the implementation of stormwater practices. The WWTF improvements are confined within existing 3.7 acre fenced yard in large part because of the well documented archeological site (former Fort Washington) outside the fence. Other site considerations include the heavy recreational use of Peirce Island and concerns from city residents about the height of the WWTF structures.

The total site disturbance during construction will be approximately 8.1 acres. There are (3) small areas that are planned for embankment stabilization. One area on the river side is eroding due to highly fractured bedrock and a second area will be impacted by construction of the new BAF. The third area facing southerly will be stabilized to facilitate equipment access around the new BAF. While the WWTF remains within the existing fence line, limited construction activities will take place outside. The Contractor will be required to implement and maintain perimeter controls for erosion and sediment control around these areas and comply with the Stormwater Pollution Prevention Plan prepared as part of the National Pollutant Discharge Elimination Systems (NPDES) Construction General Permit (CGP). There will also be upgrades to the existing utilities within the entrance roadway. The roadway grades will remain unchanged with no change in impervious area. There are three (3) areas along the entrance road to the WWTF that will be impacted temporary for staging, laydown areas, construction vehicles, and trailers. Upon completion of the project, these areas will be revegetated in-kind with non-invasive plant species. The east end of Peirce Island is planned to be closed to the public during the construction period. An Invasive Species Management Plan is included in the NHDES Standard Dredge and Fill Wetlands Application filed for the WWTF upgrade portion of the project.

The existing stormwater system within the WWTF discharges stormwater to tidal waters of the Piscataqua River via two (2) outfalls. One outfall discharges toward the deep river channel on the northeast side of the WWTF and the other discharges southerly towards Shapleigh Island via a swale and wetlands onto a shallow intertidal area. The stormwater system will be modified to address the WWTF upgrades. Because the BAF Facility and Solids Building will be connected, the site's stormwater subcatchments are being somewhat altered. The amount of stormwater that is discharged to the main flow of the Piscataqua River will increase from the existing conditions, while the discharge to the southerly side will decrease (thereby reducing impacts to the more sensitive intertidal zone). To further address water quality, the proposed stormwater management upgrades includes a level spreader, a rain garden and a 5,000 gallon water quality inlet (WQI). The WQI was

designed with the first and second chambers having 400 cubic feet of storage per acre of contributing impervious area.

The addition of buildings, tanks and pavement areas for the project will result in a total increase of impervious area of 21,270 square feet; however the total includes 14,575 square feet of new open-topped tanks that will capture rainfall (which becomes part of the wastewater flow). Therefore, the total post –construction watershed generating stormwater runoff is being reduced, resulting in a net decrease of stormwater runoff from the site.

The site is composed mostly of ledge and fills. It is estimated that the project will require blasting of more than 5,000 cubic yards of ledge. A review of the NHDES One Stop Program did not reveal any drinking wells within 2,000 feet of the facility; therefore groundwater monitoring will not be required for the project.

Historically, Peirce Island is best known as the site of Fort Washington, a star-shaped fort constructed at the eastern end of the island in 1775 as part of an extensive defense system of Portsmouth Harbor against the British in both the Revolutionary War and the War of 1812. Fort Washington was dismantled in 1815. The "Peirce Island Sewage Treatment Plant" was constructed in 1965 in the location of the old fort at the east end of the island. A number of archaeological investigations have been done at Peirce Island, most recently by Independent Archaeological Consultants. Significant precautions are being taken to preserve remaining archaeological resources on the island.

Due to the constrained Peirce Island WWTF site and the magnitude of the planned upgrade project, the construction contractor will require space for construction trailers, parking, staging, and storage outside of the existing fence line throughout the duration of the construction project. A Traffic Control Plan showing the mandatory construction access truck routes and staging plans defining the contractor's construction staging locations will be part of the final submittal. These items are being finalized and will be reviewed by City departments. It is anticipated a review by the Portsmouth Parking and Traffic Safety Committee will be completed.

CALCULATION METHODS

The drainage study was completed using HydroCAD. The program generates runoff hydrographs for specified storm distributions, and performs reservoir routing using the storage indication method. The criteria used for this drainage analysis is the 2-, 10-, and 50-year 24-hour Type III frequency storm events. The City of Portsmouth requires an analysis of a 2-, 10-, 25- and 50-year storm events. Conveyance devices are sized for the 10-year event.

Proposed erosion control measures are based upon recommended best management practices in the *New Hampshire Stormwater Management Manual* prepared by the New Hampshire Department of Environmental Services, dated December 2008, and as amended.

Curve number computations are based on guidelines for high intensity soil surveys presented in the technical report titled: *Environmental Planning for Onsite Wastewater Treatment in New Hampshire*.

The following modeling parameters and assumptions were incorporated into the analysis:

- Project area Hydrological Soil Groups are based on Site Specific Soil Mapping prepared by James H. Long, NHCSS #15.
- Routing technique is Dynamic-Storage-Indication method
- Model based on extreme precipitation values published by Cornell/UNH.
- Used Tc of 6 minutes for all subcatchments, since each measured Tc was less than 6 minutes. SCS TR-55 Urban Hydrology for Small Watersheds indicates that the minimum Tc should be 0.1 hour or 6 minutes. The Federal Highway Administration Hydraulic Engineering and NHDOT Drainage Design for Highways states that minimum time of concentration (Tc) for urbanized areas should not be less than 5-minutes. Extremely short Tc times can lead to improbable runoff values and are not appropriate for design.

Altus Engineering notes that stormwater modeling is limited in its capacity to precisely predict peak flow rates and flood elevations. Results should not be considered absolute due to the number of variables and assumptions involved in the modeling effort. Surface roughness coefficients (n), entrance loss coefficients (ke), velocity factors (kv), time of concentration (Tc), and tail water conditions are based on subjective field observations and engineering judgment. For design purposes, curve numbers (CN) describe the average conditions. However, curve numbers will vary from storm to storm depending on the antecedent runoff conditions (ARC). Modeling to simulate an actual storm event requires measurement of the pre-storm ARC to adjust the CN for the event. Also, higher flood elevations than predicted by modeling could occur if drainage channels and culverts are not maintained and become blocked by debris before or during the storm event. Siltation, blockage or damage to culverts or storm drains will impact flow capacity of the structures. Structures should be re-evaluated if future changes occur within drainage basins.

SUMMARY

Pre-Development

James H. Long, CSS, CWS completed a Site Specific Soil Survey (SSSS) for the site. The survey results are shown on the Sheet WS-1 & WS2, Pre- and Post-Development Site Specific Soils Plan. Soils determination was based on *New Hampshire Supplement of Site-Specific Soil Mapping Standard for New Hampshire and Vermont*, Version 4.0, February 2011 and disturbed areas were identified using the *Disturbed Soil Mapping Unit Supplement for DES AoT Site Specific Soil Maps*. The survey indicates that the hydrological soil group is predominately B with a small portion being C, where it's not ledge.

The pre-development watersheds are delineated on the accompanying Sheet WS-1A, Pre-Development Watershed Plan. Flow from the site flows radially outward. The majority of runoff discharges at existing two (2) drainage outfalls. Sheet flow from the remaining watersheds and the drainage outfalls flows directly into the tidal waters of Piscataqua River. The overall site runoff was analyzed at one (1) point of analysis (POA), the Piscataqua River.

Post-Development

The post-development conditions were analyzed at the same discharge point as the pre-development conditions. The post-development watersheds are delineated on the accompanying Sheet WS-2A, Post-Development Watershed Plan. Modifications to the delineated areas and associated ground cover were made to sub-catchments to account for the improvements to the property.

Drainage Analysis

A complete summary of the flow conditions is included in Appendix A. The following compares pre- and post-development peak flow rates at the point of analysis:

P.O.A.	2 Yr. Storm (3.84 in.)	10 Yr. Storm (5.04 in.)	25 Yr. Storm (6.00 in.)	50 Yr. Storm (6.84 in.)
	Q out (c.f.s.)	Q out (c.f.s.)	Q out (c.f.s.)	Q out (c.f.s.)
Pre (7R)	6.27	12.02	16.68	21.09
Post (7R)	6.07	10.80	15.29	19.04
Net Change	-0.20 cfs	-1.20 cfs	- 1.30 cfs	- 2.02 cfs

Facility Outfalls

Northerly Outfall (towards deep river channel)

P.O.A.	2 Yr. Storm (3.84 in.)	10 Yr. Storm (5.04 in.)	25 Yr. Storm (6.00 in.)	50 Yr. Storm (6.84 in.)
	Q out (c.f.s.)	Q out (c.f.s.)	Q out (c.f.s.)	Q out (c.f.s.)
Pre (1P)	1.89	3.44	4.68	5.83
Post (1aP)	4.23	7.25	9.62	11.84
Net Change	6.12 cfs	3.81 cfs	4.94 cfs	6.01 cfs

Southerly Outfall (toward Shapleigh Island)

P.O.A.	2 Yr. Storm (3.84 in.)	10 Yr. Storm (5.04 in.)	25 Yr. Storm (6.00 in.)	50 Yr. Storm (6.84 in.)
	Q out (c.f.s.)	Q out (c.f.s.)	Q out (c.f.s.)	Q out (c.f.s.)
Pre (5P)	1.98	3.68	5.04	6.33
Post (60P)	0.00	0.48	0.85	0.98
Net Change	-1.98 cfs	-3.20 cfs	- 4.19 cfs	- 5.35 cfs

Conclusion

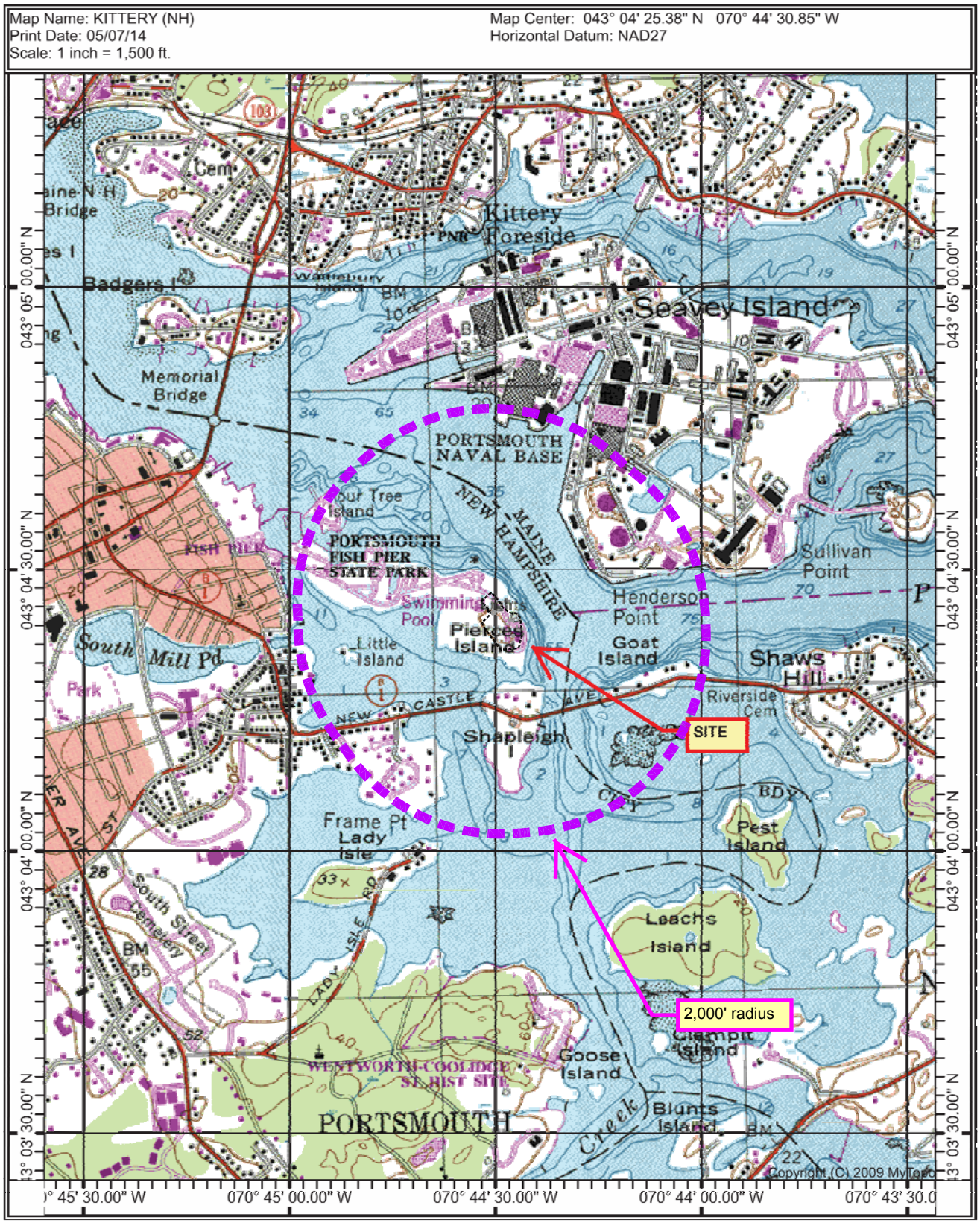
Comparison of the pre- and post-development stormwater runoff conditions indicates an overall decrease of peak flow from the site. Treatment of the WWTF's impervious areas is provided by the rain garden, level spreader and WQI. The existing 15" outfall (northerly outfall towards deep river channel) was upgraded with a new 21" outfall to reduce the outfall's velocity and headwaters within the closed drainage system. With the introduction of these best management practices, stormwater quality from the site is expected to improve.

EROSION CONTROL MEASURES

Permanent and temporary measures for erosion and sediment control are shown on the site plans. Temporary erosion control measures for perimeter control include the construction of siltation barriers, and two (2) stabilized construction entrances to minimize the transport of sediments and to prevent erosion during construction. Permanent erosion control measures include embankment stabilization, water quality inlet, rain garden and level spreader, loam and seed of side slopes, and naturally vegetated filter strips.

A complete description of the permanent and temporary erosion control measures can be found on the accompanying plans and detail sheets. The project is subject to USEPA's NPDES Stormwater Permit Program requirements. A Stormwater Pollution Prevention Plan (SWPPP) will be developed prior to the start of construction and modified as needed throughout the construction period to address changing site conditions and contractor operations. Each site operator will file a Notice of Intent (NOI) at least 14 days prior to construction to obtain permit coverage. A Notice of Termination (NOT) will be filed upon completion of construction.

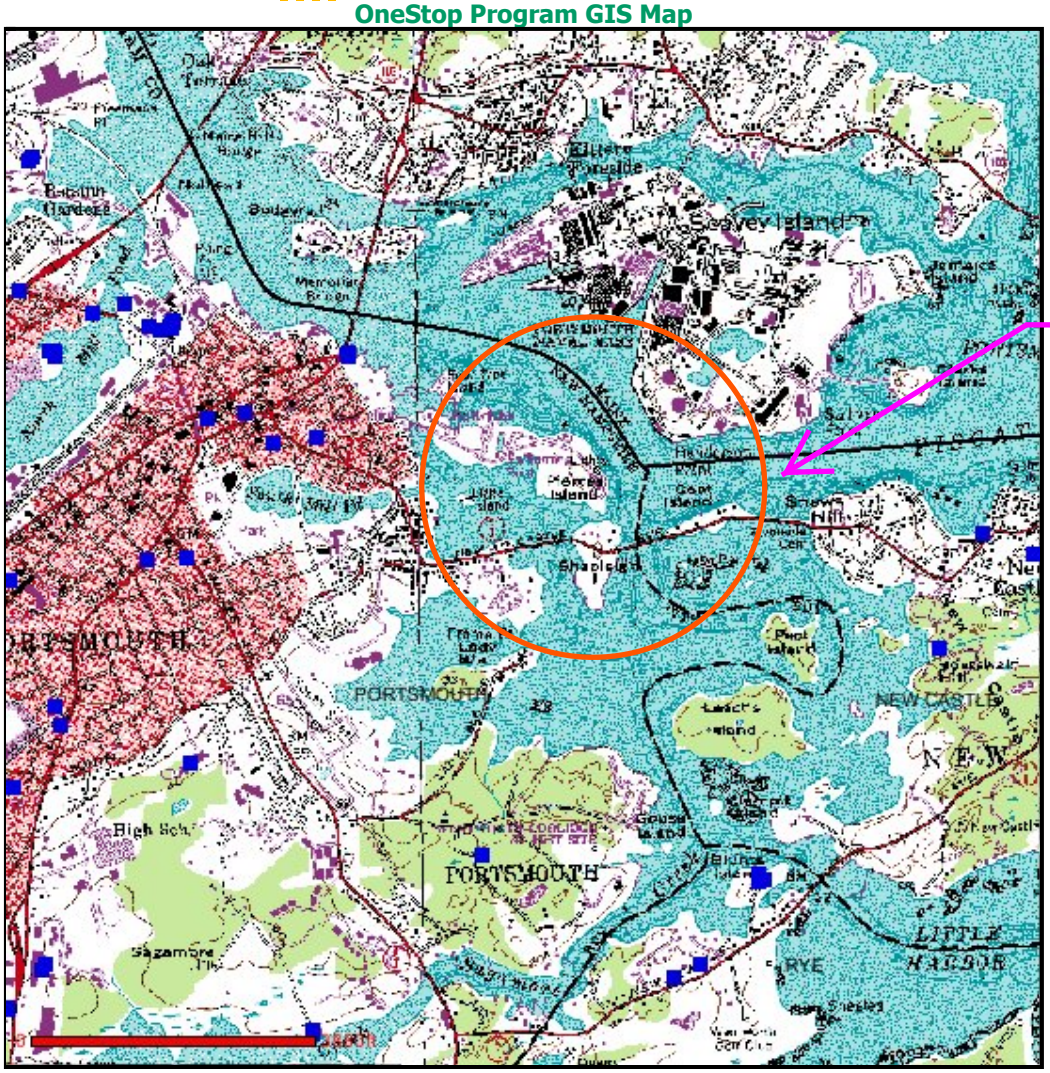
Figure A - 2,000 foot Distance from Project Site



New Hampshire Department of Environmental Services

OneStop Program GIS

OneStop Program GIS Map



Map Scale = 1 : 47816 (1" = 0.8 miles or 3985 feet)

The information contained in the OneStop Program GIS is the best available according to the procedures and standards of each of the contributing programs and of the GIS. The different programs are regularly maintaining the information in their databases. As a result, the GIS may not always provide access to all existing information, and it may occasionally contain unintentional inaccuracies. The Department can not be responsible for the misuse or misinterpretation of the information presented by this system.

Map prepared 7/13/2015 12:12:52 PM

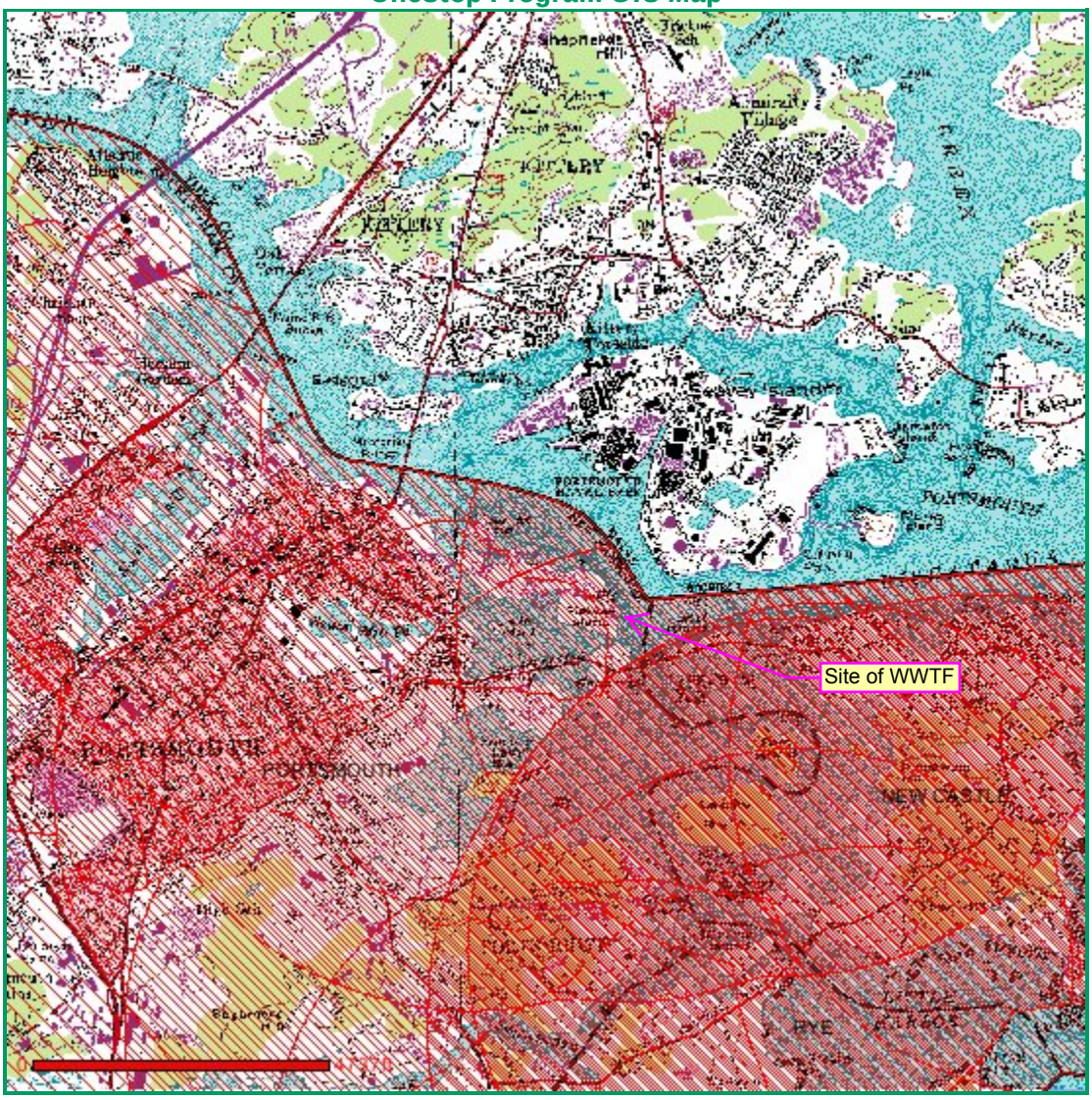
GRANIT Complex Systems Research Center

Developed in cooperation with NH GRANIT

New Hampshire Department of Environmental Services

OneStop Program GIS

OneStop Program GIS Map



Legend

- 2010 Surface Water Impairments with 1-Mile Buffer For Development Projects
- Town Boundary
- County Boundary
- State Boundary

Map Scale = 1 : 37657 (1" = 0.6 miles or 3138 feet)

The information contained in the OneStop Program GIS is the best available according to the procedures and standards of each of the contributing programs and of the GIS. The different programs are regularly maintaining the information in their databases. As a result, the GIS may not always provide access to all existing information, and it may occasionally contain unintentional inaccuracies. The Department can not be responsible for the misuse or misinterpretation of the information presented by this system.

Map prepared 6/5/2015 3:03:03 PM

GRANIT Complex Systems Research Center

Developed in cooperation with NH GRANIT

Feature Table - Internet Explorer

http://www2.des.state.nh.us/gis/onestop/select.asp?al=DESNLB,DESORW&dw=956

Feature Selection Results

2010 Surface Water Impairments with 1-Mile Buffer for Development Projects
Features returned: 5 of 904.

ASSESSMENT UNIT ID	BEACH?	ASSESSMENT UNIT NAME	IMPAIRMENTS
NHEST600031001-05	N	BACK CHANNEL	Nitrogen (Total)
NHEST600031001-02-02	N	LOWER PISCATAQUA RIVER - SOUTH	Enterococcus
NHEST600031001-04	N	LOWER SAGAMORE CREEK	Enterococcus
NHEST600031001-09	N	SOUTH MILL POND	Enterococcus
NHEST600031001-11	N	UPPER PORTSMOUTH HARBOR-NH	Nitrogen (Total)

Display/Query Layer:

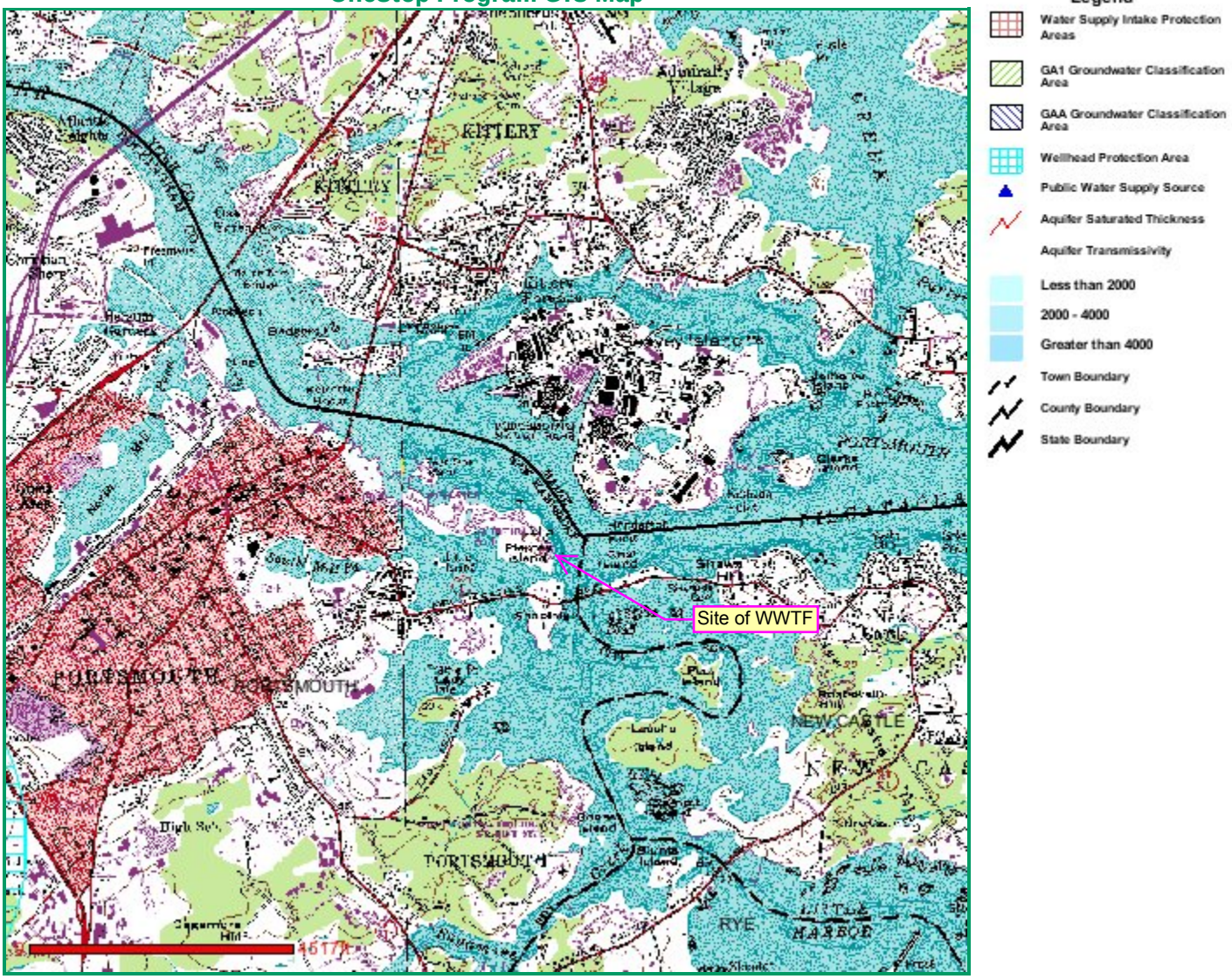
- (●) 2010 Surface Water Impairments with 1-Mile Buffer for Development Projects
- ( ) Outstanding Resource Water Watersheds

Close | Clear Form | Query | Refresh Map | Options | Save as Text

New Hampshire Department of Environmental Services

OneStop Program GIS

OneStop Program GIS Map



Map Scale = 1 : 35908 (1" = 0.6 miles or 2992 feet)

The information contained in the OneStop Program GIS is the best available according to the procedures and standards of each of the contributing programs and of the GIS. The different programs are regularly maintaining the information in their databases. As a result, the GIS may not always provide access to all existing information, and it may occasionally contain unintentional inaccuracies. The Department can not be responsible for the misuse or misinterpretation of the information presented by this system.

Map prepared 6/5/2015 3:00:09 PM

GRANIT Complex Systems Research Center

Developed in cooperation with NH GRANIT

NEW HAMPSHIRE NATURAL HERITAGE BUREAU
DRED - DIVISION OF FORESTS & LANDS
172 PEMBROKE ROAD, CONCORD, NH 03301
(603) 271-2214

To: Vicki Chase, Normandeau Associates, Inc., Environmental Analyst

From: Amy Lamb, Natural Heritage Bureau, Ecological Information Specialist
Date: June 11, 2015
Subject: NHB15-1528

This memo is a follow-up to NHB13-3237 and NHB15-1528, submitted for the review of the proposed improvements to the Peirce Island Wastewater Treatment Facility in Portsmouth, NH. The initial review (NHB13-3237) had indicated the presence of a state-threatened plant species, Marsh Elder (*Iva frutescens)*, along the shoreline of Peirce Island in the vicinity of the project. The Natural Heritage Bureau (NHB) requested a survey for Marsh Elder in the project area.

The survey was conducted on June 2, 2014 by a botanist with Normandeau Associates, Inc., under contract to Altus Engineering and AECOM. The survey focused on the areas adjacent to the wastewater treatment plant, in areas of proposed disturbance and along the highest observable tideline, where the plant prefers to inhabit. The surveyor observed and recorded four subpopulations of Marsh Elder, located around an inlet on the south side of Peirce Island.

Based on the provided documents (site plans, survey report) and subsequent email communication, NHB does not expect that this project will impact the Marsh Elder. This determination is contingent upon the following:

- No construction activity or equipment staging will occur outside of erosion control limits, approximately 40 feet from the Marsh Elder populations.
- Construction safety fencing will be installed along either side of Peirce Island Road during construction.
- During the construction season (Dec 1- Apr 30), erosion control fencing will be installed around the seasonal construction trailer/staging area, located adjacent to the eastern end of Subpopulation 1.
- Before construction fencing is removed at the end of the construction season and/or upon termination of the project, care should be taken to remove any sediments that have collected along the fence, so that they do not run off with stormwater and impact the Marsh Elder.

If these statements are no longer true of project, the dismissal of concerns would not apply. Should you have any further questions, or if the project should change, contact me at 603-271-2215 ext. 323 or at Amy.Lamb@dred.nh.gov

Marsh Elder (*Iva frutescens*) Survey Report
Peirce Island Wastewater Treatment Facility
City of Portsmouth, NH

Submitted By
Normandeau Associates, Inc.
30 International Drive, Suite 6
Portsmouth, NH 03801
603.319.5300
www.normandeau.com

June 10, 2015

NORMANDEAU
environmental consultants

INTRODUCTION

On June 2, 2014 a botanist with Normandeau Associates, Inc. (Normandeau), under contract to Altus Engineering and AECOM, completed surveys for marsh elder (*Iva frutescens*), listed as rare by the State of New Hampshire, on the eastern end of Peirce Island in Portsmouth, New Hampshire. The New Hampshire Natural Heritage Bureau (NHB) identified marsh elder at several locations on and in the vicinity of Peirce Island (Appendix A). The surveys were focused on the vicinity of the Peirce Island Waste Water Treatment Facility (WWTF) and included areas of proposed disturbance as well as the general WWTF grounds. This report outlines the methods and results of that survey, including a brief overview of the biological characteristics of marsh elder.

MARSH ELDER BIOLOGY

Marsh elder is an exclusively coastal shrub found along saline beaches, commonly at the limit of high tide from Nova Scotia south to Texas. Leaves are narrow to elliptic, thickened slightly, and oppositely branched with leaf scars that completely encircle the twig. Greenish-white flowers are borne in clusters at the ends of the branches and bloom from September to October in this region. Mature plants can reach 8 to 11 feet in height. (Haines 2011, USDA 2002, Petrides 1972).

Marsh elder is not tolerant of prolonged saltwater intrusion, although it does not typically compete well with robust upland plant species. However; marsh elder does tolerate a small amount of saline influence, which allows it to occupy the narrow band between the upland vegetation above the high salt marsh and the lands that are subject to greater tidal influence below. It has been found that the most robust growth occurs at locations that are flooded 6-7% of the time during the growing season. Greater flooding regimes result in increased mortality, with zero shrub growth recorded for areas subject to flooding for greater than 30% of the growing season (Thursby and Abdelrhman 2004). Marsh elder is an important component to the shoreline as the last line of defense for protection from shoreline erosion.

SURVEY METHODS

The life history of marsh elder demonstrates that the species is typically confined to a narrow band between the intertidal shore and areas unaffected by the normal tidal range. Therefore, field surveys were directed at areas in the vicinity of the observable height of tide, as determined by the uppermost wrack line or water stained shoreline visible at the time of survey. This is coincident with the Highest Observable Tideline (HOTL) previously identified

by Normandeau (see *Wetland and Shoreland Report* dated October 16, 2015). Potential marsh elder individuals were keyed to species using the most recent edition of *Flora Novae Angliae* (Haines 2011). When an individual or group of marsh elder was identified, data collected included information on the general health and vigor of the population, stem count and density, and characteristics of the surrounding environment. These data were used to complete NHB data sheets for submittal to the agency for inclusion into their records. Populations were located using a Trimble Geo 6000 Global Positioning System (GPS) unit capable of sub-meter accuracy. The width of the population parallel to the shore was estimated at each point taken within the population.

SURVEY RESULTS

Over 500 individuals of the target species, marsh elder, were located during the June 2, 2014 survey effort. All marsh elder were observed to be stunted, and contain approximately 50-60% dead stems, mostly confined to the upper portions of the plant. One population containing four subpopulations was identified along the southern shore of Peirce Island, along the edge of a small cove west of the WWTF. The population formed a narrow band immediately above the highest observed wrack line along the shore. Subpopulation 1 is the longest continuous band of marsh elder observed, extending from a rock outcrop on the west end of the cove, to the edge of a small freshwater wetland area (Wetland "A" as previously delineated by Normandeau). The other three subpopulations are much smaller and extend along the eastern side of the cove until adjacent upland vegetation density increased and marsh elder was no longer observed (Appendix B). All individuals were observed to be in feeble to very feeble vigor, and averaged 3-feet in height (Appendix C). A data form documenting the population was completed for submittal to NHB (Appendix D). Table 1 contains a summary of the information recorded on the subpopulations.

Table 1: Summary of marsh elder (*Iva frutescens*) survey.

Subpopulation	Number of Individuals	Vigor	Subpopulation Size (sq. ft.)
1	400+	Very Feeble	4277
2	125	Feeble	612
3	31	Very Feeble	322
4	14	Very Feeble	217

Associated upland species included staghorn sumac (*Rhus hirta*), autumn olive (*Eleagnus umbellata*), Asian bittersweet (*Celastrus orbiculatus*), and speckled alder (*Alnus incana* ssp. *rugosa*). The saline areas downslope of the marsh elder contained over 50% unvegetated substrate, as well as a mixture of cordgrass (*Spartina* sp.).

DISCUSSION

Based on current construction plans, the construction area is located away from the identified marsh elder (Appendix E). There is a staging area at the location of the dirt parking lot/snow storage area adjacent to Subpopulation 1. Presently there is a row of bollards along the perimeter of the lot which would be an appropriate guideline for limits. Care should be taken to establish the limit for construction trailer placement and the staging of construction materials. Current erosion control plans show the limits of erosion controls approximately 40 feet from the marsh elder population. If no construction activity occurs outside of the erosion control limits, the project should not result in compromising this population of marsh elder.

REFERENCES

Haines, A. (2011) *Flora Novae Angliae: A manual for the Identification of Native and Naturalized Higher Vascular Plants of New England*. New England Wildflower Society and Yale University Press, New Haven and London, 973pp.

Petrides, G.A. (1972) *A field Guide to Trees and Shrubs: Northeastern and North-central United States and Southeastern and South-central Canada* (2nd ed.). Houghton Mifflin Co., Boston/New York 428 pp.

Thursby, G.B., and M.A. Abdelrhman. (2004) Growth of Marsh Elder *Iva frutescens* in Relation to Duration of Tidal Flooding. Estuaries, Vol. 27, No. 2, pp 217-224.

United States Department of Agriculture. (2002) Plant Fact Sheet: Marsh Elder *Iva frutescens*. Accessed June 11, 2014 at https//www.plants.usda.gov/factsheet/pdf/fs_ivfr.pdf.

APPENDIX A
NHB Review Letter

Memo

NH Natural Heritage Bureau
NHB Datacheck Results Letter

To: Jeffrey Clifford, Altus Engineering
133 Court Street
Portsmouth, NH 03801

From: Melissa Coppola, NH Natural Heritage Bureau
Date: 10/30/2013 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau
NHB File ID: NHB13-3237 Town: Portsmouth Location: 208/1
Description: project entails work associated with the design and construction of improvements to the City of Portsmouth's Pierce Island Wastewater Treatment Facility

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: Please send site photos of the area closest to the shoreline that will be impacted by this project. Send requested info to: mcoppola@dred.state.nh.us.

Plant species	State[1]	Federal	Notes
Marsh Elder (*Iva frutescens*)	T	--	Threats are primarily alterations to the hydrology of the wetland, such as ditching or tidal restrictions that might affect the sheet flow of tidal waters across the intertidal flat, activities that eliminate plants, and increased input of nutrients and pollutants in storm runoff.

[1]Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

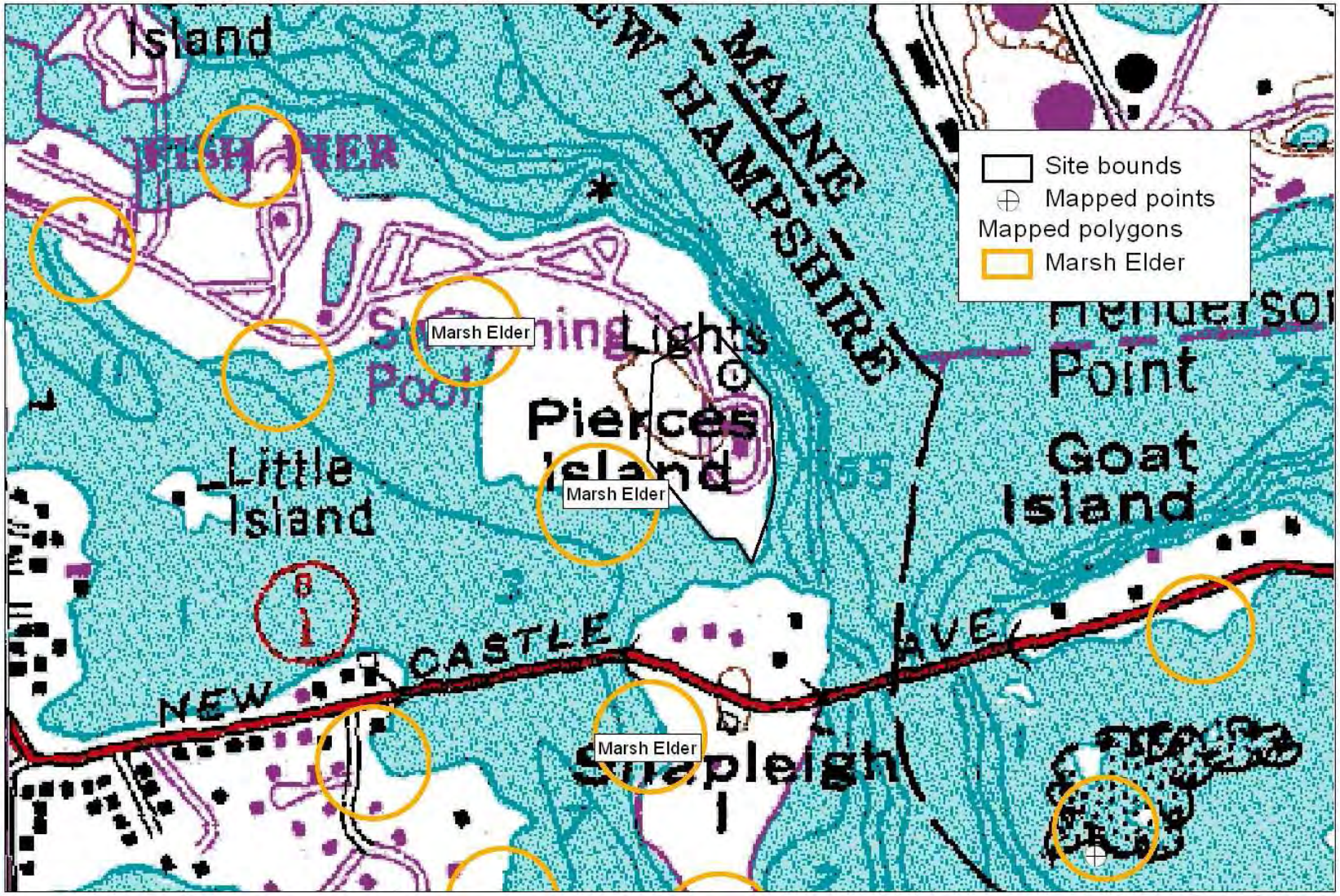
Department of Resources and Economic Development
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DRED/NHB
PO Box 1856
Concord NH 03302-1856

NH Natural Heritage Bureau

Known locations of rare species and exemplary natural communities

Note: Mapped locations are not always exact. Occurrences that are not in the vicinity of the project are not shown.



*Historical record

1:5706

Valid for one year from this date: 30 Oct 2013

New Hampshire Natural Heritage Bureau - Plant Record

Marsh Elder (*Iva frutescens*)

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Demonstrably widespread, abundant, and secure
State:	Listed Threatened	State:	Imperiled due to rarity or vulnerability

Description at this Location

Conservation Rank: Excellent quality, condition and landscape context ('A' on a scale of A-D).
Comments on Rank: This rank may be for the state rather than relative to others in the region.

Detailed Description: 1996: Constant observation since 1953 reported, including all stages of phenology and age structure. 1982: Good clump observed.

General Area: 1996: On shores of several islands and peninsulas in the more or less enclosed bay system. Associated plant species: *Solidago sempervirens* (seaside goldenrod), *Juncus gerardii* (salt marsh rush), *Spartina patens* (salt-meadow cord-grass), *Triglochin maritimum* (arrow-grass), *Elymus virginicus* (Virginia wild rye), *Atriplex patula* (narrow-leaved orach), and *Artemisia vulgaris* (common mugwort). Substrate: gravel and marsh peat and muck. 1982: On shore at Pleasant Point.

General Comments:
Management Comments:

Location

Survey Site Name: Little Harbor, back channel
Managed By: Little Harbor Trust

County:	Rockingham	USGS quad(s):	Kittery (4307016)
Town(s):	Portsmouth	Lat, Long:	430409N, 0704409W
Size:	57.8 acres	Elevation:	10 feet

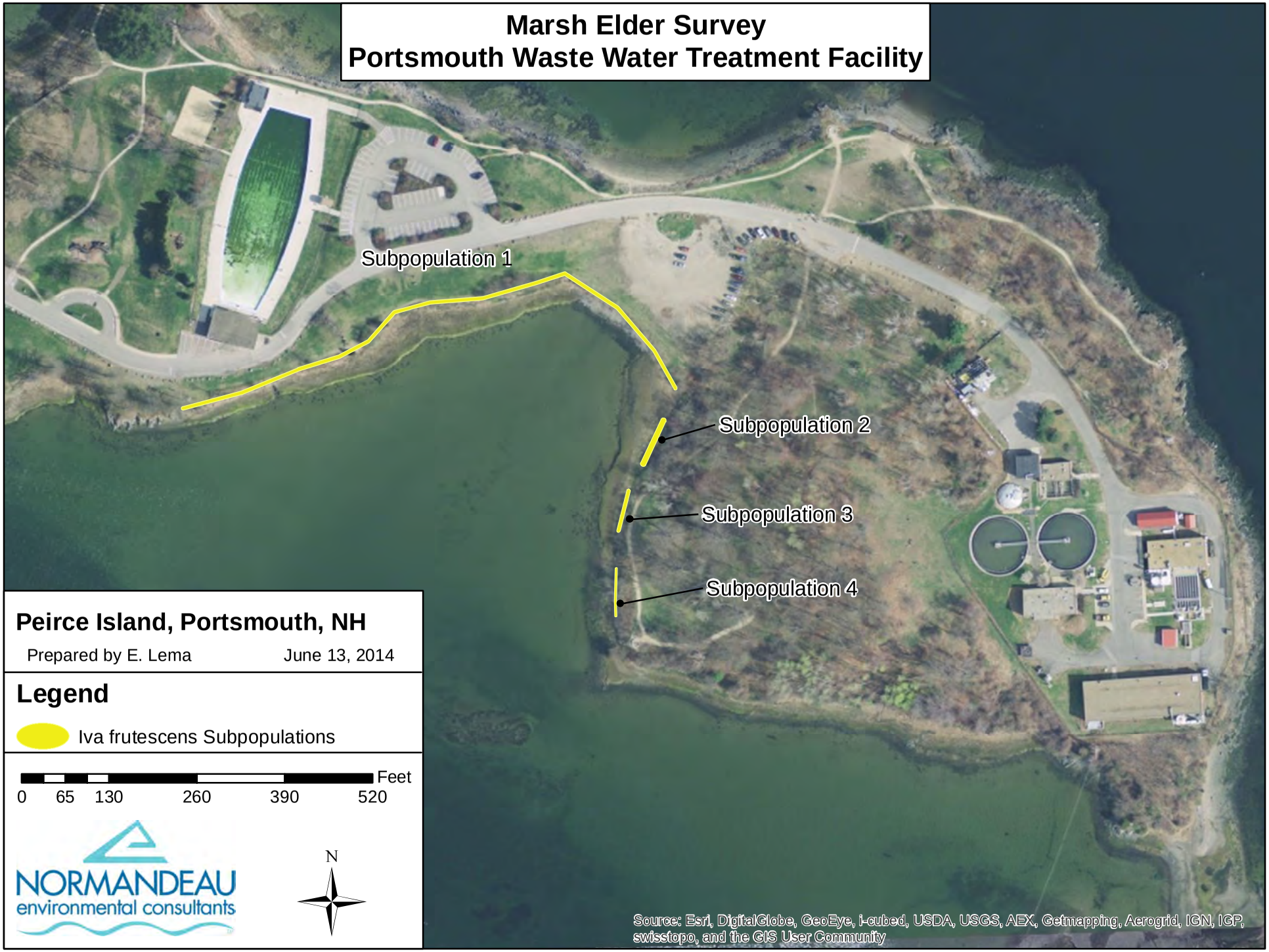
Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: In the vicinity of Rte. 1B which encircles the Little Harbor back channel from Portsmouth to New Castle and Rye. Many of the sites are visible only by boat.

Dates documented

First reported:	1953	Last reported:	1996-04-01

APPENDIX B
Marsh Elder Location Map


Marsh Elder Survey
Portsmouth Waste Water Treatment Facility
Subpopulation 1
Subpopulation 2
Subpopulation 3
Subpopulation 4
Peirce Island, Portsmouth, NH
Prepared by E. Lema
June 13, 2014
Legend
Iva frutescens Subpopulations
Feet
0
65
130
260
390
520
NORMANDEAU
environmental consultants
N
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

APPENDIX C
Documenting Photographs

Photo 1: Subpopulation 1, western end. The marsh elder is the very narrow, low-growing shrub between the herbaceous saltmarsh species and the dense upland vegetation.

Photo 2: Subpopulation 1, along road. The marsh elder (narrow, gray band of vegetation) is very short in this location and is subject to roadside disturbance.

Photo 3: Subpopulation 2. This is the widest band of marsh elder in this population, likely due to the wide, gentle gradient of the shore.

Photo 4: Subpopulation 4. This subpopulation is the least numerous, with individuals overtopped by the adjacent upland vegetation (upper left).

Photo 5: Individual marsh elder showing growth characteristic of this population. New twigs are generally low on the plant, with dieback occurring on the upper branches.

Photo 6: Another series of individuals showing feeble growth.

APPENDIX D
NHB Data Form

Special Plant Survey Form

Obs Pt _____

Survey Site: **Portsmouth Waste Water Treatment Fac.** Date: **6/2/2014** Sourcecode:

Surveyors: **E. Lema** Town: **Portsmouth** Quad name:

Phone / e-mail: **elema@normandeau.com, 207-518-6769**

GPS coordinates: **-70.744147** **43.074326** Datum (e.g., NAD 83): **NAD83** GPS Unit / model: **Trimble Geo6000**

Directions: (Map must be attached) along shore of south-facing cove at the main parking area for visitors to the grounds surrounding the Portsmouth Waste Water Treatment Facility.

Species **marsh elder (*Iva frutescens*)** EONum:

IMPORTANT: What diagnostic features were observed that would separate it from similar species?

Specimen taken? **No** Photograph taken? **Yes** Photograph attached? **Yes**

For specimens: Collector, collection #, repository:

Office Use Only ID reviewed by: Date: Based on: ☐ Description ☐ Photograph ☐ Specimen

Conclusion: ☐ Verified ☐ Possible - needs follow-up ☐ Mis-identified

Phenology (%)		Population Size				Age Structure (%)		Vigor (%)	
100	In leaf	Ramets		Genets**					
	In bud		actual #				seedlings		Very feeble
	In flower		estim. #				immature		Feeble
	Immature fruit		1-10				vegetative sprouts		Normal
	Mature fruit		11-50				1st year		Vigorous
	Seed dispersing		51-100				mature (established)		Exceptionally
		500	101-1000	**500**			senescent		vigorous
	Vegetative reproduction*		> 1,000				age unknown		

*Describe vegetative reproduction: New growth originating from lower 1/3 of plant.

Genets: How defined? Average size?: **Genets defined by individual clumps with stems arising from the same point – same as ramets.

% of plants with		Description
?	Evidence of disease	**Unknown if disease or disturbance, see below**
100	Injury / herbivory	**All plants exhibit dieback, likely from disturbance and large saltwater intrusion.**

Population Polygon (PP): If you drew a line around **all** the plants you found, how large an area would be within it?

Total Cover (TC): What is the total area covered by all the plants (as if they were growing next to one another)?

	PP	TC
< 1 sq. meter		
1-5 sq. m.		
5-10 sq. m.		
10-100 sq. m.		
100-1000 sq. m. (.1 ha)	**500**	**300**
> 0.1 ha		
actual area (if known)		

What % of the Population Polygon is covered by this species? **60** (= 100 * TC / PP)

Within the population polygon, how are the stems distributed? **Clumped**

(If "other", describe below)

How much time was spent searching in this area? **1** people searched for **180** min,

How thoroughly was the Population Polygon searched? **Very well**

Is there suitable habitat nearby that was not searched? **Yes**

Comments on population size / distribution / etc.: **Confined to a characteristic narrow band along high tide line. All individuals exhibit marked dieback and low vigor. Potential saltwater intrusion from storm disturbance and sea level rise may be contributing to decline.**

Aspect		Slope	Light	Topo position	Moisture regime	Comments
	N		0-3%	**80** Open	Crest	Inundated (hydric)	
	NE					
X	E	**X**	3-8%	**20** Partial	Upper slope	Saturated (wet-mesic)	
	NW					
X	S		8-15%	Filtered	Mid-slope	**X** Moist (mesic)	
	SE					
X	W		15-35%	Shade	**X** Lower slope	Dry-mesic	
	SW					
	Flat		35%-vert.		Bottom	Dry (xeric)	
	Degrees		degrees			

Elevation range: **0** to **1** **meters** Soil name (SCS) / Substrate:

Bedrock type:

File name: NH_Genspp_EO# or Surveysite_FFyy e.g. **NH_Arebul_002_FF09** for *Arethusa bulbosa* EO# 2 seen in 2009 or **NH_Arebul_BigFen_FF09** if EO# unknown.

Associated natural community:	**Satlmarsh (downslope) upland shrub community (upslope)** Releve completed? **No**
Associated plant species (immediate vicinity):	**saltmeadow cordgrass (*Spartina patens*), staghorn sumac (*Rhus hirta*), spearscale orache (*Atriplex patula*), Asian bittersweet (*Celastrus orbiculatus*)speckled alder (*Alnus incana* ssp. *rugosa*), goldenrod (*Solidago* sp.), turf species**
Dominant / characteristic species:	**staghorn sumac (*Rhus hirta*), Asian bittersweet (*Celastrus orbiculatus*), saltmeadow cordgrass (*Spartina patens*)**
Invasive species:	**Asian bittersweet (*Celastrus orbiculatus*)**

Sketch (habitat and/or overhead view). Include scale, north arrow, and where the plants are.

See attached map generated from sub-meter accurate GPS data.

Owner aware of the plant?	**Unknown** Owner comments:
Owner protecting the plant?	**Unknown**
Evidence of disturbance:	**Disturbance from adjacent mown roadside and maintained, unpaved parking/snow storage lot. Also disturbance from storm events likely.**
Management needs:	**Gently grading the current upland cut bank may provide the marsh elder ecological space to move as the level of seawater gradually rises. Currently the species is unable to move upslope.**

The SIZE of the population: Summarize first page, provide additional details (e.g. on the distribution of the plants, how confident you are that most of the habitat was searched, thus most plants were located).

Four subpopulations in close proximity to each other line the south-facing cove west of the treatment facility. The population forms a narrow band occupying the space between the upper tidal limit and the upland vegetation. Greater than 500 individuals were located.

The current CONDITION of the population and its immediate habitat. Include reproductive activity and health of the plants, and dispersal, establishment, and maintenance of the population. Also evidence of disturbance in the immediate vicinity including known) presence of invasive species.

The population is large, but in poor condition. All of the individuals exhibit a large amount of dead stems, and the overall height of the population is greatly below the potential 8-11 feet that is cited in resource materials. Some flotsam was observed above the range of the population, indicating that there may be more frequent tidal inundation than is ideal for the species. The individuals are resprouting from the lower 1/3 of the stems, with the uppermost portions of nearly all stems dead. The upland side of the habitat is heavily invaded by Asian bittersweet (*Celastrus orbiculatus*), and many of the larger shrub species are overhanging the marsh elder.

The condition of the LANDSCAPE in the area SURROUNDING the population (e.g. is the area an undisturbed, functioning natural ecosystem: current and past land use? fragmentation?).

The landscape is maintained in a park-like setting and is frequented by many people including numerous dog owners. Development in the vicinity is limited to the paved access road to the WWTF and an unpaved lot immediately north of the population.

Letter ranks summarizing the comments made above: A = Excellent, B = Good, C = Fair, D = Poor

Size Rank:	Condition Rank:	Landscape Context Rank:	Overall Rank (A-D):
B	**D**	**C**	**C**

Your experience with this species (ranks are relative to): ☒ Local ☐ Statewide ☐ Regional ☐ Global

File name: NH_Genspp_EO# or Surveysite_FFyy e.g. **NH_Arebul_002_FF09** for *Arethusa bulbosa* EO# 2 seen in 2009 or **NH_Arebul_BigFen_FF09** if EO# unknown.

APPENDIX E
Peirce Island Wastewater Treatment Facility Upgrade
Erosion Control Plans, ~~May 2015~~ July 2015

EXTENT OF EROSION CONTROL MEASURES (TYP.). SILT FENCE AND STRAW BALES TO BE PLACED ALONG INSIDE FACE OF PLANT PERIMETER FENCE OR CONSTRUCTION SAFETY FENCE.

MEAN HIGH WATER (MHW)

HIGHEST OBSERVABLE TIDE LINE (HOTL)

PISCATAQUA RIVER

PISCATAQUA RIVER

~ TIDAL WATERS ~

~ TIDAL WATERS ~

SILT FENCE AND STRAW BALES TO BE PLACED ALONG INSIDE FACE OF CONSTRUCTION SAFETY FENCE. CONTRACTOR TO LOCATE FENCE GATE(S) AT HIS DISCRETION.

STABILIZED CONSTRUCTION EXIT. SEE DETAILS.

EDGE OF JURISDICTIONAL WETLANDS

HIGHEST OBSERVABLE TIDE LINE (HOTL)

MATCH LINE, SEE SHEET 00 C-103 PERMIT

PLAN

SCALE: 1"=40'

1" = 40' SCALE 0 40 80 120 FEET

PERMIT APPLICATION DRAWING
NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
REVISIONS				

AECOM TECHNICAL SERVICES, INC.
701 EDGEWATER DRIVE
WAKEFIELD, MA 01880
PHONE (781) 246-3300

NORMANDEAU environmental consultants

ALTUS ENGINEERING, INC.

STATE OF NEW HAMPSHIRE – JON R. PEARSON – 7-17-15 – REGISTERED PROFESSIONAL ENGINEER

CITY OF PORTSMOUTH, NH - DEPARTMENT OF PUBLIC WORKS
PEIRCE ISLAND WWTF UPGRADE

EXISTING CONDITIONS AND EROSION CONTROL PLAN I

PERMITTING

PROJECT NO:	60301525
CAD DWG FILE:	00 C-102 -PERMIT
DESIGNED BY:	T. WASSELL
DRAWN BY:	C. BENZIGER
DEPT CHECK:	C. BENZIGER
PROJ CHECK:	E. MESERVE
DATE:	JULY 2015
SCALE:	AS NOTED

00 C-102 PERMIT

PATH/FILENAME: P:\60301525 - PORTSMOUTH WWTF UPGRADE\SHEETS\BP-2\C\00 C-102 -PERMIT.DWG
LAST UPDATE: Thursday, June 25, 2015 7:04:43 AM
PLOT DATE: Tuesday, July 14, 2015 2:13:50 PM
ANSI D - 25-Jun-15

N

MATCH LINE, SEE SHEET 00 C-102 PERMIT

GRANITE

~GRAVEL TRAIL~

6" DO NOT ENTER

CONC. MEMORIAL

GRANITE MEMORIAL

ROW OF BOULDERS

RIP RAP

CONC. PAD W/ WATER FOUNTAIN

4-12"

GRANITE

EOP

DYL ONLY

SILT FENCE AND STRAW BALES TO BE PLACED ALONG INSIDE FACE OF CONSTRUCTION SAFETY FENCE. CONTRACTOR TO LOCATE FENCE GATE(S) AT HIS DISCRETION.

EXTENT OF EROSION CONTROL MEASURES (TYP.). SILT FENCE AND STRAW BALES TO BE PLACED ALONG INSIDE FACE OF PLANT PERIMETER FENCE OR CONSTRUCTION SAFETY FENCE.

HAYBALE/SILT FENCE TO BE PROVIDED WHEN CONTRACTOR USING THIS AREA

EDGE OF JURISDICTIONAL WETLANDS

STABILIZED CONSTRUCTION EXIT. SEE DETAILS.

PISCATAQUA RIVER

~GRAVEL PARKING LOT~

#404

GUARDRAIL

HIGHEST OBSERVABLE TIDE LINE

~ TIDAL WATERS ~

MEAN HIGH WATER (MHW)

HIGHEST OBSERVABLE TIDE LINE (HOTL)

"SHORE ACCESS"

GRANITE STEPS

MEAN HIGH WATER (MHW)

HIGHEST OBSERVABLE TIDE LINE (HOTL)

"NO PARKING"

"STOP"

SILT FENCE AND STRAW BALES TO BE PLACED ALONG INSIDE FACE OF CONSTRUCTION SAFETY FENCE

BENCH

MATCH LINE, SEE THIS SHEET

PLAN

SCALE: 1"=40'

MATCH LINE, SEE THIS SHEET

"NO PARKING"

"STOP"

BIKE RACK

BOULDERS

6' CLF

#5033

#5032

TRAFFIC UTILITY BOX

GATE

~POOL AREA~

POOL BUILDING

SWL

BIKE RACK

6' CLF

GATE

EOP

"18" DIA."

"DOGS ON LEASH"

SILT FENCE AND STRAW BALES TO BE PLACED ALONG INSIDE FACE OF CONSTRUCTION SAFETY FENCE

0 40 80 120

1" = 40' SCALE FEET

PERMIT APPLICATION DRAWING
NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

AECOM TECHNICAL SERVICES, INC.
257 TOWNSEND ST.
BOSTON, MA. 01860
PHONE (781) 246-5200

NORMANDEAU environmental consultants

AITUS ENGINEERING, INC.

STATE OF NEW HAMPSHIRE - JON D. PEARSON - LICENSED PROFESSIONAL ENGINEER

CITY OF PORTSMOUTH, NH - DEPARTMENT OF PUBLIC WORKS

PEIRCE ISLAND WWTF UPGRADE

EXISTING CONDITIONS AND EROSION CONTROL PLAN II

PERMITTING

PROJECT NO:	60301525
CAD DWG FILE:	00 C-103 - PERMIT
DESIGNED BY:	T. WASSELL
DRAWN BY:	C. BENZIGER
DEPT CHECK:	C. BENZIGER
PROJ CHECK:	E. MESERVE
DATE:	JULY 2015
SCALE:	AS NOTED

00 C-103 PERMIT

PATH/FILENAME: P:\60301525 - PORTSMOUTH WWTF UPGRADE\SHEETS\BP-2\C\00 C-103 - PERMIT.DWG
LAST UPDATE: Thursday, June 25, 2015 7:04:35 AM
PLOT DATE: Tuesday, July 14, 2015 2:14:41 PM
ANSI D - 25-Jun-15

4109.11

The State of New Hampshire

Department of Environmental Services

Thomas S. Burack, Commissioner

October 06, 2015

City of Portsmouth
c/o Terry Desmarais
680 Peverly Hill Rd.
Portsmouth, NH 03801

RE: NHDES Wetlands File # 2015-01866 City of Portsmouth –Peirce Island Wastewater Treatment Facility – Portsmouth Tax Map/Lot # 208 / 1

Dear Mr. Desmarais,:

Attached please find Wetlands Permit # 2015-01866 to Impact a total of 135,975 square feet of developed and undeveloped upland tidal buffer zone, including a total of 21,745 square feet in the undeveloped tidal buffer zone (13,210 s.f. temporary and 7,505 s.f permanent impacts); and a total of 114,230 square feet in the developed tidal buffer zone (87,220 s.f. temporary and 27,010 permanent impacts) for construction to upgrade the existing Portsmouth Wastewater Treatment facility in accordance with EPA Consent Decree. Approve as mitigation implementation of the "Invasive Species Management Plan" by Normandeau Associates dated August 18, 2015.

The decision to approve this application was based on the following findings:

1. This is a major impact project per Administrative Rule Env-Wt 303.02((b) projects within 100 feet of the highest observable tide line in undeveloped uplands, relative to the work proposed for the undeveloped upland tidal buffer zone.
2. Work within the developed upland tidal buffer zone for this project is classified as minimum impact per Administrative Rule Env-Wt 303.04(b), projects in previously developed uplands within 100' of highest observable tide line that are not classified as major or minor.
3. The need for the proposed impacts has been demonstrated by the applicant per Env-Wt 302.01. The overall project is the required upgrade of the Portsmouth Wastewater Treatment plant pursuant to an EPA consent decree. This application is for the construction portion of the overall project and will be executed concurrent with the stabilization portion of the project being permitted under file 2015-1878.
4. The applicant has provided evidence which demonstrates that this proposal is the alternative with the least adverse impact to areas and environments under the department's jurisdiction per Env-Wt 302.03. The project is confined to the existing site of the wastewater treatment facility for upgrade of the faciity, and to areas that are undeveloped municipal parkland as for use as staging and site management. All temporarily disturbed areas will be restored immediately following completion of the project, and the City of Portsmouth has developed a landscape plan to further strengthen the integrity of the buffer once the treatment plant construction work is completed.
5. The applicant is providing compensatory mitigation for permanent tidal buffer zone impacts through the implementation of an invasive species removal and management plan which will be applied to several acres of the island that are now vegetated with invasive plants.
6. The applicant has demonstrated by plan and example that each factor listed in Env-Wt 302.04(a)and (c), Requirements for Application Evaluation, has been considered in the design of the project. The NH Natural Heritage Bureau ("NHB")required a field survey to locate populations of the state-threatened Marsh Elder, which was completed by Normandeau Associates and documented in a report dated July 14, 2014. NHB stated that although there are populations of the species in the immediate project vicinity, it does not expect the species to be impacted if certain stated conditions are followed. Those conditions have been included in the permit conditions.
7. DES Staff conducted a field inspection of the proposed project on August 7, 2015. Field inspection determined that the application materials accurately depict the site, and implementation of the Invasive Species Management Plan will be highly beneficial to the quality of the buffer and inner island areas.
8. In accordance with RSA 482-A:8, DES finds that the requirements for a public hearing do not apply as the permitted project is not of substantial public interest, and will not have a significant impact on or adversely affect the values of the estuarine resource, as identified under RSA 482-A:1.
9. The Portsmouth Conservation Commission recommended approval of the project.

Any person aggrieved by this decision may appeal to the N.H. Wetlands Council ("Council") by filing an appeal that meets the requirements specified in RSA 482-A:10, RSA 21-O:14, and the rules adopted by the Council, Env-WtC 100-200. The appeal must be filed **directly with the Council within 30 days** of the date of this decision and must set forth fully **every ground** upon which it is claimed that the decision complained of is unlawful or unreasonable. Only those grounds set forth in the notice of appeal can be considered by the Council.

Information about the Council, including a link to the Council's rules, is available at <http://nhec.nh.gov/> (or more directly at <http://nhec.nh.gov/wetlands/index.htm>.) Copies of the rules also are available from the DES Public Information Center at (603) 271-2975.

Your permit must be signed, and a copy must be posted in a prominent location on site during construction. If you have any questions, please contact me at the Pease District Office at (603) 559-1507 or via email at dori.wiggin@des.nh.gov.

Sincerely,

Dori Wiggin
East Region Supervisor
DES Wetlands Bureau

cc: Portsmouth Conservation Commission
Portsmouth Municipal Clerk
Normandeau Associates

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

NOTICE TO RECIPIENTS OF MAJOR IMPACT N.H. WETLANDS PERMITS

Your permit was approved by the New Hampshire Wetlands Bureau as a major impact project, and your project will be reviewed by the U.S. Army Corps. Of Engineers for possible approval under the Army Corps. New Hampshire State Programmatic General Permit- SPGP. The Army Corps. will notify you within thirty (30) days as to whether you qualify.

*********NO WORK SHOULD BE DONE IN********
***********WETLANDS UNTIL YOU RECEIVE THAT NOTICE************

IF YOU DO NOT HEAR FROM THE ARMY CORPS WITHIN THIRTY (30) DAYS, YOU SHOULD CALL THEM AT 1-800-343-4789.

****

'HIS NOTICE WAS SENT WITH MAJOR IMPACT PERMIT # 2015-1866 ON 10/6/2015 BY [signature]

:C: U.S. ARMY CORPS. OF ENGINEERS

DES Web site: **www.des.nh.gov**
P.O. Box 95, 29 Hazen Drive, Concord, New Hampshire 03302-0095
Telephone: (603) 271-2147 • Fax: (603) 271-6588 • TDD Access: Relay NH 1-800-735-2964

The State of New Hampshire

Department of Environmental Services

Thomas S. Burack, Commissioner

WETLANDS AND NON-SITE SPECIFIC PERMIT 2015-01866

Permittee: City of Portsmouth
c/o Terry Desmarais
680 Peverly Hill Rd.
Portsmouth, NH 03801

Project Location: Peirce Island, Portsmouth
Portsmouth Tax Map/Lot No. 208 / 1

Waterbody: Piscataqua River

NOTE -- CONDITIONS

APPROVAL DATE: 10/06/2015 **EXPIRATION DATE: 10/06/2020**

Based upon review of the above referenced application, in accordance with RSA 482-A and RSA 485-A:17, a Wetlands Permit and Non-Site Specific Permit was issued. This permit shall not be considered valid unless signed as specified below.

PERMIT DESCRIPTION: Impact a total of 135,975 square feet of developed and undeveloped upland tidal buffer zone, including a total of 21,745 square feet in the undeveloped tidal buffer zone (13,210 s.f. temporary and 7,505 s.f permanent impacts); and a total of 114,230 square feet in the developed tidal buffer zone (87,220 sf. temporary and 27,010 permanent impacts) for construction to upgrade the existing Portsmouth Wastewater Treatment facility in accordance with EPA Consent Decree.
Approve as mitigation implementation of the "Invasive Species Management Plan" by Normandeau Associates dated August 18, 2015.

THIS APPROVAL IS SUBJECT TO THE FOLLOWING PROJECT SPECIFIC CONDITIONS:

1. All work shall be in accordance with plans by AECom dated July 2015, as received by the NH Department of Environmental Services (DES) on 7/21/2015.
2. This permit is not valid unless an Alteration of Terrain permit or other method of compliance with RSA 485-A:17 and Env-Wq 1500 is achieved.
3. This permit is further contingent upon execution of approved mitigation "Invasive Species Management Plan" by Normandeau Associates dated August 18, 2015, with the following requirements:
   a. The Plan shall be initiated concurrent with the project facility construction;
   b. Initial report documenting the first season's activities shall be submitted no later than October 1;
   c. A second report shall be submitted following the next season no later than October 1 of the second year;
   d. A plan for long-term success and monitoring shall be submitted to DES at the end of the second year for review and approval.
4. Orange construction fence shall be installed around permitted impact areas to avoid activities expanding into unintended areas, and in further accordance with specific requirement relative to threatened species protection stated below.
5. Appropriate siltation and erosion controls shall be in place prior to construction, shall be maintained during construction, and shall remain until the area is stabilized. Temporary controls shall be removed once the area has been stabilized.
6. Relative to the protection of the state-threatened Marsh Elder populations the following conditions shall be adhered to:
   a. No construction activity or equipment staging will occur outside of erosion control limits, approximately 40 feet from Marsh Elder populations;
   b. Construction safety fencing shall be installed along either side of Peirce Island Road during the construction;
   c. During the construction season (Dec. 1- Apr. 30) erosion control fencing will be installed around the seasonal construction trailer/staging area, located adjacent to the eastern end of Sub-population 1;
   d. Before construction fencing is removed at the end of the construction season, and /or upon termination of the project, care should be taken to remove any sediments that have collected along the fence, so that they do not run off with storm water and impact the Marsh Elder.
7. Any further alteration of areas on this property that are subject to RSA 482-A jurisdiction will require a new application and further permitting.

8. All development activities associated with this project shall be conducted in compliance with applicable requirements of RSA 483-B and N.H. Code Admin. Rules Env-Wq 1400 during and after construction.
9. No person undertaking any activity shall cause or contribute to, or allow the activity to cause or contribute to, any violations of the surface water quality standards in RSA 485-A and Env-Wq 1700.
10. Erosion control products shall be installed per manufacturers recommended specifications.
11. The contractor responsible for completion of the work shall use techniques described in the New Hampshire Stormwater Manual, Volume 3, Erosion and Sediment Controls During Construction (December 2008).
12. No concrete is to be used anywhere in the construction of the stone riprap revetment. All stone shall be dry laid or placed stone underlain with filter fabric.
13. All temporary impacts shall be remediated back to natural contours and stabilized with native seed mix, as well as planted according to the approved landscape plan immediately upon completion of project construction use of the site.
14. A report documenting such restoration shall be submitted to DES within 30 days of the restoration activities being completed.
15. Construction equipment shall be inspected daily for leaking fuel, oil, and hydraulic fluid prior to entering surface waters or wetlands or operating in an area where such fluids could reach groundwater, surface waters, or wetlands.
16. The permittee's contractor shall maintain appropriate oil/diesel fuel spill kits on site that are readily accessible at all times during construction, and shall train each operator in the use of the kits.
17. All refueling of equipment shall occur outside of surface waters or wetlands during construction. Machinery shall be staged and refueled in upland areas only.
18. Faulty equipment shall be repaired immediately prior to entering areas that are subject to RSA 482-A jurisdiction.

GENERAL CONDITIONS THAT APPLY TO ALL DES WETLANDS PERMITS:
1. A copy of this permit shall be posted on site during construction in a prominent location visible to inspecting personnel;
2. This permit does not convey a property right, nor authorize any injury to property of others, nor invasion of rights of others;
3. The Wetlands Bureau shall be notified upon completion of work;
4. This permit does not relieve the applicant from the obligation to obtain other local, state or federal permits, and/or consult with other agencies as may be required (including US EPA, US Army Corps of Engineers, NH Department of Transportation, NH Division of Historical Resources (NH Department of Cultural Resources), NHDES-Alteration of Terrain, etc.);
5. Transfer of this permit to a new owner shall require notification to and approval by DES;
6. This project has been screened for potential impacts to **known** occurrences of rare species and exemplary natural communities in the immediate area. Since many areas have never been surveyed, or have received only cursory inventories, unidentified sensitive species or communities may be present. This permit does not absolve the permittee from due diligence in regard to state, local or federal laws regarding such communities or species.
7. Review enclosed sheet for status of the US Army Corps of Engineers' federal wetlands permit.

APPROVED: Dori Wiggin

Dori Wiggin, East Region Supervisor
DES Wetlands Bureau

==========

BY SIGNING BELOW I HEREBY CERTIFY THAT I HAVE FULLY READ THIS PERMIT AND AGREE TO ABIDE BY ALL PERMIT CONDITIONS.

OWNER'S SIGNATURE (required)

CONTRACTOR'S SIGNATURE (required)

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

October 09, 2015

City of Portsmouth
c/o Terry Desmarais
680 Peverly Hill Rd.
Portsmouth, NH 03801

RE: File #2015-01878 - City of Portsmouth - Portsmouth
Tax Map/Lot # 208 / 1

Dear Property Owner:

The Department of Environmental Services (DES) Wetlands Bureau has reviewed and approved the above referenced application to impact 1,040 square feet (150 linear feet) of tidal wetlands and a total of 2,445 square feet of undeveloped upland tidal buffer zone (320 sq. ft. temporary and 2,125 sq. ft. permanent impacts) over three locations for installation of rip rap revetment for shoreline bank stabilization associated with upgrade construction at the Portsmouth Pierce Island Wastewater Treatment Facility in accordance with an EPA Consent Decree.

Any person aggrieved by this decision may appeal to the N.H. Wetlands Council ("Council") by filing an appeal that meets the requirements specified in RSA 482-A:10, RSA 21-O:14, and the rules adopted by the Council, Env-WtC 100-200. The appeal must be filed **directly with the Council within 30 days** of the date of this decision and must set forth fully **every ground** upon which it is claimed that the decision complained of is unlawful or unreasonable. Only those grounds set forth in the notice of appeal can be considered by the Council.

Information about the Council, including a link to the Council's rules, is available at <http://nhec.nh.gov/> (or more directly at <http://nhec.nh.gov/wetlands/index.htm>.) Copies of the rules also are available from the DES Public Information Center at (603) 271-2975.

Because of the type and classification of this project, the application must also be approved by the Governor and Executive Council. Upon completion of the appeal period, a copy of the file will be forwarded to the Governor and Executive Council for their consideration.

Sincerely,

Collis G. Adams, CWS, CPESC
Wetlands Bureau Administrator

CGA/emk

Enclosure: copy of decision

cc: Portsmouth Conservation Commission
Portsmouth Board of Selectmen
Jon Pearson, AECOM
Abutters

DECISION DATE: 10/09/2015

DECISION:

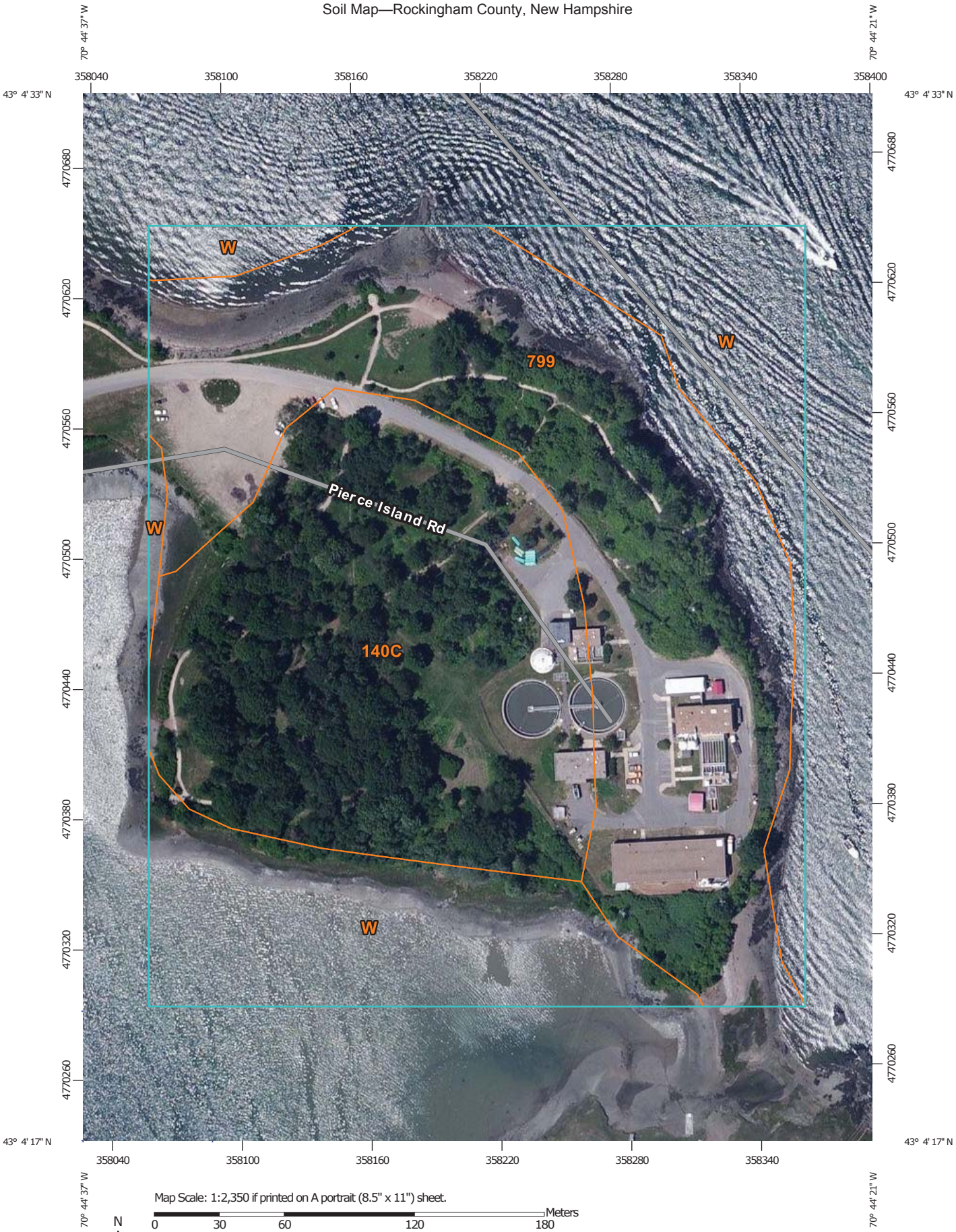
Impact 1,040 square feet (150 linear feet) of tidal wetlands and a total of 2,445 square feet of undeveloped upland tidal buffer zone (320 sq. ft. temporary and 2,125 sq. ft. permanent impacts) over three locations for installation of rip rap revetment for shoreline bank stabilization associated with upgrade construction at the Portsmouth Pierce Island Wastewater Treatment Facility in accordance with an EPA Consent Decree.

CONDITIONS:

1. All work shall be in accordance with plans by AECOM dated July 2015, as received by the NH Department of Environmental Services (DES) on July 21, 2015.
2. This permit is not valid unless an Alteration of Terrain permit or other method of compliance with RSA 485-A:17 and Env-Wq 1500 is achieved.
3. Orange construction fence shall be installed around permitted impact areas to avoid activities from creeping into unintended areas.
4. Appropriate siltation and erosion controls shall be in place prior to construction, shall be maintained during construction, and shall remain in place until the area is stabilized. Temporary siltation and erosion controls shall be removed once the area has been stabilized.
5. Relative to the protection of the state-threatened Marsh Elder populations the following conditions shall be adhered to:
    a. No construction activity or equipment staging will occur outside of erosion control limits, approximately 40 feet from Marsh Elder populations;
    b. Construction safety fencing shall be installed along either side of Pierce Island Road during the construction;
    c. During the construction season (Dec. 1- Apr. 30) erosion control fencing will be installed around the seasonal construction trailer/staging area, located adjacent to the eastern end of Sub-population 1;
    d. Before construction fencing is removed at the end of the construction season, and /or upon termination of the project, care should be taken to remove any sedimentation that has collected along the fence, so that it does not run off with storm water and impact the Marsh Elder.
6. Any further alteration of areas on this property that are subject to RSA 482-A jurisdiction will require a new application and further permitting.
7. All development activities associated with this project shall be conducted in compliance with applicable requirements of RSA 483-B and N.H. Code Admin. Rules Env-Wq 1400 during and after construction.
8. No person undertaking any activity shall cause or contribute to, or allow the activity to cause or contribute to, any violations of the surface water quality standards in RSA 485-A and Env-Wq 1700.
9. Erosion control products shall be installed per manufacturers recommended specifications.
10. The contractor responsible for completion of the work shall use techniques described in the New Hampshire Stormwater Manual, Volume 3, Erosion and Sediment Controls During Construction (December 2008).
11. No concrete is to be used anywhere in the construction of the stone riprap revetment. All stone shall be dry laid or placed stone underlain with filter fabric.
12. All temporary impacts shall be remediated back to natural contours and stabilized with native seed mix, as well as planted according to the approved landscape plan immediately upon completion of project construction use of the site.
13. A report documenting such restoration shall be submitted to DES within 30 days of the restoration activities being completed.
14. Construction equipment shall be inspected daily for leaking fuel, oil, and hydraulic fluid prior to entering surface waters or wetlands or operating in an area where such fluids could reach groundwater, surface waters, or wetlands.
15. The permittee's contractor shall maintain appropriate oil/diesel fuel spill kits on site that are readily accessible at all times during construction, and shall train each operator in the use of the kits.
16. All refueling of equipment shall occur outside of surface waters or wetlands during construction. Machinery shall be staged and refueled in upland areas only.
17. Faulty equipment shall be repaired immediately prior to entering areas that are subject to RSA 482-A jurisdiction.

FINDINGS:

1. This is a major impact project per Administrative Rule Env-Wt 303.02(a), projects withing tidal wetlands, and per Env-Wt 303.02(b) projects within 100 feet of the highest observable tide line in undeveloped uplands.
2. The need for the proposed impacts has been demonstrated by the applicant per Env-Wt 302.01. The overall project is the required upgrade of the Portsmouth Wastewater Treatment plant pursuant to an EPA consent decree. This application is for the stabilization portion of the overall project and will be executed concurrent with the construction portion of the project being permitted under file 2015-01866.
3. The applicant has provided evidence which demonstrates that this proposal is the alternative with the least adverse impact to areas and environments under the department's jurisdiction per Env-Wt 302.03. The project is confined to unstable areas adjacent to the new facility areas, and will be accomplished using natural material.
4. The applicant has demonstrated by plan and example that each factor listed in Env-Wt 302.04(a) and (c), Requirements for Application Evaluation, has been considered in the design of the project. The NH Natural Heritage Bureau ("NHB") required a field survey to locate populations of the state-threatened Marsh Elder, which was completed by Normandeau Associates and documented in a report dated July 14, 2014. NHB stated that although there are populations of the species in the immediate project vicinity, it does not expect the species to be impacted if certain stated conditions are followed. Those conditions have been included in the permit conditions.
5. DES Staff conducted a field inspection of the proposed project on August 7, 2015. Field inspection determined that the areas of erosion were severe and in close proximity to the facility, and that the stabilization work is necessary.
6. In accordance with RSA 482-A:8, DES finds that the requirements for a public hearing do not apply as the permitted project is not of substantial public interest, and will not have a significant impact on or adversely affect the values of the estuarine resource, as identified under RSA 482-A:1.
7. The Portsmouth Conservation Commission recommended approval of the project.


70° 44' 37" W
70° 44' 21" W
358040
358100
358160
358220
358280
358340
358400
43° 4' 33" N
43° 4' 17" N
4770680
4770620
4770560
4770500
4770440
4770380
4770320
4770260
W
799
140C
Pierce Island Rd
Map Scale: 1:2,350 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 30 60 120 180
Feet
0 100 200 400 600
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 1:24,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Rockingham County, New Hampshire
Survey Area Data: Version 15, Dec 31, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 20, 2010—Jul 18, 2010

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

Rockingham County, New Hampshire (NH015)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
140C	Chatfield-Hollis-Canton complex, 8 to 15 percent slopes, very stony	8.9	33.0%
799	Urban land-Canton complex, 3 to 15 percent slopes	10.8	40.0%
W	Water	7.3	27.0%
Totals for Area of Interest		**27.1**	**100.0%**


Four Tree Island
Pierce Island
Little Island
© 2014 Google

PORTSMOUTH WASTEWATER TREATMENT FACILITY

Photo #1: Treatment plant entrance

Photo #2: Looking south along Operation/Lab Building

PORTSMOUTH WASTERWATER TREATMENT FACILITY

Photo #3: Looking west behind BAF Building

Photo #4: At the southwest corner of BAF Building

PORTSMOUTH WASTERWATER TREATMENT FACILITY

Photo #5: Looking northwest along west side of facility

Photo #6: Looking east at facility from west side of facility

PORTSMOUTH WASTERWATER TREATMENT FACILITY

Photo #7: Looking south along west side of facility

Photo #8: Looking north at facility from Shapleigh Island

Groundwater Recharge Volume (GRV) Calculation

-	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
0.15	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
-	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
-	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.25	inches	Rd = weighted groundwater recharge depth	
0.0375	ac-in	GRV = AI * Rd	
136	cf	GRV conversion (ac-in x 43,560 sf/ac x 1ft/12”)	

Provide calculations below showing that the project meets the groundwater recharge requirements (Env-Wq 1507.04):

Pond 60 has capacity to infiltrate 559 cubic feet during a 2-yr storm event.

General Calculations - WQV and WQF
(optional worksheet)

This worksheet may be useful when designing a BMP that does not fit into one of the specific worksheets already provided. For example, if proposing a new technology, which is not a stormwater wetland, infiltration practice, etc., then this worksheet may be useful.

Water Quality Volume (WQV)

0.18	ac	A = Area draining to the practice
0.14	ac	A_I = Impervious area draining to the practice
0.78	decimal	I = percent impervious area draining to the practice, in decimal form
0.75	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)
0.14	ac-in	WQV= 1" x Rv x A
490	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")

Water Quality Flow (WQF)

1	inches	P = amount of rainfall. For WQF in NH, P = 1".
0.75	inches	Q = water quality depth. Q = WQV/A
98	unitless	CN = unit peak discharge curve number. $CN = 1000/(10+5P+10Q-10*[Q^2 + 1.25*Q*P]^{0.5})$
0.3	inches	S = potential maximum retention. S = (1000/CN) - 10
0.051	inches	Ia = initial abstraction. Ia = 0.2S
6.0	minutes	T_c = Time of Concentration
700.0	$cfs/mi^2/in$	qu is the unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III
0.148	cfs	WQF = q_u x WQV. Conversion: to convert "$cfs/mi^2/in$ * ac-in" to "cfs" multiply by $1mi^2/640ac$

Designer's Notes:

Runoff directed to Pond 60 (rain garden)

Summary for Pond 60: Rain garden

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=130)

Inflow Area = 0.180 ac, 76.65% Impervious, Inflow Depth = 2.09" for 2-yr event
Inflow = 0.44 cfs @ 12.09 hrs, Volume= 0.031 af
Outflow = 0.04 cfs @ 13.02 hrs, Volume= 0.031 af, Atten= 91%, Lag= 56.1 min
Discarded = 0.04 cfs @ 13.02 hrs, Volume= 0.031 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 29.74' @ 13.02 hrs Surf.Area= 558 sf Storage= 559 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 135.3 min (946.3 - 811.0)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	1,025 cf	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.50	320	0	0
29.00	410	183	183
30.00	610	510	693
30.50	720	333	1,025

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**3.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	29.75'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	30.20'	**6.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

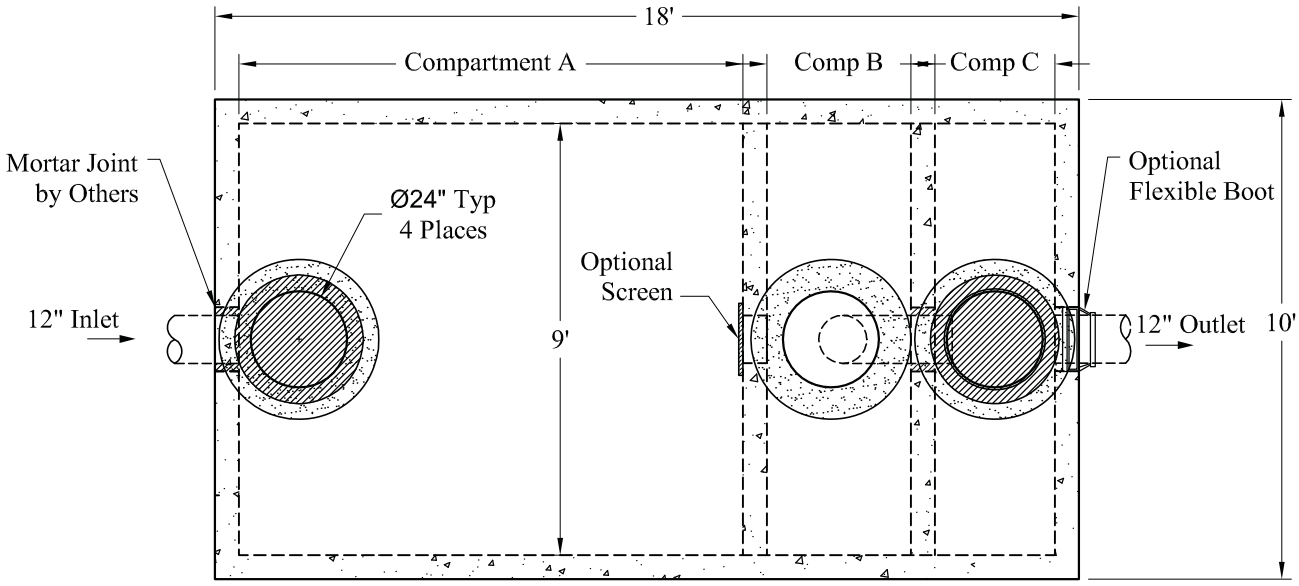
Discarded OutFlow Max=0.04 cfs @ 13.02 hrs HW=29.74' (Free Discharge)
└**1=Exfiltration** (Controls 0.04 cfs)

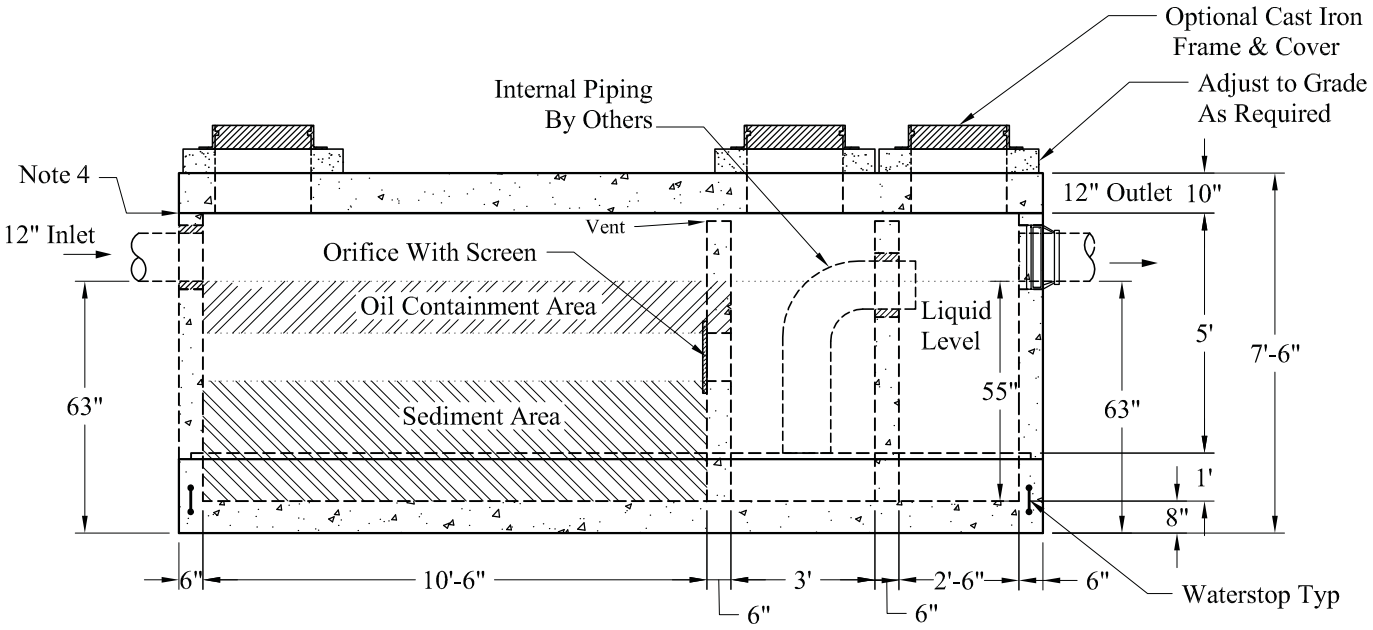
Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=28.50' TW=9.10' (Dynamic Tailwater)
└**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

1-800-639-2199 Fax (603) 224-2927

Phoenix Precast Products

Tanks\Water Quality Inlet\Examples\5000 Gal HS20 Water Quality Unit (Opt3) (v)





Liquid Level:
Compartment "A"
10.5' x 9.0' = 709 Gals/VF
@4.58' = **3,247 Gals**
Compartment "C"
2.5' x 9.00' = 168.75 Gals/VF
@4.58'= **773 Gals**

Compartment "B"
3.0' x 9.0' = 202.5 Gals/VF
@4.58'= **927 Gals**

12" Invert Inlet: 63"
12" Invert Outlet: 63"

Volume of compartment 1 & 2:
WQI Stds. 400 cubic feet treats 1 acres of impervious
This unit provides 3,247 gal + 927 gal = 4,174 gal or 558 cubic feet
System able to treat 558 ft3 * 1 ac. / 400 ft3 = 1.395 ac.
1.338 ac. of impervious directed to unit

General Notes
1. Concrete: fc = 5,000 psi @ 28 Days Minimum Type III Cement
2. Steel Reinforcement Conforms to Latest ASTM Specifications: ASTM-A615 Grade 60 Black Deformed Bars
3. Design Loading: AASHTO-HS20-44
   Design Specified as ACI 318-08, AASHTO-1992
4. Butyl Rubber Joint Sealant Provided
5. Flexible Sleeves Available for Pipe Connections
6. Pipe Sizes and Compartment Configurations per Job Specifications

Total Capacity: 4,947 Gallons

Phoenix Precast Products	5,000 Gallon HS-20 3 Comp Water Quality Unit Option 3

Phoenix Precast Products

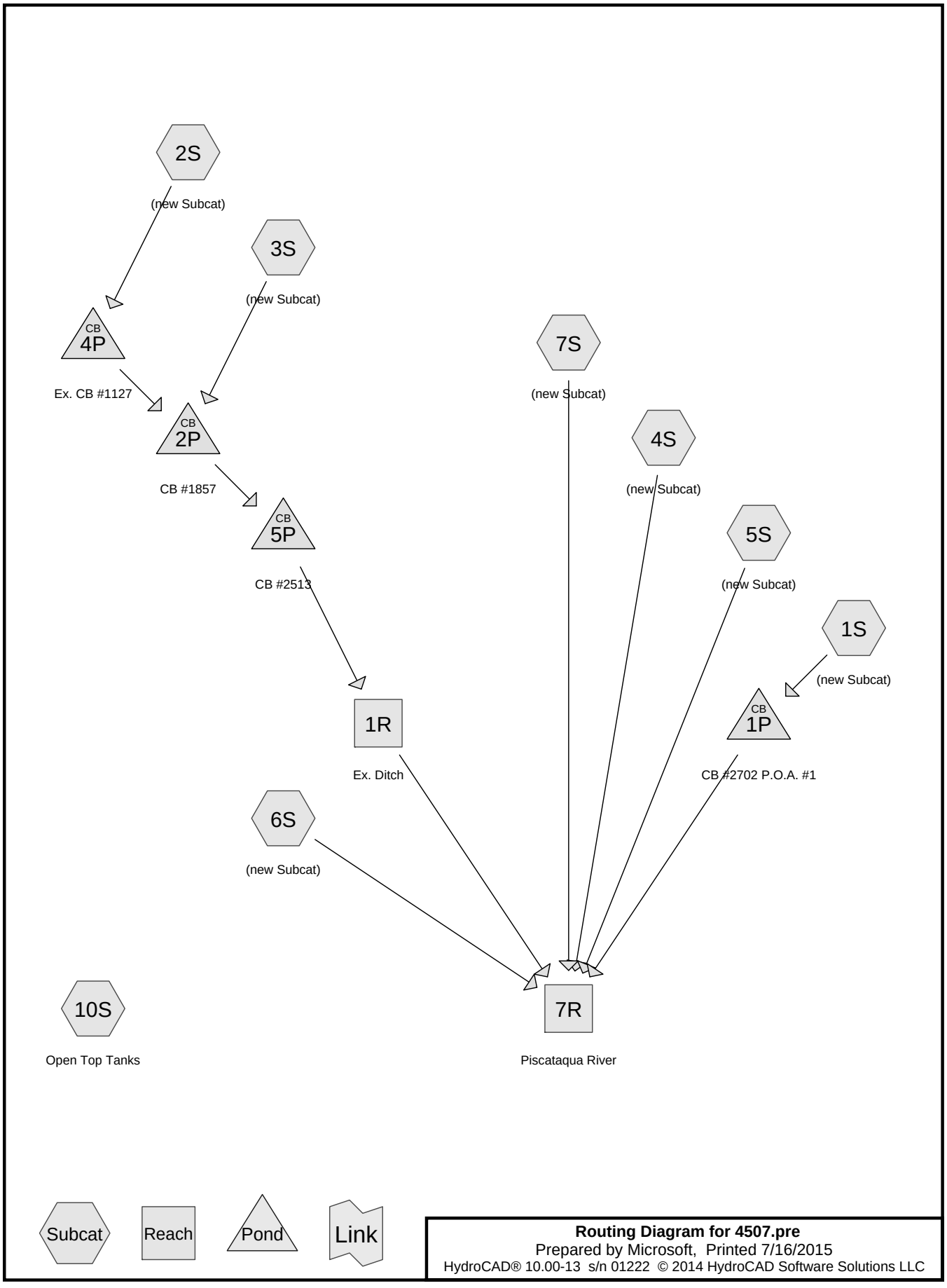
10Jan14_Rev0 ews

77 Regional Drive Concord, NH 03301

APPENDIX A:

SUPPORTING CALCULATIONS

PRE-DEVELOPMENT CALCULATIONS



Routing Diagram for 4507.pre
Prepared by Microsoft, Printed 7/16/2015
HydroCAD® 10.00-13 s/n 01222 © 2014 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.463	61	>75% Grass cover, Good, HSG B (1S, 2S, 3S, 4S, 5S, 6S, 7S)
0.052	74	>75% Grass cover, Good, HSG C (1S)
1.982	98	Paved parking, HSG B (1S, 2S, 3S, 4S, 5S, 6S, 7S)
0.268	98	Water Surface, HSG B (10S)
3.764	**83**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.712	HSG B	1S, 2S, 3S, 4S, 5S, 6S, 7S, 10S
0.052	HSG C	1S
0.000	HSG D	
0.000	Other	
3.764		**TOTAL AREA**

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (new Subcat) Runoff Area=39,754 sf 63.90% Impervious Runoff Depth=1.77"
Flow Length=249' Tc=6.0 min CN=85 Runoff=1.89 cfs 0.134 af

Subcatchment 2S: (new Subcat) Runoff Area=9,178 sf 46.22% Impervious Runoff Depth=1.28"
Flow Length=210' Tc=6.0 min CN=78 Runoff=0.31 cfs 0.022 af

Subcatchment 3S: (new Subcat) Runoff Area=35,036 sf 65.55% Impervious Runoff Depth=1.77"
Flow Length=340' Tc=6.0 min CN=85 Runoff=1.67 cfs 0.118 af

Subcatchment 4S: (new Subcat) Runoff Area=25,809 sf 54.79% Impervious Runoff Depth=1.48"
Flow Length=100' Slope=0.1400 '/' Tc=6.0 min CN=81 Runoff=1.02 cfs 0.073 af

Subcatchment 5S: (new Subcat) Runoff Area=15,181 sf 49.81% Impervious Runoff Depth=1.34"
Flow Length=40' Slope=0.1200 '/' Tc=6.0 min CN=79 Runoff=0.54 cfs 0.039 af

Subcatchment 6S: (new Subcat) Runoff Area=23,060 sf 41.87% Impervious Runoff Depth=1.16"
Flow Length=90' Slope=0.0300 '/' Tc=6.0 min CN=76 Runoff=0.70 cfs 0.051 af

Subcatchment 7S: (new Subcat) Runoff Area=4,275 sf 55.11% Impervious Runoff Depth=1.48"
Flow Length=90' Slope=0.0300 '/' Tc=6.0 min CN=81 Runoff=0.17 cfs 0.012 af

Subcatchment 10S: Open Top Tanks Runoff Area=11,657 sf 100.00% Impervious Runoff Depth=2.98"
Tc=0.0 min CN=98 Runoff=1.02 cfs 0.066 af

Reach 1R: Ex. Ditch Avg. Flow Depth=0.83' Max Vel=1.03 fps Inflow=1.98 cfs 0.141 af
n=0.040 L=50.0' S=0.0020 '/' Capacity=19.05 cfs Outflow=1.96 cfs 0.141 af

Reach 7R: Piscataqua River Inflow=6.27 cfs 0.450 af
Outflow=6.27 cfs 0.450 af

Pond 1P: CB #2702 P.O.A. #1 Peak Elev=12.76' Inflow=1.89 cfs 0.134 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=1.89 cfs 0.134 af

Pond 2P: CB #1857 Peak Elev=20.86' Inflow=1.98 cfs 0.141 af
12.0" Round Culvert n=0.013 L=82.0' S=0.1290 '/' Outflow=1.98 cfs 0.141 af

Pond 4P: Ex. CB #1127 Peak Elev=21.19' Inflow=0.31 cfs 0.022 af
12.0" Round Culvert n=0.012 L=148.0' S=0.0090 '/' Outflow=0.31 cfs 0.022 af

Pond 5P: CB #2513 Peak Elev=10.22' Inflow=1.98 cfs 0.141 af
15.0" Round Culvert n=0.012 L=11.0' S=0.0091 '/' Outflow=1.98 cfs 0.141 af

Total Runoff Area = 3.764 ac Runoff Volume = 0.517 af Average Runoff Depth = 1.65"
40.24% Pervious = 1.514 ac 59.76% Impervious = 2.249 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (new Subcat) Runoff Area=39,754 sf 63.90% Impervious Runoff Depth=3.25"
Flow Length=249' Tc=6.0 min CN=85 Runoff=3.44 cfs 0.247 af

Subcatchment 2S: (new Subcat) Runoff Area=9,178 sf 46.22% Impervious Runoff Depth=2.60"
Flow Length=210' Tc=6.0 min CN=78 Runoff=0.64 cfs 0.046 af

Subcatchment 3S: (new Subcat) Runoff Area=35,036 sf 65.55% Impervious Runoff Depth=3.25"
Flow Length=340' Tc=6.0 min CN=85 Runoff=3.04 cfs 0.218 af

Subcatchment 4S: (new Subcat) Runoff Area=25,809 sf 54.79% Impervious Runoff Depth=2.87"
Flow Length=100' Slope=0.1400 '/' Tc=6.0 min CN=81 Runoff=1.99 cfs 0.142 af

Subcatchment 5S: (new Subcat) Runoff Area=15,181 sf 49.81% Impervious Runoff Depth=2.69"
Flow Length=40' Slope=0.1200 '/' Tc=6.0 min CN=79 Runoff=1.10 cfs 0.078 af

Subcatchment 6S: (new Subcat) Runoff Area=23,060 sf 41.87% Impervious Runoff Depth=2.43"
Flow Length=90' Slope=0.0300 '/' Tc=6.0 min CN=76 Runoff=1.51 cfs 0.107 af

Subcatchment 7S: (new Subcat) Runoff Area=4,275 sf 55.11% Impervious Runoff Depth=2.87"
Flow Length=90' Slope=0.0300 '/' Tc=6.0 min CN=81 Runoff=0.33 cfs 0.023 af

Subcatchment 10S: Open Top Tanks Runoff Area=11,657 sf 100.00% Impervious Runoff Depth=4.63"
Tc=0.0 min CN=98 Runoff=1.55 cfs 0.103 af

Reach 1R: Ex. Ditch Avg. Flow Depth=1.12' Max Vel=1.22 fps Inflow=3.68 cfs 0.263 af
n=0.040 L=50.0' S=0.0020 '/' Capacity=19.05 cfs Outflow=3.66 cfs 0.263 af

Reach 7R: Piscataqua River Inflow=12.02 cfs 0.861 af
Outflow=12.02 cfs 0.861 af

Pond 1P: CB #2702 P.O.A. #1 Peak Elev=13.39' Inflow=3.44 cfs 0.247 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=3.44 cfs 0.247 af

Pond 2P: CB #1857 Peak Elev=21.53' Inflow=3.68 cfs 0.263 af
12.0" Round Culvert n=0.013 L=82.0' S=0.1290 '/' Outflow=3.68 cfs 0.263 af

Pond 4P: Ex. CB #1127 Peak Elev=21.64' Inflow=0.64 cfs 0.046 af
12.0" Round Culvert n=0.012 L=148.0' S=0.0090 '/' Outflow=0.64 cfs 0.046 af

Pond 5P: CB #2513 Peak Elev=10.61' Inflow=3.68 cfs 0.263 af
15.0" Round Culvert n=0.012 L=11.0' S=0.0091 '/' Outflow=3.68 cfs 0.263 af

Total Runoff Area = 3.764 ac Runoff Volume = 0.964 af Average Runoff Depth = 3.07"
40.24% Pervious = 1.514 ac 59.76% Impervious = 2.249 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (new Subcat) Runoff Area=39,754 sf 63.90% Impervious Runoff Depth=4.46"
Flow Length=249' Tc=6.0 min CN=85 Runoff=4.68 cfs 0.339 af

Subcatchment 2S: (new Subcat) Runoff Area=9,178 sf 46.22% Impervious Runoff Depth=3.73"
Flow Length=210' Tc=6.0 min CN=78 Runoff=0.92 cfs 0.065 af

Subcatchment 3S: (new Subcat) Runoff Area=35,036 sf 65.55% Impervious Runoff Depth=4.46"
Flow Length=340' Tc=6.0 min CN=85 Runoff=4.12 cfs 0.299 af

Subcatchment 4S: (new Subcat) Runoff Area=25,809 sf 54.79% Impervious Runoff Depth=4.04"
Flow Length=100' Slope=0.1400 '/' Tc=6.0 min CN=81 Runoff=2.79 cfs 0.199 af

Subcatchment 5S: (new Subcat) Runoff Area=15,181 sf 49.81% Impervious Runoff Depth=3.83"
Flow Length=40' Slope=0.1200 '/' Tc=6.0 min CN=79 Runoff=1.56 cfs 0.111 af

Subcatchment 6S: (new Subcat) Runoff Area=23,060 sf 41.87% Impervious Runoff Depth=3.53"
Flow Length=90' Slope=0.0300 '/' Tc=6.0 min CN=76 Runoff=2.19 cfs 0.156 af

Subcatchment 7S: (new Subcat) Runoff Area=4,275 sf 55.11% Impervious Runoff Depth=4.04"
Flow Length=90' Slope=0.0300 '/' Tc=6.0 min CN=81 Runoff=0.46 cfs 0.033 af

Subcatchment 10S: Open Top Tanks Runoff Area=11,657 sf 100.00% Impervious Runoff Depth=5.93"
Tc=0.0 min CN=98 Runoff=1.97 cfs 0.132 af

Reach 1R: Ex. Ditch Avg. Flow Depth=1.30' Max Vel=1.33 fps Inflow=5.04 cfs 0.365 af
n=0.040 L=50.0' S=0.0020 '/' Capacity=19.05 cfs Outflow=5.02 cfs 0.365 af

Reach 7R: Piscataqua River Inflow=16.68 cfs 1.203 af
Outflow=16.68 cfs 1.203 af

Pond 1P: CB #2702 P.O.A. #1 Peak Elev=14.56' Inflow=4.68 cfs 0.339 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=4.68 cfs 0.339 af

Pond 2P: CB #1857 Peak Elev=22.36' Inflow=5.04 cfs 0.365 af
12.0" Round Culvert n=0.013 L=82.0' S=0.1290 '/' Outflow=5.04 cfs 0.365 af

Pond 4P: Ex. CB #1127 Peak Elev=22.47' Inflow=0.92 cfs 0.065 af
12.0" Round Culvert n=0.012 L=148.0' S=0.0090 '/' Outflow=0.92 cfs 0.065 af

Pond 5P: CB #2513 Peak Elev=11.12' Inflow=5.04 cfs 0.365 af
15.0" Round Culvert n=0.012 L=11.0' S=0.0091 '/' Outflow=5.04 cfs 0.365 af

Total Runoff Area = 3.764 ac Runoff Volume = 1.336 af Average Runoff Depth = 4.26"
40.24% Pervious = 1.514 ac 59.76% Impervious = 2.249 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (new Subcat) Runoff Area=39,754 sf 63.90% Impervious Runoff Depth=5.63"
Flow Length=249' Tc=6.0 min CN=85 Runoff=5.83 cfs 0.428 af

Subcatchment 2S: (new Subcat) Runoff Area=9,178 sf 46.22% Impervious Runoff Depth=4.83"
Flow Length=210' Tc=6.0 min CN=78 Runoff=1.19 cfs 0.085 af

Subcatchment 3S: (new Subcat) Runoff Area=35,036 sf 65.55% Impervious Runoff Depth=5.63"
Flow Length=340' Tc=6.0 min CN=85 Runoff=5.14 cfs 0.377 af

Subcatchment 4S: (new Subcat) Runoff Area=25,809 sf 54.79% Impervious Runoff Depth=5.17"
Flow Length=100' Slope=0.1400 '/' Tc=6.0 min CN=81 Runoff=3.54 cfs 0.255 af

Subcatchment 5S: (new Subcat) Runoff Area=15,181 sf 49.81% Impervious Runoff Depth=4.94"
Flow Length=40' Slope=0.1200 '/' Tc=6.0 min CN=79 Runoff=2.00 cfs 0.144 af

Subcatchment 6S: (new Subcat) Runoff Area=23,060 sf 41.87% Impervious Runoff Depth=4.61"
Flow Length=90' Slope=0.0300 '/' Tc=6.0 min CN=76 Runoff=2.85 cfs 0.203 af

Subcatchment 7S: (new Subcat) Runoff Area=4,275 sf 55.11% Impervious Runoff Depth=5.17"
Flow Length=90' Slope=0.0300 '/' Tc=6.0 min CN=81 Runoff=0.59 cfs 0.042 af

Subcatchment 10S: Open Top Tanks Runoff Area=11,657 sf 100.00% Impervious Runoff Depth=7.15"
Tc=0.0 min CN=98 Runoff=2.37 cfs 0.159 af

Reach 1R: Ex. Ditch Avg. Flow Depth=1.45' Max Vel=1.42 fps Inflow=6.33 cfs 0.462 af
n=0.040 L=50.0' S=0.0020 '/' Capacity=19.05 cfs Outflow=6.30 cfs 0.462 af

Reach 7R: Piscataqua River Inflow=21.09 cfs 1.534 af
Outflow=21.09 cfs 1.534 af

Pond 1P: CB #2702 P.O.A. #1 Peak Elev=15.97' Inflow=5.83 cfs 0.428 af
12.0" Round Culvert n=0.013 L=100.0' S=0.0100 '/' Outflow=5.83 cfs 0.428 af

Pond 2P: CB #1857 Peak Elev=23.38' Inflow=6.33 cfs 0.462 af
12.0" Round Culvert n=0.013 L=82.0' S=0.1290 '/' Outflow=6.33 cfs 0.462 af

Pond 4P: Ex. CB #1127 Peak Elev=23.57' Inflow=1.19 cfs 0.085 af
12.0" Round Culvert n=0.012 L=148.0' S=0.0090 '/' Outflow=1.19 cfs 0.085 af

Pond 5P: CB #2513 Peak Elev=11.69' Inflow=6.33 cfs 0.462 af
15.0" Round Culvert n=0.012 L=11.0' S=0.0091 '/' Outflow=6.33 cfs 0.462 af

Total Runoff Area = 3.764 ac Runoff Volume = 1.693 af Average Runoff Depth = 5.40"
40.24% Pervious = 1.514 ac 59.76% Impervious = 2.249 ac

Summary for Subcatchment 1S: (new Subcat)

Runoff = 3.44 cfs @ 12.09 hrs, Volume= 0.247 af, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
25,403	98	Paved parking, HSG B
12,096	61	>75% Grass cover, Good, HSG B
2,255	74	>75% Grass cover, Good, HSG C
39,754	85	Weighted Average
14,351		36.10% Pervious Area
25,403		63.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	24	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.21"
0.9	225	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0	249	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 2S: (new Subcat)

Runoff = 0.64 cfs @ 12.09 hrs, Volume= 0.046 af, Depth= 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
4,242	98	Paved parking, HSG B
4,936	61	>75% Grass cover, Good, HSG B
9,178	78	Weighted Average
4,936		53.78% Pervious Area
4,242		46.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	20	0.0200	1.00		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.21"
0.5	80	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	110	0.0600	3.67		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	210	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 3S: (new Subcat)

Runoff = 3.04 cfs @ 12.09 hrs, Volume= 0.218 af, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
22,967	98	Paved parking, HSG B
12,069	61	>75% Grass cover, Good, HSG B
35,036	85	Weighted Average
12,069		34.45% Pervious Area
22,967		65.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	40	0.1500	0.32		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.21"
1.4	300	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.5	340	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 4S: (new Subcat)

Runoff = 1.99 cfs @ 12.09 hrs, Volume= 0.142 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
14,141	98	Paved parking, HSG B
11,668	61	>75% Grass cover, Good, HSG B
25,809	81	Weighted Average
11,668		45.21% Pervious Area
14,141		54.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	100	0.1400	0.37		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.21"
4.5	100	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 5S: (new Subcat)

Runoff = 1.10 cfs @ 12.09 hrs, Volume= 0.078 af, Depth= 2.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
7,562	98	Paved parking, HSG B
7,619	61	>75% Grass cover, Good, HSG B
15,181	79	Weighted Average
7,619		50.19% Pervious Area
7,562		49.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	40	0.1200	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.21"
2.3	40	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 6S: (new Subcat)

Runoff = 1.51 cfs @ 12.09 hrs, Volume= 0.107 af, Depth= 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
9,656	98	Paved parking, HSG B
13,404	61	>75% Grass cover, Good, HSG B
23,060	76	Weighted Average
13,404		58.13% Pervious Area
9,656		41.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	40	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.21"
0.3	50	0.0300	2.60		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
4.3	90	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 7S: (new Subcat)

Runoff = 0.33 cfs @ 12.09 hrs, Volume= 0.023 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
2,356	98	Paved parking, HSG B
1,919	61	>75% Grass cover, Good, HSG B
4,275	81	Weighted Average
1,919		44.89% Pervious Area
2,356		55.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	40	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.21"
0.3	50	0.0300	2.60		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
4.3	90	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment 10S: Open Top Tanks

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.55 cfs @ 12.00 hrs, Volume= 0.103 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
11,657	98	Water Surface, HSG B
11,657		100.00% Impervious Area

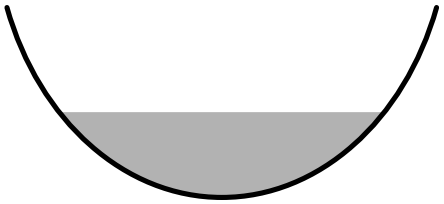
Summary for Reach 1R: Ex. Ditch

Inflow Area = 1.015 ac, 61.54% Impervious, Inflow Depth = 3.11" for 10-yr event
Inflow = 3.68 cfs @ 12.09 hrs, Volume= 0.263 af
Outflow = 3.66 cfs @ 12.10 hrs, Volume= 0.263 af, Atten= 1%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.22 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 2.0 min

Peak Storage= 150 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.12'
Bank-Full Depth= 2.50' Flow Area= 10.0 sf, Capacity= 19.05 cfs

6.00' x 2.50' deep Parabolic Channel, n= 0.040 Earth, cobble bottom, clean sides
Length= 50.0' Slope= 0.0020 '/'
Inlet Invert= 9.10', Outlet Invert= 9.00'



Summary for Reach 7R: Piscataqua River

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.496 ac, 56.68% Impervious, Inflow Depth = 2.95" for 10-yr event
Inflow = 12.02 cfs @ 12.09 hrs, Volume= 0.861 af
Outflow = 12.02 cfs @ 12.09 hrs, Volume= 0.861 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: CB #2702 P.O.A. #1

[57] Hint: Peaked at 13.39' (Flood elevation advised)

Inflow Area = 0.913 ac, 63.90% Impervious, Inflow Depth = 3.25" for 10-yr event
Inflow = 3.44 cfs @ 12.09 hrs, Volume= 0.247 af
Outflow = 3.44 cfs @ 12.09 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.0 min
Primary = 3.44 cfs @ 12.09 hrs, Volume= 0.247 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 13.39' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	12.00'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.00' / 11.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.44 cfs @ 12.09 hrs HW=13.38' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 3.44 cfs @ 4.38 fps)

Summary for Pond 2P: CB #1857

[57] Hint: Peaked at 21.53' (Flood elevation advised)

Inflow Area = 1.015 ac, 61.54% Impervious, Inflow Depth = 3.11" for 10-yr event
Inflow = 3.68 cfs @ 12.09 hrs, Volume= 0.263 af
Outflow = 3.68 cfs @ 12.09 hrs, Volume= 0.263 af, Atten= 0%, Lag= 0.0 min
Primary = 3.68 cfs @ 12.09 hrs, Volume= 0.263 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 21.53' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	20.08'	**12.0" Round Culvert** L= 82.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 20.08' / 9.50' S= 0.1290 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.67 cfs @ 12.09 hrs HW=21.52' TW=10.60' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.67 cfs @ 4.68 fps)

Summary for Pond 4P: Ex. CB #1127

[57] Hint: Peaked at 21.64' (Flood elevation advised)

Inflow Area = 0.211 ac, 46.22% Impervious, Inflow Depth = 2.60" for 10-yr event
Inflow = 0.64 cfs @ 12.09 hrs, Volume= 0.046 af
Outflow = 0.64 cfs @ 12.09 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min
Primary = 0.64 cfs @ 12.09 hrs, Volume= 0.046 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 21.64' @ 12.10 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	20.80'	**12.0" Round Culvert** L= 148.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 20.80' / 19.47' S= 0.0090 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=0.62 cfs @ 12.09 hrs HW=21.63' TW=21.52' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.62 cfs @ 1.20 fps)

Summary for Pond 5P: CB #2513

[57] Hint: Peaked at 10.61' (Flood elevation advised)

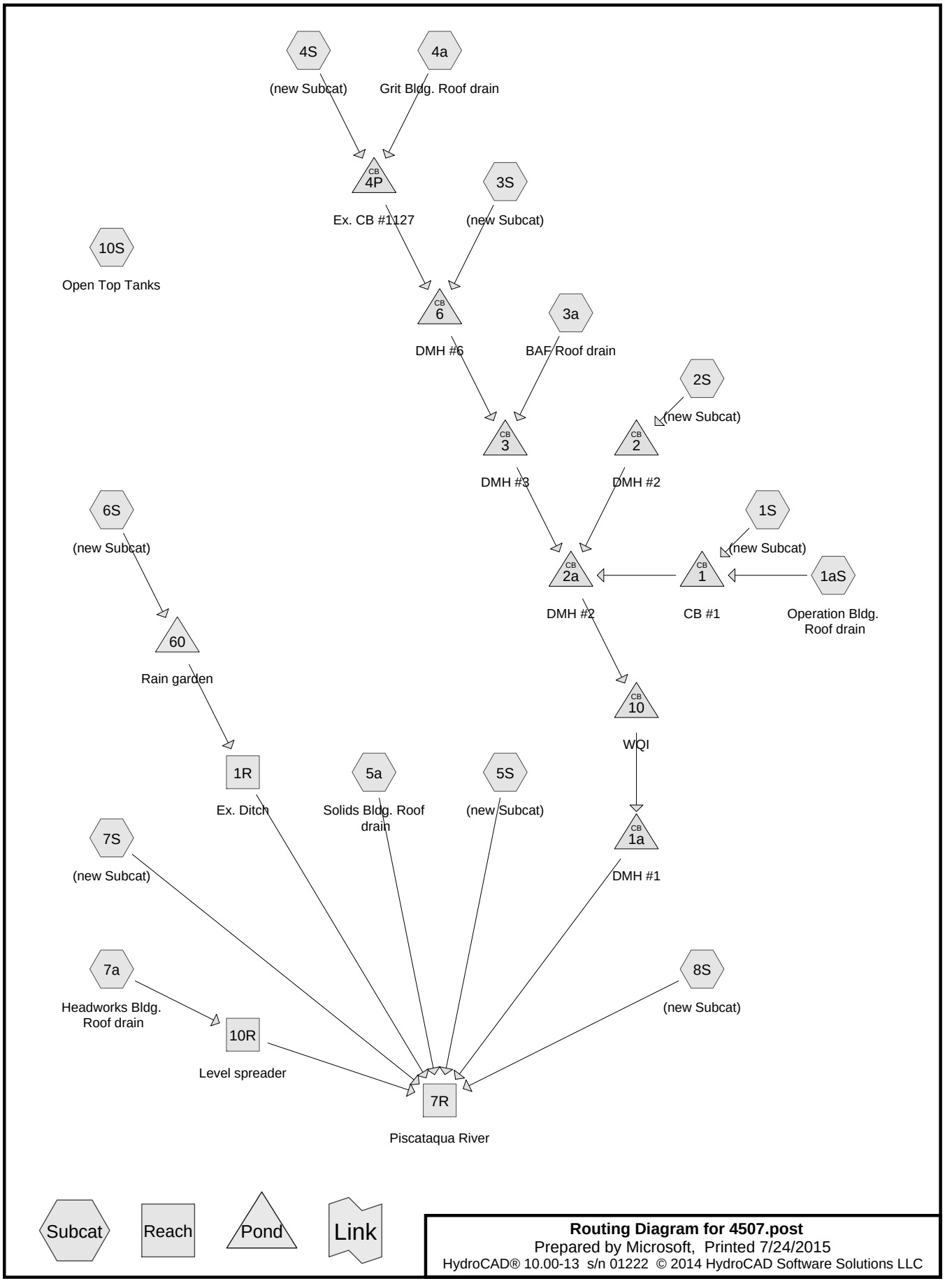
Inflow Area = 1.015 ac, 61.54% Impervious, Inflow Depth = 3.11" for 10-yr event
Inflow = 3.68 cfs @ 12.09 hrs, Volume= 0.263 af
Outflow = 3.68 cfs @ 12.09 hrs, Volume= 0.263 af, Atten= 0%, Lag= 0.0 min
Primary = 3.68 cfs @ 12.09 hrs, Volume= 0.263 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 10.61' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	9.40'	**15.0" Round Culvert** L= 11.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.40' / 9.30' S= 0.0091 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf

Primary OutFlow Max=3.62 cfs @ 12.09 hrs HW=10.60' TW=10.21' (Dynamic Tailwater)
1=Culvert (Inlet Controls 3.62 cfs @ 2.99 fps)

POST-DEVELOPMENT CALCULATIONS



Routing Diagram for 4507.post
Prepared by Microsoft, Printed 7/24/2015
HydroCAD® 10.00-13 s/n 01222 © 2014 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.974	61	>75% Grass cover, Good, HSG B (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S)
0.039	74	>75% Grass cover, Good, HSG C (1S)
1.628	98	Paved parking, HSG B (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S)
0.013	98	Paved parking, HSG C (1S)
0.495	98	Roofs, HSG B (1aS, 3a, 4a, 5a, 7a)
0.615	98	Water Surface, HSG B (10S)
3.764	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.712	HSG B	1aS, 1S, 2S, 3a, 3S, 4a, 4S, 5a, 5S, 6S, 7a, 7S, 8S, 10S
0.052	HSG C	1S
0.000	HSG D	
0.000	Other	
3.764		**TOTAL AREA**

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1aS: Operation Bldg. Roof Runoff Area=3,603 sf 100.00% Impervious Runoff Depth=2.98"
Tc=6.0 min CN=98 Runoff=0.26 cfs 0.021 af

Subcatchment 1S: (new Subcat) Runoff Area=26,534 sf 70.81% Impervious Runoff Depth=2.01"
Tc=6.0 min CN=88 Runoff=1.43 cfs 0.102 af

Subcatchment 2S: (new Subcat) Runoff Area=5,208 sf 80.61% Impervious Runoff Depth=2.27"
Tc=6.0 min CN=91 Runoff=0.31 cfs 0.023 af

Subcatchment 3a: BAF Roof drain Runoff Area=3,297 sf 100.00% Impervious Runoff Depth=2.98"
Tc=0.0 min CN=98 Runoff=0.29 cfs 0.019 af

Subcatchment 3S: (new Subcat) Runoff Area=27,106 sf 69.97% Impervious Runoff Depth=1.92"
Tc=6.0 min CN=87 Runoff=1.40 cfs 0.100 af

Subcatchment 4a: Grit Bldg. Roof drain Runoff Area=2,255 sf 100.00% Impervious Runoff Depth=2.98"
Tc=6.0 min CN=98 Runoff=0.16 cfs 0.013 af

Subcatchment 4S: (new Subcat) Runoff Area=10,184 sf 70.19% Impervious Runoff Depth=1.92"
Tc=6.0 min CN=87 Runoff=0.53 cfs 0.037 af

Subcatchment 5a: Solids Bldg. Roof drain Runoff Area=9,405 sf 100.00% Impervious Runoff Depth=2.98"
Tc=0.0 min CN=98 Runoff=0.82 cfs 0.054 af

Subcatchment 5S: (new Subcat) Runoff Area=30,051 sf 40.19% Impervious Runoff Depth=1.16"
Tc=6.0 min CN=76 Runoff=0.91 cfs 0.067 af

Subcatchment 6S: (new Subcat) Runoff Area=7,825 sf 76.65% Impervious Runoff Depth=2.09"
Tc=6.0 min CN=89 Runoff=0.44 cfs 0.031 af

Subcatchment 7a: Headworks Bldg. Roof Runoff Area=2,986 sf 100.00% Impervious Runoff Depth=2.98"
Tc=6.0 min CN=98 Runoff=0.21 cfs 0.017 af

Subcatchment 7S: (new Subcat) Runoff Area=3,777 sf 30.45% Impervious Runoff Depth=0.94"
Tc=6.0 min CN=72 Runoff=0.09 cfs 0.007 af

Subcatchment 8S: (new Subcat) Runoff Area=4,912 sf 64.17% Impervious Runoff Depth=1.77"
Tc=6.0 min CN=85 Runoff=0.23 cfs 0.017 af

Subcatchment 10S: Open Top Tanks Runoff Area=26,807 sf 100.00% Impervious Runoff Depth=2.98"
Tc=0.0 min CN=98 Runoff=2.34 cfs 0.153 af

Reach 1R: Ex. Ditch Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.040 L=50.0' S=0.0020 '/' Capacity=19.05 cfs Outflow=0.00 cfs 0.000 af

Reach 7R: Piscataqua River Inflow=6.07 cfs 0.474 af
Outflow=6.07 cfs 0.474 af

Reach 10R: Level spreader Avg. Flow Depth=0.48' Max Vel=0.47 fps Inflow=0.21 cfs 0.017 af
n=0.040 L=20.0' S=0.0010 '/' Capacity=0.92 cfs Outflow=0.21 cfs 0.017 af

Pond 1: CB #1 Peak Elev=11.98' Inflow=1.69 cfs 0.122 af
12.0" Round Culvert n=0.013 L=24.0' S=0.0075 '/' Outflow=1.69 cfs 0.122 af

Pond 1a: DMH #1 Peak Elev=10.88' Inflow=4.23 cfs 0.314 af
21.0" Round Culvert n=0.011 L=18.0' S=0.0111 '/' Outflow=4.23 cfs 0.314 af

Pond 2: DMH #2 Peak Elev=11.81' Inflow=0.31 cfs 0.023 af
12.0" Round Culvert n=0.013 L=8.0' S=0.0162 '/' Outflow=0.31 cfs 0.023 af

Pond 2a: DMH #2 Peak Elev=11.79' Inflow=4.23 cfs 0.314 af
18.0" Round Culvert n=0.009 L=7.0' S=0.0043 '/' Outflow=4.23 cfs 0.314 af

Pond 3: DMH #3 Peak Elev=14.90' Inflow=2.23 cfs 0.169 af
15.0" Round Culvert n=0.013 L=59.0' S=0.0608 '/' Outflow=2.23 cfs 0.169 af

Pond 4P: Ex. CB #1127 Peak Elev=21.22' Inflow=0.69 cfs 0.050 af
12.0" Round Culvert n=0.012 L=220.0' S=0.0297 '/' Outflow=0.69 cfs 0.050 af

Pond 6: DMH #6 Peak Elev=15.27' Inflow=2.09 cfs 0.150 af
15.0" Round Culvert n=0.013 L=138.0' S=0.0228 '/' Outflow=2.09 cfs 0.150 af

Pond 10: WQI Peak Elev=11.51' Inflow=4.23 cfs 0.314 af
18.0" Round Culvert n=0.009 L=10.0' S=0.0040 '/' Outflow=4.23 cfs 0.314 af

Pond 60: Rain garden Peak Elev=29.74' Storage=559 cf Inflow=0.44 cfs 0.031 af
Discarded=0.04 cfs 0.031 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.031 af

Total Runoff Area = 3.764 ac Runoff Volume = 0.658 af Average Runoff Depth = 2.10"
26.91% Pervious = 1.013 ac 73.09% Impervious = 2.751 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1aS: Operation Bldg. Roof Runoff Area=3,603 sf 100.00% Impervious Runoff Depth=4.63"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment 1S: (new Subcat) Runoff Area=26,534 sf 70.81% Impervious Runoff Depth=3.55"
Tc=6.0 min CN=88 Runoff=2.48 cfs 0.180 af

Subcatchment 2S: (new Subcat) Runoff Area=5,208 sf 80.61% Impervious Runoff Depth=3.86"
Tc=6.0 min CN=91 Runoff=0.52 cfs 0.038 af

Subcatchment 3a: BAF Roof drain Runoff Area=3,297 sf 100.00% Impervious Runoff Depth=4.63"
Tc=0.0 min CN=98 Runoff=0.44 cfs 0.029 af

Subcatchment 3S: (new Subcat) Runoff Area=27,106 sf 69.97% Impervious Runoff Depth=3.45"
Tc=6.0 min CN=87 Runoff=2.47 cfs 0.179 af

Subcatchment 4a: Grit Bldg. Roof drain Runoff Area=2,255 sf 100.00% Impervious Runoff Depth=4.63"
Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af

Subcatchment 4S: (new Subcat) Runoff Area=10,184 sf 70.19% Impervious Runoff Depth=3.45"
Tc=6.0 min CN=87 Runoff=0.93 cfs 0.067 af

Subcatchment 5a: Solids Bldg. Roof drain Runoff Area=9,405 sf 100.00% Impervious Runoff Depth=4.63"
Tc=0.0 min CN=98 Runoff=1.25 cfs 0.083 af

Subcatchment 5S: (new Subcat) Runoff Area=30,051 sf 40.19% Impervious Runoff Depth=2.43"
Tc=6.0 min CN=76 Runoff=1.96 cfs 0.140 af

Subcatchment 6S: (new Subcat) Runoff Area=7,825 sf 76.65% Impervious Runoff Depth=3.65"
Tc=6.0 min CN=89 Runoff=0.75 cfs 0.055 af

Subcatchment 7a: Headworks Bldg. Roof Runoff Area=2,986 sf 100.00% Impervious Runoff Depth=4.63"
Tc=6.0 min CN=98 Runoff=0.33 cfs 0.026 af

Subcatchment 7S: (new Subcat) Runoff Area=3,777 sf 30.45% Impervious Runoff Depth=2.10"
Tc=6.0 min CN=72 Runoff=0.21 cfs 0.015 af

Subcatchment 8S: (new Subcat) Runoff Area=4,912 sf 64.17% Impervious Runoff Depth=3.25"
Tc=6.0 min CN=85 Runoff=0.43 cfs 0.031 af

Subcatchment 10S: Open Top Tanks Runoff Area=26,807 sf 100.00% Impervious Runoff Depth=4.63"
Tc=0.0 min CN=98 Runoff=3.58 cfs 0.238 af

Reach 1R: Ex. Ditch Avg. Flow Depth=0.42' Max Vel=0.68 fps Inflow=0.48 cfs 0.014 af
n=0.040 L=50.0' S=0.0020 '/' Capacity=19.05 cfs Outflow=0.47 cfs 0.014 af

Reach 7R: Piscataqua River Inflow=10.80 cfs 0.855 af
Outflow=10.80 cfs 0.855 af

Reach 10R: Level spreader Avg. Flow Depth=0.60' Max Vel=0.53 fps Inflow=0.33 cfs 0.026 af
n=0.040 L=20.0' S=0.0010 '/' Capacity=0.92 cfs Outflow=0.33 cfs 0.026 af

Pond 1: CB #1 Peak Elev=13.33' Inflow=2.87 cfs 0.212 af
12.0" Round Culvert n=0.013 L=24.0' S=0.0075 '/' Outflow=2.87 cfs 0.212 af

Pond 1a: DMH #1 Peak Elev=11.29' Inflow=7.25 cfs 0.545 af
21.0" Round Culvert n=0.011 L=18.0' S=0.0111 '/' Outflow=7.25 cfs 0.545 af

Pond 2: DMH #2 Peak Elev=12.78' Inflow=0.52 cfs 0.038 af
12.0" Round Culvert n=0.013 L=8.0' S=0.0162 '/' Outflow=0.52 cfs 0.038 af

Pond 2a: DMH #2 Peak Elev=12.76' Inflow=7.25 cfs 0.545 af
18.0" Round Culvert n=0.009 L=7.0' S=0.0043 '/' Outflow=7.25 cfs 0.545 af

Pond 3: DMH #3 Peak Elev=15.22' Inflow=3.87 cfs 0.295 af
15.0" Round Culvert n=0.013 L=59.0' S=0.0608 '/' Outflow=3.87 cfs 0.295 af

Pond 4P: Ex. CB #1127 Peak Elev=21.37' Inflow=1.17 cfs 0.087 af
12.0" Round Culvert n=0.012 L=220.0' S=0.0297 '/' Outflow=1.17 cfs 0.087 af

Pond 6: DMH #6 Peak Elev=15.87' Inflow=3.65 cfs 0.266 af
15.0" Round Culvert n=0.013 L=138.0' S=0.0228 '/' Outflow=3.65 cfs 0.266 af

Pond 10: WQI Peak Elev=12.04' Inflow=7.25 cfs 0.545 af
18.0" Round Culvert n=0.009 L=10.0' S=0.0040 '/' Outflow=7.25 cfs 0.545 af

Pond 60: Rain garden Peak Elev=29.92' Storage=652 cf Inflow=0.75 cfs 0.055 af
Discarded=0.04 cfs 0.041 af Primary=0.48 cfs 0.014 af Outflow=0.53 cfs 0.055 af

Total Runoff Area = 3.764 ac Runoff Volume = 1.133 af Average Runoff Depth = 3.61"
26.91% Pervious = 1.013 ac 73.09% Impervious = 2.751 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1aS: Operation Bldg. Roof Runoff Area=3,603 sf 100.00% Impervious Runoff Depth=5.93"
Tc=6.0 min CN=98 Runoff=0.50 cfs 0.041 af

Subcatchment 1S: (new Subcat) Runoff Area=26,534 sf 70.81% Impervious Runoff Depth=4.79"
Tc=6.0 min CN=88 Runoff=3.30 cfs 0.243 af

Subcatchment 2S: (new Subcat) Runoff Area=5,208 sf 80.61% Impervious Runoff Depth=5.12"
Tc=6.0 min CN=91 Runoff=0.68 cfs 0.051 af

Subcatchment 3a: BAF Roof drain Runoff Area=3,297 sf 100.00% Impervious Runoff Depth=5.93"
Tc=0.0 min CN=98 Runoff=0.56 cfs 0.037 af

Subcatchment 3S: (new Subcat) Runoff Area=27,106 sf 69.97% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=87 Runoff=3.31 cfs 0.243 af

Subcatchment 4a: Grit Bldg. Roof drain Runoff Area=2,255 sf 100.00% Impervious Runoff Depth=5.93"
Tc=6.0 min CN=98 Runoff=0.31 cfs 0.026 af

Subcatchment 4S: (new Subcat) Runoff Area=10,184 sf 70.19% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=87 Runoff=1.24 cfs 0.091 af

Subcatchment 5a: Solids Bldg. Roof drain Runoff Area=9,405 sf 100.00% Impervious Runoff Depth=5.93"
Tc=0.0 min CN=98 Runoff=1.59 cfs 0.107 af

Subcatchment 5S: (new Subcat) Runoff Area=30,051 sf 40.19% Impervious Runoff Depth=3.53"
Tc=6.0 min CN=76 Runoff=2.85 cfs 0.203 af

Subcatchment 6S: (new Subcat) Runoff Area=7,825 sf 76.65% Impervious Runoff Depth=4.90"
Tc=6.0 min CN=89 Runoff=0.99 cfs 0.073 af

Subcatchment 7a: Headworks Bldg. Roof Runoff Area=2,986 sf 100.00% Impervious Runoff Depth=5.93"
Tc=6.0 min CN=98 Runoff=0.41 cfs 0.034 af

Subcatchment 7S: (new Subcat) Runoff Area=3,777 sf 30.45% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=72 Runoff=0.32 cfs 0.023 af

Subcatchment 8S: (new Subcat) Runoff Area=4,912 sf 64.17% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=85 Runoff=0.58 cfs 0.042 af

Subcatchment 10S: Open Top Tanks Runoff Area=26,807 sf 100.00% Impervious Runoff Depth=5.93"
Tc=0.0 min CN=98 Runoff=4.54 cfs 0.304 af

Reach 1R: Ex. Ditch Avg. Flow Depth=0.56' Max Vel=0.81 fps Inflow=0.85 cfs 0.027 af
n=0.040 L=50.0' S=0.0020 '/' Capacity=19.05 cfs Outflow=0.85 cfs 0.027 af

Reach 7R: Piscataqua River Inflow=15.29 cfs 1.167 af
Outflow=15.29 cfs 1.167 af

Reach 10R: Level spreader Avg. Flow Depth=0.67' Max Vel=0.56 fps Inflow=0.41 cfs 0.034 af
n=0.040 L=20.0' S=0.0010 '/' Capacity=0.92 cfs Outflow=0.41 cfs 0.034 af

Pond 1: CB #1 Peak Elev=15.11' Inflow=3.80 cfs 0.284 af
12.0" Round Culvert n=0.013 L=24.0' S=0.0075 '/' Outflow=3.80 cfs 0.284 af

Pond 1a: DMH #1 Peak Elev=11.60' Inflow=9.62 cfs 0.732 af
21.0" Round Culvert n=0.011 L=18.0' S=0.0111 '/' Outflow=9.62 cfs 0.732 af

Pond 2: DMH #2 Peak Elev=14.16' Inflow=0.68 cfs 0.051 af
12.0" Round Culvert n=0.013 L=8.0' S=0.0162 '/' Outflow=0.68 cfs 0.051 af

Pond 2a: DMH #2 Peak Elev=14.13' Inflow=9.62 cfs 0.732 af
18.0" Round Culvert n=0.009 L=7.0' S=0.0043 '/' Outflow=9.62 cfs 0.732 af

Pond 3: DMH #3 Peak Elev=15.54' Inflow=5.15 cfs 0.397 af
15.0" Round Culvert n=0.013 L=59.0' S=0.0608 '/' Outflow=5.15 cfs 0.397 af

Pond 4P: Ex. CB #1127 Peak Elev=21.47' Inflow=1.56 cfs 0.117 af
12.0" Round Culvert n=0.012 L=220.0' S=0.0297 '/' Outflow=1.56 cfs 0.117 af

Pond 6: DMH #6 Peak Elev=16.70' Inflow=4.87 cfs 0.359 af
15.0" Round Culvert n=0.013 L=138.0' S=0.0228 '/' Outflow=4.87 cfs 0.359 af

Pond 10: WQI Peak Elev=12.87' Inflow=9.62 cfs 0.732 af
18.0" Round Culvert n=0.009 L=10.0' S=0.0040 '/' Outflow=9.62 cfs 0.732 af

Pond 60: Rain garden Peak Elev=30.01' Storage=698 cf Inflow=0.99 cfs 0.073 af
Discarded=0.04 cfs 0.046 af Primary=0.85 cfs 0.027 af Outflow=0.90 cfs 0.073 af

Total Runoff Area = 3.764 ac Runoff Volume = 1.517 af Average Runoff Depth = 4.84"
26.91% Pervious = 1.013 ac 73.09% Impervious = 2.751 ac

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1aS: Operation Bldg. Roof Runoff Area=3,603 sf 100.00% Impervious Runoff Depth=7.15"
Tc=6.0 min CN=98 Runoff=0.60 cfs 0.049 af

Subcatchment 1S: (new Subcat) Runoff Area=26,534 sf 70.81% Impervious Runoff Depth=5.97"
Tc=6.0 min CN=88 Runoff=4.06 cfs 0.303 af

Subcatchment 2S: (new Subcat) Runoff Area=5,208 sf 80.61% Impervious Runoff Depth=6.32"
Tc=6.0 min CN=91 Runoff=0.83 cfs 0.063 af

Subcatchment 3a: BAF Roof drain Runoff Area=3,297 sf 100.00% Impervious Runoff Depth=7.15"
Tc=0.0 min CN=98 Runoff=0.67 cfs 0.045 af

Subcatchment 3S: (new Subcat) Runoff Area=27,106 sf 69.97% Impervious Runoff Depth=5.86"
Tc=6.0 min CN=87 Runoff=4.10 cfs 0.304 af

Subcatchment 4a: Grit Bldg. Roof drain Runoff Area=2,255 sf 100.00% Impervious Runoff Depth=7.15"
Tc=6.0 min CN=98 Runoff=0.38 cfs 0.031 af

Subcatchment 4S: (new Subcat) Runoff Area=10,184 sf 70.19% Impervious Runoff Depth=5.86"
Tc=6.0 min CN=87 Runoff=1.54 cfs 0.114 af

Subcatchment 5a: Solids Bldg. Roof drain Runoff Area=9,405 sf 100.00% Impervious Runoff Depth=7.15"
Tc=0.0 min CN=98 Runoff=1.91 cfs 0.129 af

Subcatchment 5S: (new Subcat) Runoff Area=30,051 sf 40.19% Impervious Runoff Depth=4.61"
Tc=6.0 min CN=76 Runoff=3.71 cfs 0.265 af

Subcatchment 6S: (new Subcat) Runoff Area=7,825 sf 76.65% Impervious Runoff Depth=6.09"
Tc=6.0 min CN=89 Runoff=1.21 cfs 0.091 af

Subcatchment 7a: Headworks Bldg. Roof Runoff Area=2,986 sf 100.00% Impervious Runoff Depth=7.15"
Tc=6.0 min CN=98 Runoff=0.50 cfs 0.041 af

Subcatchment 7S: (new Subcat) Runoff Area=3,777 sf 30.45% Impervious Runoff Depth=4.16"
Tc=6.0 min CN=72 Runoff=0.42 cfs 0.030 af

Subcatchment 8S: (new Subcat) Runoff Area=4,912 sf 64.17% Impervious Runoff Depth=5.63"
Tc=6.0 min CN=85 Runoff=0.72 cfs 0.053 af

Subcatchment 10S: Open Top Tanks Runoff Area=26,807 sf 100.00% Impervious Runoff Depth=7.15"
Tc=0.0 min CN=98 Runoff=5.44 cfs 0.367 af

Reach 1R: Ex. Ditch Avg. Flow Depth=0.59' Max Vel=0.84 fps Inflow=0.98 cfs 0.041 af
n=0.040 L=50.0' S=0.0020 '/' Capacity=19.05 cfs Outflow=0.97 cfs 0.041 af

Reach 7R: Piscataqua River Inflow=19.04 cfs 1.467 af
Outflow=19.04 cfs 1.467 af

Reach 10R: Level spreader Avg. Flow Depth=0.73' Max Vel=0.59 fps Inflow=0.50 cfs 0.041 af
n=0.040 L=20.0' S=0.0010 '/' Capacity=0.92 cfs Outflow=0.50 cfs 0.041 af

Pond 1: CB #1 Peak Elev=17.22' Inflow=4.66 cfs 0.352 af
12.0" Round Culvert n=0.013 L=24.0' S=0.0075 '/' Outflow=4.66 cfs 0.352 af

Pond 1a: DMH #1 Peak Elev=11.90' Inflow=11.84 cfs 0.909 af
21.0" Round Culvert n=0.011 L=18.0' S=0.0111 '/' Outflow=11.84 cfs 0.909 af

Pond 2: DMH #2 Peak Elev=15.78' Inflow=0.83 cfs 0.063 af
12.0" Round Culvert n=0.013 L=8.0' S=0.0162 '/' Outflow=0.83 cfs 0.063 af

Pond 2a: DMH #2 Peak Elev=15.74' Inflow=11.84 cfs 0.909 af
18.0" Round Culvert n=0.009 L=7.0' S=0.0043 '/' Outflow=11.84 cfs 0.909 af

Pond 3: DMH #3 Peak Elev=16.88' Inflow=6.35 cfs 0.494 af
15.0" Round Culvert n=0.013 L=59.0' S=0.0608 '/' Outflow=6.35 cfs 0.494 af

Pond 4P: Ex. CB #1127 Peak Elev=21.56' Inflow=1.91 cfs 0.145 af
12.0" Round Culvert n=0.012 L=220.0' S=0.0297 '/' Outflow=1.91 cfs 0.145 af

Pond 6: DMH #6 Peak Elev=18.55' Inflow=6.01 cfs 0.449 af
15.0" Round Culvert n=0.013 L=138.0' S=0.0228 '/' Outflow=6.01 cfs 0.449 af

Pond 10: WQI Peak Elev=13.83' Inflow=11.84 cfs 0.909 af
18.0" Round Culvert n=0.009 L=10.0' S=0.0040 '/' Outflow=11.84 cfs 0.909 af

Pond 60: Rain garden Peak Elev=30.09' Storage=751 cf Inflow=1.21 cfs 0.091 af
Discarded=0.05 cfs 0.051 af Primary=0.98 cfs 0.041 af Outflow=1.02 cfs 0.091 af

Total Runoff Area = 3.764 ac Runoff Volume = 1.884 af Average Runoff Depth = 6.01"
26.91% Pervious = 1.013 ac 73.09% Impervious = 2.751 ac

Summary for Subcatchment 1aS: Operation Bldg. Roof drain

Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
3,603	98	Roofs, HSG B
3,603		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 1S: (new Subcat)

Runoff = 2.48 cfs @ 12.09 hrs, Volume= 0.180 af, Depth= 3.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
18,214	98	Paved parking, HSG B
576	98	Paved parking, HSG C
6,065	61	>75% Grass cover, Good, HSG B
1,679	74	>75% Grass cover, Good, HSG C
26,534	88	Weighted Average
7,744		29.19% Pervious Area
18,790		70.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 2S: (new Subcat)

Runoff = 0.52 cfs @ 12.08 hrs, Volume= 0.038 af, Depth= 3.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
4,198	98	Paved parking, HSG B
1,010	61	>75% Grass cover, Good, HSG B
5,208	91	Weighted Average
1,010		19.39% Pervious Area
4,198		80.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 3a: BAF Roof drain

Runoff = 0.44 cfs @ 12.00 hrs, Volume= 0.029 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
3,297	98	Roofs, HSG B
3,297		100.00% Impervious Area

Summary for Subcatchment 3S: (new Subcat)

Runoff = 2.47 cfs @ 12.09 hrs, Volume= 0.179 af, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
18,965	98	Paved parking, HSG B
8,141	61	>75% Grass cover, Good, HSG B
27,106	87	Weighted Average
8,141		30.03% Pervious Area
18,965		69.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4a: Grit Bldg. Roof drain

Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
2,255	98	Roofs, HSG B
2,255		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 4S: (new Subcat)

Runoff = 0.93 cfs @ 12.09 hrs, Volume= 0.067 af, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
7,148	98	Paved parking, HSG B
3,036	61	>75% Grass cover, Good, HSG B
10,184	87	Weighted Average
3,036		29.81% Pervious Area
7,148		70.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 5a: Solids Bldg. Roof drain

Runoff = 1.25 cfs @ 12.00 hrs, Volume= 0.083 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
9,405	98	Roofs, HSG B
9,405		100.00% Impervious Area

Summary for Subcatchment 5S: (new Subcat)

Runoff = 1.96 cfs @ 12.09 hrs, Volume= 0.140 af, Depth= 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
12,076	98	Paved parking, HSG B
17,975	61	>75% Grass cover, Good, HSG B
30,051	76	Weighted Average
17,975		59.81% Pervious Area
12,076		40.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 6S: (new Subcat)

Runoff = 0.75 cfs @ 12.09 hrs, Volume= 0.055 af, Depth= 3.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
5,998	98	Paved parking, HSG B
1,827	61	>75% Grass cover, Good, HSG B
7,825	89	Weighted Average
1,827		23.35% Pervious Area
5,998		76.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7a: Headworks Bldg. Roof drain

Runoff = 0.33 cfs @ 12.08 hrs, Volume= 0.026 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
2,986	98	Roofs, HSG B
2,986		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 7S: (new Subcat)

Runoff = 0.21 cfs @ 12.09 hrs, Volume= 0.015 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
1,150	98	Paved parking, HSG B
2,627	61	>75% Grass cover, Good, HSG B
3,777	72	Weighted Average
2,627		69.55% Pervious Area
1,150		30.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 8S: (new Subcat)

Runoff = 0.43 cfs @ 12.09 hrs, Volume= 0.031 af, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
3,152	98	Paved parking, HSG B
1,760	61	>75% Grass cover, Good, HSG B
4,912	85	Weighted Average
1,760		35.83% Pervious Area
3,152		64.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment 10S: Open Top Tanks

Runoff = 3.58 cfs @ 12.00 hrs, Volume= 0.238 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
26,807	98	Water Surface, HSG B
26,807		100.00% Impervious Area

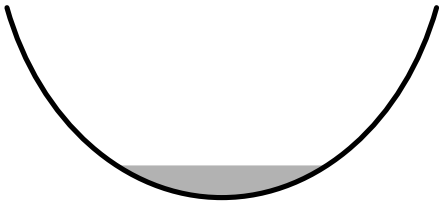
Summary for Reach 1R: Ex. Ditch

Inflow Area = 0.180 ac, 76.65% Impervious, Inflow Depth = 0.94" for 10-yr event
Inflow = 0.48 cfs @ 12.16 hrs, Volume= 0.014 af
Outflow = 0.47 cfs @ 12.18 hrs, Volume= 0.014 af, Atten= 3%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.68 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.27 fps, Avg. Travel Time= 3.0 min

Peak Storage= 34 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 2.50' Flow Area= 10.0 sf, Capacity= 19.05 cfs

6.00' x 2.50' deep Parabolic Channel, n= 0.040 Earth, cobble bottom, clean sides
Length= 50.0' Slope= 0.0020 '/'
Inlet Invert= 9.10', Outlet Invert= 9.00'



Summary for Reach 7R: Piscataqua River

Inflow Area = 3.148 ac, 67.83% Impervious, Inflow Depth = 3.26" for 10-yr event
Inflow = 10.80 cfs @ 12.08 hrs, Volume= 0.855 af
Outflow = 10.80 cfs @ 12.08 hrs, Volume= 0.855 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

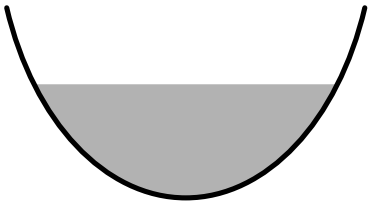
Summary for Reach 10R: Level spreader

Inflow Area = 0.069 ac,100.00% Impervious, Inflow Depth = 4.63" for 10-yr event
Inflow = 0.33 cfs @ 12.08 hrs, Volume= 0.026 af
Outflow = 0.33 cfs @ 12.09 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.53 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.18 fps, Avg. Travel Time= 1.8 min

Peak Storage= 12 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.00' Flow Area= 1.3 sf, Capacity= 0.92 cfs

2.00' x 1.00' deep Parabolic Channel, n= 0.040 Earth, cobble bottom, clean sides
Length= 20.0' Slope= 0.0010 '/'
Inlet Invert= 0.00', Outlet Invert= -0.02'



Summary for Pond 1: CB #1

Inflow Area = 0.692 ac, 74.30% Impervious, Inflow Depth = 3.68" for 10-yr event
Inflow = 2.87 cfs @ 12.09 hrs, Volume= 0.212 af
Outflow = 2.87 cfs @ 12.09 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.0 min
Primary = 2.87 cfs @ 12.09 hrs, Volume= 0.212 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 13.33' @ 12.09 hrs
Flood Elev= 13.75'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.75'	**12.0" Round Culvert** L= 24.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.75' / 10.57' S= 0.0075 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.79 cfs @ 12.09 hrs HW=13.30' TW=12.75' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 2.79 cfs @ 3.55 fps)

Summary for Pond 1a: DMH #1

Inflow Area = 1.795 ac, 74.51% Impervious, Inflow Depth = 3.65" for 10-yr event
Inflow = 7.25 cfs @ 12.08 hrs, Volume= 0.545 af
Outflow = 7.25 cfs @ 12.08 hrs, Volume= 0.545 af, Atten= 0%, Lag= 0.0 min
Primary = 7.25 cfs @ 12.08 hrs, Volume= 0.545 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 11.29' @ 12.08 hrs
Flood Elev= 14.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	9.85'	**21.0" Round Culvert** L= 18.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.85' / 9.65' S= 0.0111 '/' Cc= 0.900 n= 0.011 Concrete pipe, finished, Flow Area= 2.41 sf

Primary OutFlow Max=7.24 cfs @ 12.08 hrs HW=11.29' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Barrel Controls 7.24 cfs @ 4.65 fps)

Summary for Pond 2: DMH #2

Inflow Area = 0.120 ac, 80.61% Impervious, Inflow Depth = 3.86" for 10-yr event
Inflow = 0.52 cfs @ 12.08 hrs, Volume= 0.038 af
Outflow = 0.52 cfs @ 12.08 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min
Primary = 0.52 cfs @ 12.08 hrs, Volume= 0.038 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 12.78' @ 12.10 hrs
Flood Elev= 14.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	11.20'	**12.0" Round Culvert** L= 8.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 11.20' / 11.07' S= 0.0162 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.08 hrs HW=12.74' TW=12.75' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)

Summary for Pond 2a: DMH #2

Inflow Area = 1.795 ac, 74.51% Impervious, Inflow Depth = 3.65" for 10-yr event
Inflow = 7.25 cfs @ 12.08 hrs, Volume= 0.545 af
Outflow = 7.25 cfs @ 12.08 hrs, Volume= 0.545 af, Atten= 0%, Lag= 0.0 min
Primary = 7.25 cfs @ 12.08 hrs, Volume= 0.545 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 12.76' @ 12.09 hrs
Flood Elev= 14.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.47'	**18.0" Round Culvert** L= 7.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.47' / 10.44' S= 0.0043 '/' Cc= 0.900 n= 0.009 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=7.19 cfs @ 12.08 hrs HW=12.75' TW=12.04' (Dynamic Tailwater)
1=Culvert (Inlet Controls 7.19 cfs @ 4.07 fps)

Summary for Pond 3: DMH #3

Inflow Area = 0.984 ac, 73.91% Impervious, Inflow Depth = 3.60" for 10-yr event
Inflow = 3.87 cfs @ 12.08 hrs, Volume= 0.295 af
Outflow = 3.87 cfs @ 12.08 hrs, Volume= 0.295 af, Atten= 0%, Lag= 0.0 min
Primary = 3.87 cfs @ 12.08 hrs, Volume= 0.295 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 15.22' @ 12.08 hrs
Flood Elev= 17.85'

Device	Routing	Invert	Outlet Devices
#1	Primary	14.16'	**15.0" Round Culvert** L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 14.16' / 10.57' S= 0.0608 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.86 cfs @ 12.08 hrs HW=15.21' TW=12.75' (Dynamic Tailwater)
1=Culvert (Inlet Controls 3.86 cfs @ 3.50 fps)

Summary for Pond 4P: Ex. CB #1127

Inflow Area = 0.286 ac, 75.59% Impervious, Inflow Depth = 3.66" for 10-yr event
Inflow = 1.17 cfs @ 12.09 hrs, Volume= 0.087 af
Outflow = 1.17 cfs @ 12.09 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min
Primary = 1.17 cfs @ 12.09 hrs, Volume= 0.087 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 21.37' @ 12.09 hrs
Flood Elev= 26.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	20.80'	**12.0" Round Culvert** L= 220.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 20.80' / 14.26' S= 0.0297 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=1.17 cfs @ 12.09 hrs HW=21.37' TW=15.86' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 1.17 cfs @ 2.56 fps)

Summary for Pond 6: DMH #6

Inflow Area = 0.908 ac, 71.74% Impervious, Inflow Depth = 3.51" for 10-yr event
Inflow = 3.65 cfs @ 12.09 hrs, Volume= 0.266 af
Outflow = 3.65 cfs @ 12.09 hrs, Volume= 0.266 af, Atten= 0%, Lag= 0.0 min
Primary = 3.65 cfs @ 12.09 hrs, Volume= 0.266 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 15.87' @ 12.09 hrs
Flood Elev= 20.06'

Device	Routing	Invert	Outlet Devices
#1	Primary	14.16'	**15.0" Round Culvert** L= 138.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 14.16' / 11.02' S= 0.0228 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=3.64 cfs @ 12.09 hrs HW=15.86' TW=15.21' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 3.64 cfs @ 2.97 fps)

Summary for Pond 10: WQI

Inflow Area = 1.795 ac, 74.51% Impervious, Inflow Depth = 3.65" for 10-yr event
Inflow = 7.25 cfs @ 12.08 hrs, Volume= 0.545 af
Outflow = 7.25 cfs @ 12.08 hrs, Volume= 0.545 af, Atten= 0%, Lag= 0.0 min
Primary = 7.25 cfs @ 12.08 hrs, Volume= 0.545 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 12.04' @ 12.08 hrs
Flood Elev= 14.55'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.29'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.29' / 10.25' S= 0.0040 '/' Cc= 0.900 n= 0.009 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=7.24 cfs @ 12.08 hrs HW=12.04' TW=11.29' (Dynamic Tailwater)
└**1=Culvert** (Barrel Controls 7.24 cfs @ 4.42 fps)

Summary for Pond 60: Rain garden

Inflow Area = 0.180 ac, 76.65% Impervious, Inflow Depth = 3.65" for 10-yr event
Inflow = 0.75 cfs @ 12.09 hrs, Volume= 0.055 af
Outflow = 0.53 cfs @ 12.16 hrs, Volume= 0.055 af, Atten= 30%, Lag= 4.8 min
Discarded = 0.04 cfs @ 12.16 hrs, Volume= 0.041 af
Primary = 0.48 cfs @ 12.16 hrs, Volume= 0.014 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 29.92' @ 12.16 hrs Surf.Area= 594 sf Storage= 652 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 108.9 min (904.2 - 795.3)

Volume	Invert	Avail.Storage	Storage Description
#1	28.50'	1,025 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.50	320	0	0
29.00	410	183	183
30.00	610	510	693
30.50	720	333	1,025

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.50'	**3.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	29.75'	**8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	30.20'	**6.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.04 cfs @ 12.16 hrs HW=29.92' (Free Discharge)
└**1=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.48 cfs @ 12.16 hrs HW=29.92' TW=9.51' (Dynamic Tailwater)
├**2=Orifice/Grate** (Weir Controls 0.48 cfs @ 1.35 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

EROSION CONTROL CALCULATIONS

Portsmouth Wastewater Treatment Plant Upgrade
Riprap Stone Apron Sizing
10-Year Storm Event

Pond 1a (21" outfall)

La	Apron Length, Ft.	Calculated
Tw	**Tailwater, Ft.**	**0.4**
Q	**Flow, 10 Yr Storm, CFS**	**7.25**
D50	Median Stone Dia., Ft.	Calculated
D	Depth of Stone, In	Calculated
Do	**Pipe Diameter, Ft**	**1.75**
W1	Width @ Start, Ft.	Calculated
W2	Width @ End, Ft	Calculated
W	**Width of Channel**	**7**

W1:

3(Do)= 5.25 Ft.

Width @ Start: 5 Ft.

D50: $\frac{0.041(Q)^{4/3}}{Tw(Do)}$

D50= 0.82 Ft.

or 9.8 In.

Median Stone Size: 10 In.

D: 2.25*D50

Depth of Riprap: 22 In.

La: If Tw<= Do/2:

$La=1.8Q/Do^{3/2} + 7Do$

and W2=width of channel

or

W2=3Do+La

Do/2= 0.875 Ft.

Tw= 0.4 Ft.

If Tw>Do/2:

$La=3Q/Do^{3/2} + 7Do$

and W2=width of channel

or

W2=3Do+0.4La

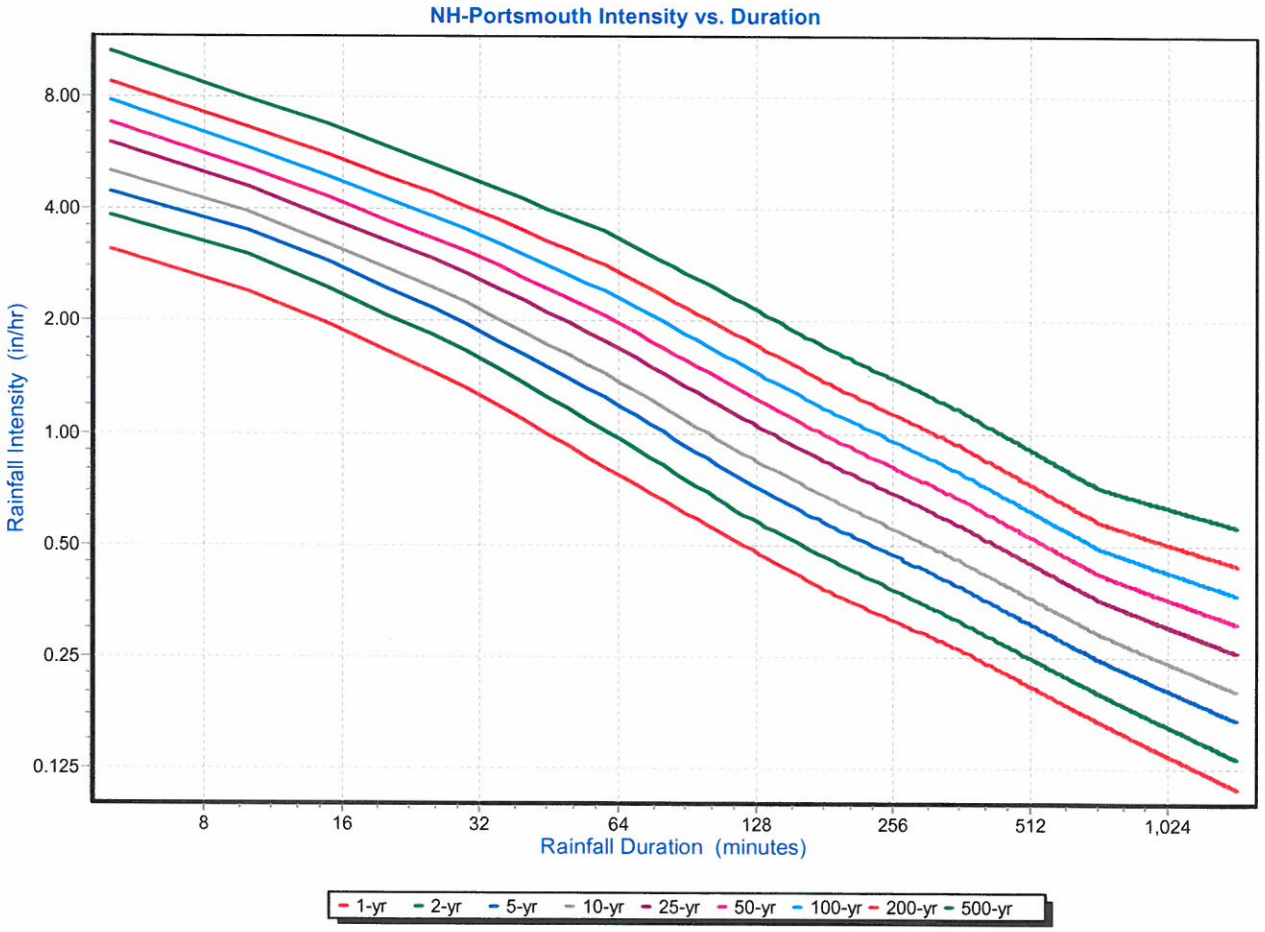
Length of Apron: 18 Ft.

Width @ End: 7 Ft.

APPENDIX B:

HYDROLOGICAL DATA

IDF Curve Report



NH-Portsmouth Intensity vs. Duration

Duration (minutes)	1-yr (in/hr)	2-yr (in/hr)	5-yr (in/hr)	10-yr (in/hr)	25-yr (in/hr)	50-yr (in/hr)	100-yr (in/hr)	200-yr (in/hr)	500-yr (in/hr)
5	**3.12**	**3.84**	**4.44**	**5.04**	**6.00**	**6.84**	**7.80**	**8.76**	**10.56**
10	2.40	3.00	3.48	3.90	4.56	5.16	5.82	6.60	7.86
15	1.96	2.44	2.88	3.20	3.76	4.28	4.88	5.60	6.72
20	1.66	2.08	2.45	2.76	3.28	3.73	4.26	4.90	5.88
25	1.46	1.84	2.17	2.46	2.95	3.36	3.84	4.42	5.31
30	1.32	1.66	1.96	2.24	2.70	3.08	3.52	4.06	4.88
35	1.18	1.49	1.77	2.03	2.46	2.82	3.24	3.74	4.53
40	1.08	1.36	1.63	1.87	2.27	2.61	3.01	3.49	4.24
45	0.99	1.25	1.51	1.74	2.11	2.44	2.83	3.28	4.00
50	0.92	1.16	1.41	1.63	1.98	2.30	2.67	3.10	3.80
55	0.86	1.08	1.32	1.53	1.87	2.18	2.54	2.95	3.63
60	0.81	1.02	1.25	1.45	1.77	2.07	2.42	2.82	3.48
65	0.77	0.96	1.18	1.37	1.67	1.96	2.29	2.68	3.31
70	0.73	0.91	1.12	1.30	1.59	1.86	2.18	2.55	3.16
75	0.69	0.86	1.06	1.23	1.52	1.78	2.09	2.44	3.02
80	0.66	0.82	1.01	1.18	1.45	1.70	2.00	2.34	2.90
85	0.64	0.78	0.97	1.13	1.39	1.63	1.92	2.25	2.79
90	0.61	0.75	0.93	1.08	1.34	1.57	1.85	2.17	2.69
95	0.59	0.72	0.89	1.04	1.29	1.51	1.78	2.09	2.60
100	0.57	0.69	0.86	1.00	1.24	1.46	1.72	2.03	2.52
105	0.55	0.67	0.83	0.97	1.20	1.41	1.67	1.96	2.44
110	0.53	0.65	0.80	0.94	1.16	1.37	1.62	1.90	2.37
115	0.52	0.62	0.77	0.91	1.13	1.33	1.57	1.85	2.30
120	0.50	0.61	0.75	0.88	1.09	1.29	1.53	1.80	2.24
125	0.49	0.59	0.73	0.86	1.07	1.26	1.48	1.75	2.18
130	0.47	0.57	0.71	0.84	1.04	1.23	1.45	1.71	2.12
135	0.46	0.56	0.69	0.82	1.02	1.20	1.41	1.67	2.07
140	0.45	0.55	0.68	0.80	0.99	1.17	1.38	1.63	2.02
145	0.44	0.54	0.66	0.78	0.97	1.14	1.35	1.59	1.98
150	0.43	0.52	0.65	0.76	0.95	1.12	1.32	1.56	1.93
155	0.42	0.51	0.64	0.75	0.93	1.09	1.29	1.52	1.89
160	0.41	0.50	0.62	0.73	0.91	1.07	1.26	1.49	1.85
165	0.40	0.49	0.61	0.72	0.89	1.05	1.24	1.46	1.81
170	0.39	0.48	0.60	0.71	0.87	1.03	1.21	1.43	1.78
175	0.39	0.48	0.59	0.69	0.86	1.01	1.19	1.41	1.75
180	0.38	0.47	0.58	0.68	0.84	0.99	1.17	1.38	1.71
185	0.37	0.46	0.57	0.67	0.83	0.98	1.15	1.36	1.69
190	0.37	0.45	0.56	0.66	0.82	0.96	1.13	1.34	1.66
195	0.36	0.45	0.55	0.65	0.80	0.95	1.12	1.32	1.64
200	0.36	0.44	0.54	0.64	0.79	0.93	1.10	1.30	1.61
205	0.35	0.43	0.54	0.63	0.78	0.92	1.09	1.28	1.59
210	0.35	0.43	0.53	0.62	0.77	0.91	1.07	1.26	1.57
215	0.35	0.42	0.52	0.61	0.76	0.90	1.06	1.24	1.55
220	0.34	0.42	0.51	0.60	0.75	0.88	1.04	1.23	1.53
225	0.34	0.41	0.51	0.60	0.74	0.87	1.03	1.21	1.51
230	0.33	0.40	0.50	0.59	0.73	0.86	1.02	1.20	1.49
235	0.33	0.40	0.49	0.58	0.72	0.85	1.00	1.18	1.47
240	0.33	0.39	0.49	0.57	0.71	0.84	0.99	1.17	1.45
245	0.32	0.39	0.48	0.57	0.70	0.83	0.98	1.15	1.43
250	0.32	0.39	0.48	0.56	0.70	0.82	0.97	1.14	1.42
255	0.32	0.38	0.47	0.55	0.69	0.81	0.96	1.13	1.40
260	0.31	0.38	0.47	0.55	0.68	0.80	0.95	1.12	1.39

APPENDIX C:

WATERSHED PLANS

MAP UNIT NO.	SOIL TAXONOMIC NAME	HYDROLOGICAL SOIL GROUP
42B	CANTON 3–8% SLOPE	B
83E	HOLLIS CANTON COMPLEX 25–50% SLOPE	C
444D	NEWFIELDS SERIES 15–25% SLOPE	B
656B/P	RIDGEBURY SERIES 3–8% SLOPE	B
597C/VP	WESTBROOK VARIANT 8–15% SLOPE	B
299A/ccaab	UDORTHENTS SMOOTH 0–3% SLOPE	B
299B/ccaab	UDORTHENTS SMOOTH 3–8% SLOPE	B
299C/ccaab	UDORTHENTS SMOOTH 8–15% SLOPE	B
299D/ccaab	UDORTHENTS SMOOTH 15–25% SLOPE	B
299E/ccaab	UDORTHENTS SMOOTH 25–50% SLOPE	B
299A/cchab	UDORTHENTS SMOOTH 0–3% SLOPE	B
299B/cchab	UDORTHENTS SMOOTH 3–8% SLOPE	B
299E/ccfab	UDORTHENTS SMOOTH 15–25% SLOPE	B

NOTE: SITE-SPECIFIC SOIL MAPPING SURVEY WAS CONDUCTED BY JAMES LONG, CSS, CWS OF GZA GEOENVIROMENTAL, INC. ON JULY 9, 2014.

LEGEND

- HIGHEST OBSERVABLE TIDE LINE
- JURISDICTIONAL WETLANDS
- EXISTING CONTOUR
- EXISTING TREELINE
- SSSS BOUNDARY
- 100A/daabb SSSS DISTURBED SOIL DESIGNATION
- SOILS – HSG A
- SOILS – HSG B
- SOILS – HSG C
- SOILS – HSG D
- SOILS – IMPERVIOUS
- SOILS – WATER

N

299C/ccaab 299D/ccaab 83E 299B/cchab 42B 299B/ccaab 299A/cchab 299E/ccaab 299C/ccaab 299D/ccaab 299E/ccaab 299B/ccaab 299A/cchab 299C/ccaab 299E/ccaab 299D/ccaab 299B/ccaab 597C VP 444D 656B P

PLAN
SCALE: 1"=30'

1" = 30' SCALE 0 30 60 90 FEET

PERMIT APPLICATION DRAWING
NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
REVISIONS				

AECOM TECHNICAL SERVICES, INC.
257 TOWNSEND STREET
BOSTON, MA 01810
PHONE (781) 246-3300

ALTUS ENGINEERING, INC.

CITY OF PORTSMOUTH, NH - DEPARTMENT OF PUBLIC WORKS
PEIRCE ISLAND WWTF UPGRADE
PRE-DEVELOPMENT
SITE SPECIFIC SOILS PLAN
AOT PERMIT

JAMES H. LONG NO. 15/12/16/17 NEW HAMPSHIRE SOIL SCIENTIST

STATE OF NEW HAMPSHIRE JAMES H. LONG 12/16/17 No. 007 CERTIFIED WETLAND SCIENTIST

PROJECT NO:	60301525
CAD DWG FILE:	WS-1 AOT PERMIT
DESIGNED BY:	T. WASSELL
DRAWN BY:	C. BENZIGER
DEPT CHECK:	C. BENZIGER
PROJ CHECK:	E. MESERVE
DATE:	JULY 2015
SCALE:	AS NOTED

WS-1

PATH/FILENAME: P:\60301525 - PORTSMOUTH WWTF UPGRADE\SHEETS\BP-2\CWS-1 AOT PERMIT.DWG
LAST UPDATE: Friday, July 17, 2015 10:23:21 AM
PLOT DATE: Tuesday, July 21, 2015 6:38:48 AM
ANSI D — 17-Jun-15

MAP UNIT NO.	SOIL TAXONOMIC NAME	HYDROLOGICAL SOIL GROUP
42B	CANTON 3–8% SLOPE	B
83E	HOLLIS CANTON COMPLEX 25–50% SLOPE	C
444D	NEWFIELDS SERIES 15–25% SLOPE	B
656B/P	RIDGEBURY SERIES 3–8% SLOPE	B
597C/VP	WESTBROOK VARIANT 8–15% SLOPE	B
299A/ccaab	UDORTHENTS SMOOTH 0–3% SLOPE	B
299B/ccaab	UDORTHENTS SMOOTH 3–8% SLOPE	B
299C/ccaab	UDORTHENTS SMOOTH 8–15% SLOPE	B
299D/ccaab	UDORTHENTS SMOOTH 15–25% SLOPE	B
299E/ccaab	UDORTHENTS SMOOTH 25–50% SLOPE	B
299A/cchab	UDORTHENTS SMOOTH 0–3% SLOPE	B
299B/cchab	UDORTHENTS SMOOTH 3–8% SLOPE	B
299E/ccfab	UDORTHENTS SMOOTH 15–25% SLOPE	B

NOTE: SITE–SPECIFIC SOIL MAPPING SURVEY WAS CONDUCTED BY JAMES LONG, CSS, CWS OF GZA GEOENVIROMENTAL, INC. ON JULY 9, 2014.

LEGEND

- HIGHEST OBSERVABLE TIDE LINE
- JURISDICTIONAL WETLANDS
- 30 EXISTING CONTOUR
- EXISTING TREELINE
- 33 PROPOSED CONTOUR
- SSSS BOUNDARY
- 100A/daabb SSSS DISTURBED SOIL DESIGNATION
- SOILS – HSG A
- SOILS – HSG B
- SOILS – HSG C
- SOILS – HSG D
- SOILS – IMPERVIOUS
- SOILS – WATER

PISCATAQUA RIVER

SANITARY PUMP STATION No. 2

OPERATIONS/LAB BUILDING

EFFLUENT DISTRIBUTION BOX

CONC. BLOCK RETAINING WALL

4' WIDE MOWING STRIP (TYP.)

6' WIDE SINGLE SWING GATE

TRANSFORMER ON CONC. PAD

GENERATOR

ELECT. BLDG.

FLOW METER VAULT

BAF FACILITY

PLANT PERIMETER FENCE (TYP.)

BELOW GRADE PROPANE TANK 1990 GAL. (TYP. OF 3) ON CONC. PAD

SANITARY PUMP STATION No. 1

SOLIDS BUILDING

4 FT. WIDE BIT. CONC. WALK

ODOR CONTROL SYSTEM No. 2

12' WIDE DOUBLE SWING GATE

4 FT. WIDE BIT. CONC. WALK

HEADWORKS

SCUM PUMP STATION

SCUM WELL

GRAVITY THICKENER No. 2

14' WIDE SLIDING GATE

RAIN GARDEN

ODOR CONTROL SYSTEM No. 1

12' WIDE DOUBLE SWING GATE

LEVEL SPREADER

~ TIDAL WATERS ~

PLAN

SCALE: 1"=30'

1" = 30' SCALE 0 30 60 90 FEET

PERMIT APPLICATION DRAWING
NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
REVISIONS				

AECOM TECHNICAL SERVICES, INC.
101 EDGEWATER DRIVE
WAKEFIELD, MA 01880
PHONE (781) 246-5200

ALTUS ENGINEERING, INC.

CITY OF PORTSMOUTH, NH - DEPARTMENT OF PUBLIC WORKS

PEIRCE ISLAND WWTF UPGRADE

POST-DEVELOPMENT SITE SPECIFIC SOILS PLAN

AOT PERMIT

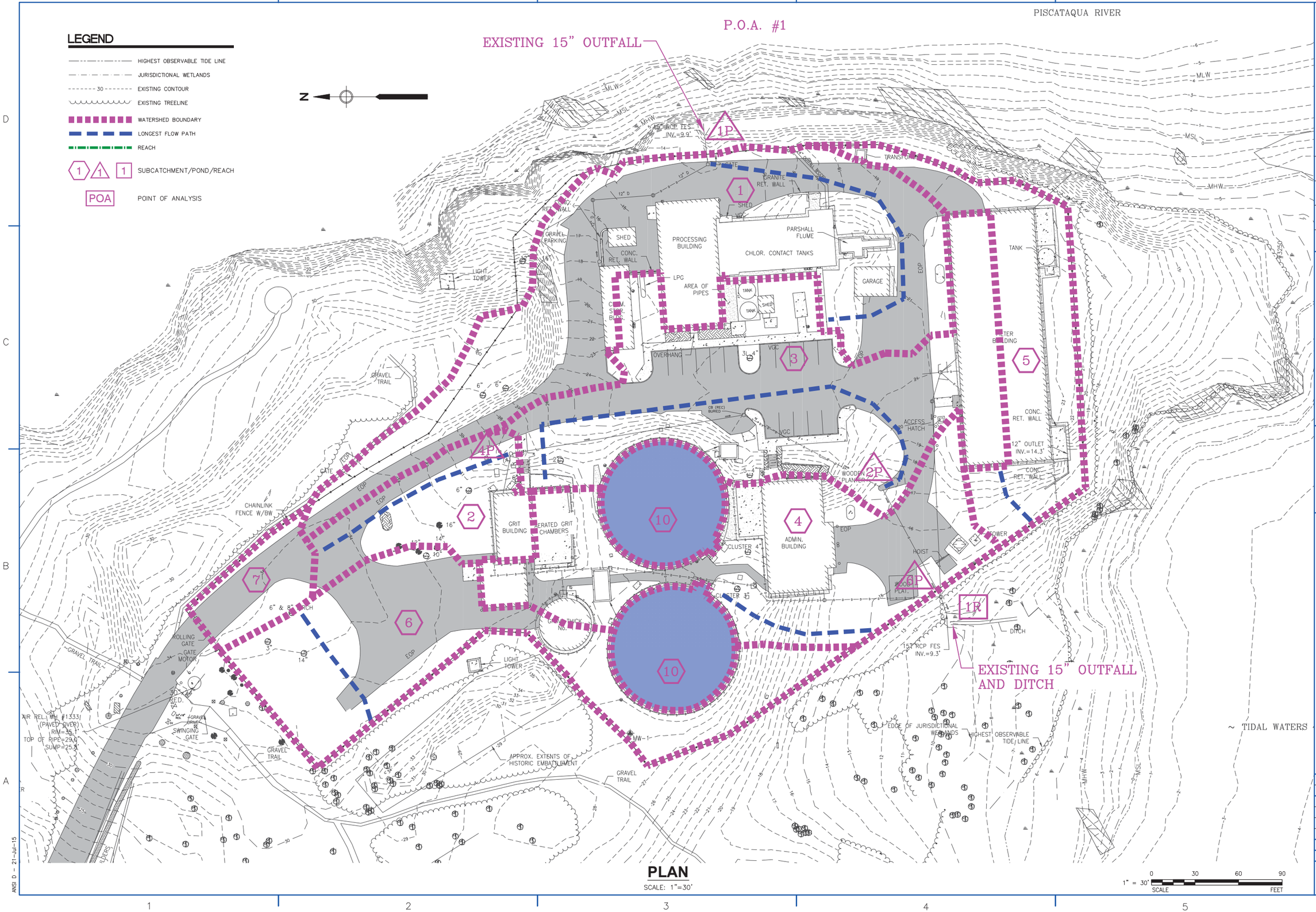
PROJECT NO:	60301525
CAD DWG FILE:	WS-2 AOT PERMIT
DESIGNED BY:	T. WASSELL
DRAWN BY:	C. BENZIGER
DEPT CHECK:	C. BENZIGER
PROJ CHECK:	E. MESERVE
DATE:	JULY 2015
SCALE:	AS NOTED

WS-2

STATE OF NEW HAMPSHIRE JAMES H. LONG No. 15 12/16/14 CERTIFIED SOIL SCIENTIST

STATE OF NEW HAMPSHIRE JAMES H. LONG No. 007 12/16/14 CERTIFIED WETLAND SCIENTIST

PATH/FILENAME: P:\60301525 - PORTSMOUTH WWTF UPGRADE\SHEETS\BP-2\CIVIL\WS-2 AOT PERMIT.DWG
LAST UPDATE: Friday, July 17, 2015 10:23:33 AM
PLOT DATE: Tuesday, July 21, 2015 6:59:36 AM
ANSI D – 17-Jul-15



PERMIT APPLICATION DRAWING
NOT FOR CONSTRUCTION

MARK	DATE	MADE BY	CHECKED	DESCRIPTION

REVISIONS

AECOM TECHNICAL SERVICES, INC.
1 LEWIS STREET
WAKEFIELD, MA 01880
PHONE (781) 246-3200

AECOM

AITUS ENGINEERING, INC

JEFFREY K. CLIFFORD No. 6524 LICENSED PROFESSIONAL ENGINEER - STATE OF NEW HAMPSHIRE

CITY OF PORTSMOUTH, NH - DEPARTMENT OF PUBLIC WORKS

PEIRCE ISLAND WWTF UPGRADE

PRE-DEVELOPMENT WATERSHED PLAN

AOT PERMIT

PROJECT NO:	60301525
CAD DWG FILE:	WS-1A AOT PERMIT
DESIGNED BY:	T. WASSELL
DRAWN BY:	C. BENZIGER
DEPT CHECK:	C. BENZIGER
PROJ CHECK:	E. MESERVE
DATE:	JULY 2015
SCALE:	AS NOTED

WS-1A

PATH/FILENAME: P:\60301525 - PORTSMOUTH WWTF UPGRADE\SHEETS\BP-2\CVS-1A AOT PERMIT.DWG
LAST UPDATE: Tuesday, July 21, 2015 1:18:58 PM
PLOT DATE: Tuesday, July 21, 2015 1:59:27 PM
ANSI D – 21-Jul-15

PROPOSED 21" OUTFALL
REPLACES EXISTING 15"

P.O.A. #1

PISCATAQUA RIVER

LEGEND

- HIGHEST OBSERVABLE TIDE LINE
- JURISDICTIONAL WETLANDS
- 30 EXISTING CONTOUR
- EXISTING TREELINE
- 33 PROPOSED CONTOUR
- WATERSHED BOUNDARY
- LONGEST FLOW PATH
- REACH
- 1 1 1 SUBCATCHMENT/POND/REACH
- POA POINT OF ANALYSIS

N

CB-1 RIM EL. 13.75
SANITARY PUMP STATION No. 2
21" SD
DMH-1
18" SD
WATER QUALITY INLET (WQI)
15" SD
DMH-3
4" SD
15" SD
6" SD
DMH-2
12" SD
6" SD
OPERATIONS/LAB BUILDING
CONNECT 12" SD TO EXIST. DMH
CB-2 RIM EL. 14.60
CB-4
4" SD
SHED
CONC. RET. WALL
RAMP
EFFLUENT DISTRIBUTION BOX
TRANSFORMER ON CONC. PAD
GENERATOR
ELECT. BLDG.
CHEM. STOR. BLDG.
LIGHT TOWER
CONC. BLOCK RETAINING WALL
DMH-5
6" DRAIN (PERFORATED UNDERDRAIN (TYP.)
3" SD
4' WIDE MOWING STRIP (TYP.)
6" WIDE SINGLE SWING GATE
FLOW METER VAULT
DMH-6
15" SD
12" SD
CB-3 RIM 19.95 INV 14.61
BAF FACILITY
GRAVEL TRAIL
PLANT PERIMETER FENCE (TYP.)
BELOW GRADE PROPANE TANK 1990 GAL. (TYP. OF 3) ON CONC. PAD
GATE
CHAINLINK FENCE W/BW
WWTF SIGN
4" SD
GRIT BUILDING
AERATED GRIT CHAMBERS
SANITARY PUMP STATION No. 1
CONNECT 15" SD TO EXIST. CB
SOLIDS BUILDING
4 FT. WIDE BIT. CONC. WALK
ODOR CONTROL SYSTEM No. 2
8" SD
12' WIDE DOUBLE SWING GATE
4 FT. WIDE BIT. CONC. WALK
"NO PARKING"
ROLLING GATE
GATE OPERATOR
HEADWORKS
SCUM PUMP STATION
LIGHT TOWER
GRAVITY THICKENER No. 2
DMH-8
DMH-7
DITCH
14' WIDE SLIDING GATE
12" SD
12 FT. WIDE VEGETATED MAINTENANCE CORRIDOR
EXISTING 15" OUTFALL AND DITCH
RAIN GARDEN
DROP INLET
12" SD
ODOR CONTROL SYSTEM No. 1
APPROX. EXTENTS OF HISTORIC EMBAYLEMENT
12' WIDE DOUBLE SWING GATE
DMH-9
DMH-10
DMH-11
12" SD
EDGE OF JURISDICTIONAL WETLANDS
HIGHEST OBSERVABLE TIDE LINE
~ TIDAL WATERS ~
LEVEL SPREADER
(3) 4" DI DRAINS
AIR REL.-MH #1333 (PAVED OVER) RIM=35.1' TOP OF PIPE=29.0' SUMP=25.8'
SWINGING GATE
"NO PARKING"

PLAN
SCALE: 1"=30'

0 30 60 90
1" = 30' SCALE FEET

PERMIT APPLICATION DRAWING
NOT FOR CONSTRUCTION

REVISIONS			
MARK	DATE	MADE BY	CHECKED
		DESCRIPTION	

AECOM TECHNICAL SERVICES, INC.
1 LEWIS STREET
WAKEFIELD, MA 01880
PHONE (781) 246-3200

AECOM

ALTUS ENGINEERING, INC

JEFFREY K. CLIFFORD No. 6524 LICENSED PROFESSIONAL ENGINEER - STATE OF NEW HAMPSHIRE

CITY OF PORTSMOUTH, NH - DEPARTMENT OF PUBLIC WORKS
PEIRCE ISLAND WWTF UPGRADE
POST-DEVELOPMENT WATERSHED PLAN
AOT PERMIT

PROJECT NO:	60301525
CAD DWG FILE:	WS-2A AOT PERMIT
DESIGNED BY:	T. WASSELL
DRAWN BY:	C. BENZIGER
DEPT CHECK:	C. BENZIGER
PROJ CHECK:	E. MESERVE
DATE:	JULY 2015
SCALE:	AS NOTED

WS-2A

PATH/FILENAME: P:\60301525 - PORTSMOUTH WWTF UPGRADE\SHEETS\BP-2\CWS-2A AOT PERMIT.DWG
LAST UPDATE: Tuesday, July 21, 2015 2:10:13 PM
PLOT DATE: Tuesday, July 21, 2015 2:46:35 PM
ANSI D - 21-Jul-15

APPENDIX D:

SITE-SPECIFIC SOIL MAPPING REPORT

GZA
GeoEnvironmental, Inc.

Engineers and
Scientists

VIA EMAIL

October 3, 2014
File No: 04.0190131.00

Mr. Jeffrey Clifford, PE
Altus Engineering, Inc.
133 Court Street
Portsmouth, New Hampshire 03801

Re: Site-Specific Soil Mapping Report
Peirce Island Wastewater Treatment Facility
Portsmouth, New Hampshire

5 Commerce Park North
Suite 201
Bedford
New Hampshire
03110-6984
603-623-3600
FAX 603-624-9463
www.gza.com

Dear Jeff:

This letter report presents the findings of a Site-Specific Soil Mapping survey conducted on the above-referenced property by GZA GeoEnvironmental, Inc. (GZA) on July 9, 2014. The subject property is located at the south end of Peirce Island and is currently the location of the Wastewater Treatment Facility (WWTF) for the City of Portsmouth. See attached plan "Peirce Island Wastewater Treatment Facility" by Altus Engineering, Inc. dated January 27, 2014. The WWTF is bounded by the Piscataqua River to the east and tidal waters to the west. Per your request, only the area shaded in yellow on the attached plan (approximately 5 acres) was included in the mapping. It is our understanding that the soil information is needed in support of a proposed project to expand the WWTF.

The Site-Specific Soil Mapping was conducted by New Hampshire Certified Soil Scientist, James H. Long, (CSS No. 15) in accordance with the *New Hampshire Supplement of the Site-Specific Soil Mapping Standard for New Hampshire and Vermont*, Version 4.0, February 2011, published by the Society of Soil Scientists of Northern New England. Soil map units identified on the Site were classified using the *New Hampshire State-Wide Numerical Soils Legend*, United States Department of Agriculture (USDA) Natural Resource Conservation Service, Issue No. 10, January 2011. The Site-Specific Standards are based on a universally recognized taxonomic system of soil classification and are supported by national soil mapping standards established by the USDA National Cooperative Soil Survey. This map has been prepared to comply with soil mapping requirements of RSA 485 A:17 and New Hampshire Department of Environmental Services (DES) Env-Wq 1500, Alteration of Terrain (AoT) rules.

This report and the attached soil series map (**Appendix A**) provide soil information such as soil drainage classification, physical characteristics, and depth to bedrock (if encountered). Soil characteristics on the property were evaluated through the evaluation of the test pits as well as tile spade and hand-auger probe observations conducted throughout the survey area. Slope phases were measured through the use of a clinometer and augmented by the topography shown on the Base Plan, which depicted the area of the site at a scale of 1 inch = 50 feet and provided topographic information at a contour interval of 1-foot. The accompanying *Site-Specific Soil Map* developed by GZA in September 2014 was developed using the Base Plan as the mapping base.

Copyright © 2014 GZA GeoEnvironmental, Inc.

Soil parent materials encountered consist of glacial till materials, marine organic soils, and anthropogenic soils. The Soil Map Units identified during the soil survey are briefly described below. Soil characteristics for each Soil Map Unit comply with the Range in Characteristics described in the Official Series Descriptions for each Soil Map Unit (**Appendix B).**

The conditions that exist within the disturbed areas are the result of anthropogenic processes and consist of excavated, regraded and filled areas. The majority of the soils in and around the WWTF have been cut and filled to create the necessary grades for the facility. Soil material making up the map units appear to have come for the immediate area. The material excavated, filled and regarded is similar in characteristics to the Canton soils that were excavated. Canton soils have a hydrologic soil Group B and have a Ksat value in the lower C of 6 inches per hour. The disturbed areas have been identified using the *Disturbed Soil Mapping Unit Supplement for DES AOT Site Specific Soil Maps* section of the standards **(Appendix C)**.

The very poorly drained marine soils are mapped as a Westbrook variant. Westbrook soils have a range of depth to bedrock to greater than 60 inches. Bedrock in this area was encountered at less than 24 inches and therefore is mapped as a Westbrook Variant.

The following is a brief description of the soils mapped on site.

MAP UNIT NO.	SOIL TAXONOMIC NAME	DESCRIPTION
42B	Canton 3-8% slope	Very deep, well drained soils formed in a loamy mantle underlain by sandy till. These soils are on nearly level through very steep glaciated plains, hills and ridges. Slopes range from 0 through 35 percent. Saturated hydraulic conductivity is high in the solum and high or very high in the substratum.
83E	Hollis Canton Complex 25-50% slope	The Hollis Canton complex is mapped where depth to bedrock is so variable a single soil type cannot be applied and therefore, will be mapped as a complex of soil types. Hollis soils are well drained soils formed in a thin mantle of till. They are shallow to bedrock. They are nearly level through very steep upland soils on bedrock-controlled hills and ridges. Slopes range from 0 to 60 percent. Saturated hydraulic conductivity is moderately high or high.
444D	Newfields Series 15-25% slope	Very deep, moderately well drained soils formed in a loamy mantle underlain by a sandy till on upland hills, moraines, till plains and mountain side slopes. Saturated hydraulic conductivity is moderately high to very high. Slopes range from 0 to 25 percent.
656B P	Ridgebury Series 3-8% slope	Very deep, poorly drained soils formed in till. They are nearly level to gently sloping in low areas of uplands. Slopes range from 0 to 15%. Saturated hydraulic conductivity ranges from moderately low to high in the solum and very low to moderately low in the substratum.
597C VP	Westbrook Variant 8-15% slope	Very poorly drained soils, formed in organic deposits over bedrock. They are in tidal marshes subject to inundation by salt water twice a day. Saturated hydraulic conductivity is moderately high to very high in the organic layers.
299A/ccaab	Udorthents, smooth 0-3% slope	This map unit represents areas that have been cut and filled to create a large level on nearly level area. Soil material making up the map units typically comes from the immediate area. The drainage class is well drained and the parent material is glacial till. There is no restrictive layer. The Ksat value is high and the hydrologic soil group is B.

MAP UNIT NO.	SOIL TAXONOMIC NAME	DESCRIPTION
299B/ccaab	Udorthents, smooth 3-8% slope	This map unit represents areas that have been cut and filled to create a large level on nearly level area. Soil material making up the map units typically comes from the immediate area. The drainage class is well drained and the parent material is glacial till. There is no restrictive layer. The Ksat value is high and the hydrologic soil group is B.
299C/ccaab	Udorthents, smooth 8-15% slope	This map unit represents areas that have been cut and filled to create a large level on nearly level area. Soil material making up the map units typically comes from the immediate area. The drainage class is well drained and the parent material is glacial till. There is no restrictive layer. The Ksat value is high and the hydrologic soil group is B.
299D/ccaab	Udorthents, smooth 15-25% slope	This map unit represents areas that have been cut and filled to create a large level on nearly level area. Soil material making up the map units typically comes from the immediate area. The drainage class is well drained and the parent material is glacial till. There is no restrictive layer. The Ksat value is high and the hydrologic soil group is B.
299E/ccaab	Udorthents, smooth 25-50% slope	This map unit represents areas that have been cut and filled to create a large level on nearly level area. Soil material making up the map units typically comes from the immediate area. The drainage class is well drained and the parent material is glacial till. There is no restrictive layer. The Ksat value is high and the hydrologic soil group is B.
299A/cchab	Udorthents Smooth 0-3% slope	This map unit represents areas that have been cut and filled to create a large level on nearly level area. Soil material making up the map units typically comes from the immediate area. The drainage class is well drained and the parent material is glacial till. Man-made impervious surface including pavement, concrete or built up surfaces (i.e. buildings) with no morphological restrictive layer within control section. The Ksat value is high and the hydrologic soil group is B.
299B/cchab	Udorthents Smooth 3-8% slope	This map unit represents areas that have been cut and filled to create a large level on nearly level area. Soil material making up the map units typically comes from the immediate area. The drainage class is well drained and the parent material is glacial till. Man-made impervious surface including pavement, concrete or built up surfaces (i.e. buildings) with no morphological restrictive layer within control section. The Ksat value is high and the hydrologic soil group is B.
299E/ccfab	Udorthents Smooth 25-50% slope	This map unit represents areas that have been cut and tilled that have been cut and filled to create a large level on nearly level area. Soil material making up the map units typically comes from the immediate area. The drainage class is well drained and the parent material is glacial till. There is no restrictive layer. Areas where depth to bedrock is so variable that a single soil type cannot be applied, will be mapped as a complex of soil types. The Ksat value is high and the hydrologic soil group is B.

GZA trusts that this report and the soil survey meet your current planning needs. Once you have reviewed the report and soils information, please let us know if you will require additional information. This report is subject to the Limitations contained in **Appendix D**.

Please do not hesitate to contact Mr. James Long at 603-232-8756 if you have any questions.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

James H. Long, CSS, CWS
Senior Technical Specialist

John C. Murphy, CHMM
Principal

Deborah M. Zarta Gier
Consultant / Reviewer

JHL/JCM/DMZ:mm
P:\04Jobs\0190100s\04.0190131.00\Report\final 04 0190131 00 Site Specific Soil Mapping Report 100314.docx

Attachments: Appendix A –Site-Specific Soil Map
Appendix B - Official Series Descriptions
Appendix C – Disturbed Soil Mapping Unit Supplement
Appendix D – Limitations

APPENDIX A

SITE SPECIFIC SOIL MAP

LEGEND:

- EX. CHAIN LINK FENCE
- EX. BUILDING
- JURISDICTIONAL WETLANDS
- HIGHEST OBSERVABLE TIDE LINE (HOTL)
- PROPOSED BUILDING
- 100' WETLANDS BUFFER
- 100' BUFFER FROM HOTL
- 250' BUFFER FROM HOTL
- EXISTING PAVED ROAD

PISCATAQUA RIVER

PISCATAQUA RIVER (TIDAL)

FLOOD

EBB

~ TIDAL WATERS ~

FRESHWATER WETLANDS "A" 3,096 s.f.

JURISDICTIONAL WETLAND LIMITS

100' CITY WETLANDS BUFFER

HEADWORKS, STANDBY GENERATOR AND MAIN ELECTRICAL BUILDING

APPROXIMATE EXTENTS OF HISTORIC EMBANKMENT

NAVIGATION LIGHT

RELOCATED ODOR CONTROL

GRAVEL TRAIL (TYP.)

RETAINING WALL

250' NHDES PROTECTED SHORELAND

100' NHDES TIDAL BUFFER

100' CITY WETLANDS BUFFER

HIGHEST OBSERVABLE TIDE LINE (HOTL)

SCUM BUILDING ADDITION

Area of proposed WWTF upgrades

SOLIDS BUILDING AND SECONDARY INFLUENT PUMP STATION

ADMINISTRATION BUILDING

STAGE 2 BAF

STAGE 2 MUDWELL (BELOW)

SUPPLEMENTAL CARBON FACILITY

CHEMICAL STORAGE AND FEED FACILITY

STAGE 1 BAF CELL (TYP.)

STAGE 1 MUDWELL (BELOW)

GRAVITY THICKENER

PRIMARY CLARIFIER

PRIMARY CLARIFIER EFFLUENT DISTRIBUTION BOX

JURISDICTIONAL WETLAND LIMITS

FRESHWATER WETLANDS "B" 7,360 s.f.

RETAINING WALL

STAGE 2 - BAF (DENITRIFICATION)

STAGE 1 (BOD REMOVAL AND

GRAPHIC SCALE

50 0 25 50 100

(IN FEET)

AN REFERENCE:

"TOPOGRAPHIC PLAN OF PEIRCE ISLAND WASTEWATER TREATMENT FACILITY, PEIRCE ISLAND ROAD, PORTSMOUTH, NH" BY DOUCET SURVEY, INC., DATED JULY 10, 2013.
"SITE LAYOUT PLAN, PEIRCE ISLAND WWTF – PORTSMOUTH, NH" BY AECOM, DATED NOVEMBER 2013.

NOT FOR CONSTRUCTION

P4507

ALTUS ENGINEERING, INC.

133 COURT STREET PORTSMOUTH, NH 03801
(603) 433-2335 www.ALTUS-ENG.com

PROGRESS PRINT

ISSUED FOR: REVIEW

ISSUE DATE: JANUARY 27, 2014

REVISIONS

NO.	DESCRIPTION	BY	DATE
0	–	JKC	-/-/-

DRAWN BY: RMB
APPROVED BY: JKC
DRAWING FILE: 4507.DWG

SCALE:
11"x17": 1" = 100'
22"x34": 1" = 50'

OWNER/APPLICANT:

CITY OF PORTSMOUTH
DEPT. OF PUBLIC WORKS
680 PEVERLY HILL ROAD
PORTSMOUTH, NH

PROJECT:

PEIRCE ISLAND WASTEWATER TREATMENT FACILITY

PORTSMOUTH, NH 03801

TITLE:

–
–

SHEET NUMBER:

–

APPENDIX B

OFFICIAL SERIES DESCRIPTION

LOCATION CANTON MA CT NH RI

Established Series
Rev. WHT-SMF-SJM-DAS
03/2010

CANTON SERIES

The Canton series consists of very deep, well drained soils formed in a loamy mantle underlain by sandy till derived from parent materials that are very low in iron sulfides. They are on nearly level through very steep glaciated plains, hills, and ridges. Slope ranges from 0 through 35 percent. Saturated hydraulic conductivity is high in the solum and high or very high in the substratum. The mean annual temperature is about 46 degrees F. (10 degrees C.) and the annual precipitation is about 44 inches (1194 millimeters).

TAXONOMIC CLASS: Coarse-loamy over sandy or sandy-skeletal, mixed, semiactive, mesic Typic Dystrudepts

TYPICAL PEDON: Canton fine sandy loam, 3 to 8 percent slopes, extremely bouldery in a forested area at an elevation of about 87 meters. (Colors are for moist soil.)

A-- 0 to 1 inch (0 to 3 centimeters); black (10YR 2/1) fine sandy loam; weak fine granular structure; very friable; many fine roots; 10 percent rock fragments; extremely acid; abrupt smooth boundary. (1 to 3 inches (3 to 8 centimeters) thick.)

E-- 1 to 2 inches (3 to 5 centimeters); dark gray (10YR 4/1) fine sandy loam; weak fine granular structure; very friable; many fine roots; 10 percent rock fragments; extremely acid; abrupt broken boundary. (0 to 2 inches (0 to 5 centimeters) thick.)

Bw1-- 2 to 12 inches (5 to 30 centimeters); yellowish brown (10YR 5/6) fine sandy loam; massive; very friable; many fine and medium roots; many fine pores; 10 percent rock fragments; very strongly acid; clear wavy boundary.

Bw2-- 12 to 22 inches (30 to 56 centimeters); light yellowish brown (2.5Y 6/4) gravelly fine sandy loam; massive; very friable; many fine and medium roots; many fine pores; 15 percent rock fragments; very strongly acid; abrupt wavy boundary. (Combined thickness of the Bw horizons is 13 to 33 inches (43 to 84 centimeters).)

2C1-- 22 to 31 inches (56 to 79 centimeters); light olive gray (5Y 6/2) gravelly loamy sand; single grain; very friable; common medium roots; many medium pores; 25 percent rock fragments; pebbles have thin patchy silt caps; very strongly acid; abrupt wavy boundary. (8 to 20 inches (20 to 50 centimeters) thick.)

2C2-- 31 to 65 inches (79 to 165 centimeters); olive gray (5Y 5/2) very gravelly loamy sand; single grain; friable; few fine roots; 35 percent rock fragments; thick continuous silt caps on pebbles; very strongly acid.

TYPE LOCATION: Norfolk County, Massachusetts; Town of Sharon; 0.3 miles south of junction of East Foxborough Road and Mohawk Street, in a borrow pit on the east side of East Foxborough Road. USGS Brockton, MA quadrangle; Latitude 42 degrees, 05 minutes, 46 seconds N., and Longitude 71 degrees, 11 minutes, 19 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Solum thickness commonly ranges from 18 through 36 inches (46 to 91 centimeters), but the range includes through 14 inches (36 centimeters). It corresponds closely to the depth to the sandy till. Rock fragment content consists of 0 through 20 percent gravel and 0 through 5 percent cobbles in the solum. Gravel content is 10 through 30 percent, cobbles 5 through 10 percent, and stones 0 through 10 percent in the substratum. Stones and boulders are 0 through 15 percent of the surface and subsoil. Rock fragments are dominantly granite, gneiss, and quartzite. The soil ranges from extremely acid through moderately acid. The weighted average dithionite-citrate extractable iron (pedogenic iron) is less than 1 percent throughout the mineral pedon. The weighted average dithionite-citrate extractable aluminum content is commonly 0.67 times less than that found in competing series. The ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron is high, greater than 0.15.

Some pedons have an O horizon.

The A horizon has hue of 7.5YR or 10YR, value of 2 through 4, and chroma of 1 through 3. Texture is sandy loam, fine sandy loam, loam, or very fine sandy loam in the fine-earth fraction.

Some pedons have an E horizon.

The Bw1 horizon commonly has hue of 10YR, and includes 7.5YR when a high ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron (> 0.15) exists, value of 4 or 5, and chroma of 4 through 8. The Bw2 horizon has hue of 10YR or 2.5Y, value of 4 through 7, and chroma of 4 through 8. Texture of the fine-earth fraction is commonly fine sandy loam and less commonly sandy loam, loam and very fine sandy loam. Structure of the Bw is granular or subangular blocky.

Some pedons have a Bs, Bh, or BC horizon.

The 2C horizon typically has hue of 2.5Y or 5Y, value of 5 through 7, and chroma of 2 or 3, but includes a hue of 10YR with chroma of 4 through 6. The texture of the fine-earth fraction is loamy fine sand or coarser. Structure is single grain or massive and consistence is friable, very friable or loose. Thin lenses or small pockets of firm or very firm finer textured material are common below 36 through 40 inches (91 to 100 centimeters).

COMPETING SERIES: There are no other soils currently in the same family.

The Agawam, Barnstable, Branford, Brookfield, Charlton, Haven, and Narragansett series are in closely related families. The Agawam, Branford, and Haven soils have stratified sand or sand and gravel in the series control section. In addition, the Branford soils have hues redder than 7.5YR throughout the B horizon. Barnstable soils formed in till over outwash and have less than 30 percent fine sand in the lower part of the Bw horizon. Brookfield soils formed in sulfur bearing parent materials and have a ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron less than 0.15 and have pedogenic iron contents greater than 1 percent throughout the pedon. Charlton soils lack a lithologic discontinuity of abrupt change in sand distribution. Narragansett soils have more than 55 percent silt and very fine sand in the solum.

GEOGRAPHIC SETTING: Canton soils are on glaciated upland plains, hills, and ridges. Slope ranges from 0 through 35 percent. The soils developed in a fine sandy loam mantle over acid sandy till of Wisconsin age derived from parent materials that are very low in sulfur, mainly from granite and gneiss and some fine-grained sandstone. The climate is humid temperate. The mean annual air temperature is 45 to 51 degrees F. (7 through 11 degrees C.), and the mean annual precipitation ranges from 42 through 26 inches (1016 through 1295 millimeters).

GEOGRAPHICALLY ASSOCIATED SOILS: The Newfields series is the moderately well drained member of the same toposequence. The Agawam, Haven, Merrimac, and Warwick soils are on nearby glacial outwash kames and plains. The Barnstable, Brookfield, Charlton, Cheshire, Dutchess, Gloucester, Hollis, Montauk, Narragansett, and Paxton soils are on nearby glaciated uplands. Brookfield, Charlton, Cheshire, Dutchess, Gloucester, Hollis, Montauk, and Paxton soils lack a contrasting particle size in the control section.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained. Runoff is negligible to medium. Internal drainage is medium. Saturated hydraulic conductivity is high in the solum and high or very high in the substratum.

USE AND VEGETATION: Mostly forested. Some areas have been cleared of surface stones and are used for crops and pasture. Native vegetation is forest composed of eastern white pine, northern red, white, and black oaks, hickory, red maple, sugar maple, gray birch, yellow birch, beech, eastern hemlock, and white ash.

DISTRIBUTION AND EXTENT: Glaciated uplands in Connecticut, Massachusetts, New Hampshire, eastern New York, and Rhode Island, also in the Massachusetts Coastal Islands; MLRAs 144A, 145, and 149B. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Herkimer County, New York, 1969.

REMARKS: This revision reflects revision of the series concept and range in characteristics as well as general updating to metric units. Research results indicate Canton soils are not associated with iron sulfide bearing materials. The weighted average dithionite-citrate extractable iron (pedogenic iron) is less than 1 percent throughout the mineral pedon. The weighted average dithionite-citrate extractable aluminum content is commonly 0.67 times less than that found in competing series. The ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron is high, greater than 0.15.

Diagnostic horizons and features recognized in this pedon are:
1) Ochric epipedon - the zone from 0 to 2 inches (0 to 5 centimeters) (A and E horizons).
2) Cambic horizon - the zone from 2 to 22 inches (5 to 56 centimeters) (Bw1 and Bw2 horizons).
3) Contrasting particle size - the coarse-loamy material contains less than 50 percent fine sand or coarser, and the transition zone between the two parts of the particle-size control section is less than 5 inches (12.5 cm) thick. (Coarse-loamy over sandy or sandy skeletal).
4) Lithologic discontinuity abrupt change in sand distribution at 22 inches (56 centimeters) (2C1 horizon).
5) Cation exchange activity class based upon available data for 4 pedons.
6) Particle-size control section - the zone from 10 through 40 inches (25 through 100 centimeters) (Bw1, Bw2, 2C1, and 2C2 horizons).

ADDITIONAL DATA: M.S. Thesis work by Shawn McVey, University of Connecticut, 2006. Full characterization data for sample no. S82CT007001, S99CT013001, S99CT013004, S00CT007003 and S04CT011003. Pedons analyzed by the NSSL, Lincoln, NE.

National Cooperative Soil Survey
U.S.A.

LOCATION HOLLIS CT+MA NH NJ NY

Established Series
Rev. MFF-SMF-SJM-DAS
01/2013

HOLLIS SERIES

The Hollis series consists of well drained and somewhat excessively drained soils formed in a thin mantle of till derived mainly from parent materials that are very low in iron sulfides such as gneiss, schist, and granite. They are shallow to bedrock. They are nearly level through very steep upland soils on bedrock-controlled hills and ridges. Slope ranges from 0 through 60 percent. Saturated hydraulic conductivity is moderately high or high. Depth to hard bedrock ranges from 25 to 50 cm. Mean annual temperature is about 9 degrees C, and mean annual precipitation is about 1270 mm.

TAXONOMIC CLASS: Loamy, mixed, active, mesic Lithic Dystrudepts

TYPICAL PEDON: Hollis gravelly fine sandy loam, 3 to 15 percent slopes, forested. (Colors are for moist soil.)

Oi--0 to 3 cm; slightly decomposed plant material.

Oa--3 to 5 cm; black (10YR 2/1) highly decomposed plant material; moderate fine granular structure; very friable; many fine and very fine roots; abrupt smooth boundary. (Combined thickness of O horizons is 0 to 4 inches (0 to 10 cm thick)

A--5 to 18 cm; very dark grayish brown (10YR 3/2) gravelly fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common fine, very fine, medium, and coarse roots; 10 percent gravel, 5 percent channers; very strongly acid; clear smooth boundary. (1 to 6 inches (3 to 15 cm thick)

Bw1--18 to 25 cm; dark yellowish brown (10YR 4/4) gravelly fine sandy loam; moderate medium subangular blocky structure; friable; few very fine and fine roots, common medium roots; 10 percent gravel, 10 percent channers; strongly acid; clear wavy boundary.

Bw2--25 to 41 cm; yellowish brown (10YR 5/6) gravelly fine sandy loam; moderate medium and coarse subangular blocky structure; friable; few fine and very fine roots, common medium roots; 10 percent gravel, 5 percent channers; strongly acid; abrupt smooth boundary. (Combined thickness of Bw horizons is 18 to 48 cm.)

2R--41 cm; schist bedrock.

TYPE LOCATION: Middlesex County, Connecticut, town of East Hampton, 1000 feet due west of Connecticut Route 196 and 3200 feet due north of Connecticut Route 151; USGS Moodus, CT topographic quadrangle, Latitude 41 degrees 31, minutes 28, seconds N., Longitude 72 degrees, 29

minutes, 48 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to bedrock range from 25 to 50 cm. Rock fragments commonly range from 5 through 35 percent by volume, but some pedons have less than 5 percent rock fragments. The fragments are mostly subrounded gravel, except where the surface is stony. The soil has 20 percent or more silt in the particle-size control section. Unless limed, reaction ranges from extremely acid through moderately acid in the organic horizons and very strongly acid through moderately acid in the mineral horizons. The weighted average dithionite-citrate extractable iron (pedogenic iron) is less than 1 percent throughout the mineral pedon. The weighted average dithionite-citrate extractable aluminum content is commonly 0.67 times less than that found in competing series. The ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron is high, greater than 0.15.

The O horizon, where present, ranges from slightly decomposed through highly decomposed plant material.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4, and chroma of 1 to 3. It is sandy loam, fine sandy loam, or loam in the fine-earth fraction. Consistence is friable or very friable.

Some pedons have a BA horizon.

The Bw horizon commonly has hue of 10YR or 2.5Y, and includes 7.5YR when a high ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron (> 0.15) exists, value of 4 or 5, and chroma of 4 through 8. It is sandy loam, fine sandy loam, or loam in the fine-earth fraction. The Bw horizon has granular or subangular blocky structure. Consistence is friable or very friable.

Some pedons have a thin BC or C horizon with color like the Bw horizon, except it includes hue of 5Y. Texture, structure, and consistence are similar to the Bw horizon.

COMPETING SERIES: These are the Cleveland and Kearsarge series. Cleveland soils have less than 20 percent silt in the particle-size control section and lack a 2R horizon. Kearsarge soils lack a 2R horizon and have rock fragments of phyllite, slate, or schist.

Brimfield soils are in a closely related family and formed in parent materials derived from sulfur bearing schist and have a ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron of less than 0.15 and have pedogenic iron contents of greater than 1 percent throughout the pedon.

GEOGRAPHIC SETTING: Hollis soils are nearly level through very steep soils on bedrock controlled hills, modified by glacial processes. Slope ranges from 0 to 60 percent. The soils formed in a thin mantle of till derived from local bedrock of schist, granite, and gneiss that is very low in sulfur. Mean annual temperature ranges from 7 to 12 degrees C and mean annual precipitation ranges from 940 to 1295 mm, but the range includes as low as 660 mm in some places east of Adirondack Mountains in the Champlain Valley of New York. The growing season ranges from 115 through 185 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Brimfield, Acton, Broadbrook, Brookfield, Canton, Charlton, Chatfield, Essex, Gloucester, Hibernia, Leicester, Montauk, Narragansett, Paxton, Rainbow, Ridgebury, Rockaway, Scituate, Sutton, Wapping, Whitman, and

Woodbridge soils on nearby landscapes. All are very deep upland soils formed in till except for the Brimfield and Chatfield soils. Acton, Rainbow, Rockaway, Scituate, Sutton, Wapping, and Woodbridge soils are moderately well drained. The Broadbrook, Brookfield, Canton, Charlton, Essex, Montauk, Narragansett, and Paxton soils are well drained. Chatfield soils have bedrock within a depth of 20 to 40 inches. Gloucester soils are somewhat excessively drained. Hibernia, Leicester, and Ridgebury soils are somewhat poorly drained or poorly drained soils in drainageways or low lying areas.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained and somewhat excessively drained. Surface runoff is negligible to very high. Saturated hydraulic conductivity is moderately high or high.

USE AND VEGETATION: Mostly forested. Small areas with few rock outcrops are cleared of stones and used for cultivated crops, but most cleared areas are in hay or pasture. Scattered areas are used for community development. Common trees are northern red, white, black, and chestnut oak, hickory, eastern white pine, eastern hemlock, and gray and black birch.

DISTRIBUTION AND EXTENT: Glaciated uplands in Connecticut, Massachusetts, New Jersey, New Hampshire, and eastern New York. MLRAs 101, 142, 144A, and 145. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Nashua Area, New Hampshire, 1909.

REMARKS: Cation exchange activity class placement based upon a review of lab data and similar and associated soils. Research results indicate Hollis soils are not associated with iron sulfide bearing materials. The weighted average dithionite-citrate extractable iron (pedogenic iron) is less than 1 percent throughout the mineral pedon. The weighted average dithionite-citrate extractable aluminum content is commonly 0.67 times less than that found in competing series. The ratio of ammonium oxalate extractable iron to dithionite-citrate extractable iron is high, greater than 0.15. These characteristics provide a distinction from other series, particularly the Brimfield series.

Diagnostic horizons and features recognized in this pedon include:
1. Ochric epipedon - the zone from 0 to 18 cm) (O and A horizons).
2. Cambic horizon - the zone from 18 to 41 cm (Bw1 and Bw2 horizons).
3. Lithic contact - hard bedrock at 41 cm (2R horizon).
4. Particle-size control section - the zone from 25 to 41 cm.
5. Loamy (coarse-loamy) particle-size class - the control section from 25 to 41 cm) averages less than 35 percent clay in fine-earth fraction and the soil is in a Lithic subgroup.
6. Lithologic discontinuity - till with rock fragments from mixed sources overlying single kind of hard bedrock at 41 cm.

ADDITIONAL DATA: M.S. Thesis work by Shawn McVey, University of Connecticut, 2006. Full characterization data for sample no. S00CT007004, S99CT005001 and S98NY061001. Partial characterization data for sample no. S99NY061003 and S99NY061003A-3D. Analyzed by the NSSL, Lincoln, NE.

National Cooperative Soil Survey
U.S.A.

LOCATION NEWFIELDS NH+MA

Established Series
HRM-RJK-DAS
01/2013

NEWFIELDS SERIES

The Newfields series consists of very deep, moderately well drained soils formed in a loamy mantle underlain by sandy till on upland hills, moraines, till plains, and mountain side slopes. Saturated hydraulic conductivity is moderately high to very high. Slope ranges from 0 through 25 percent. Mean annual precipitation is about 40 inches (1016 millimeters), and mean annual temperature is about 48 degrees F. (9 degrees C.).

TAXONOMIC CLASS: Coarse-loamy over sandy or sandy-skeletal, mixed, active, mesic Oxyaquic Dystrudepts

TYPICAL PEDON: Newfields fine sandy loam, on a nearly level slope in a wooded area. The surface is covered by a 1 inch (3 centimeter) layer of leaves and twigs. (Colors are for moist soil.)

Ap -- 0 to 9 inches (0 to 23 centimeters); very dark grayish brown (10YR 3/2) fine sandy loam; light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine and medium, and common coarse roots; 5 percent gravel; moderately acid; abrupt smooth boundary. (4 to 10 inches (10 to 25 centimeters) thick.)

Bw1 -- 9 to 20 inches (23 to 51 centimeters); yellowish brown (10YR 5/6) fine sandy loam; weak medium granular structure; very friable; common medium and few coarse roots; 10 percent gravel; moderately acid; clear wavy boundary.

Bw2 -- 20 to 28 inches (51 to 71 centimeters); olive yellow (2.5Y 6/6) fine sandy loam; weak medium granular structure; very friable; common fine and few medium roots; 10 percent gravel; moderately acid; clear wavy boundary. (Combined thickness of the Bw horizon is 5 to 30 inches (13 to 76 centimeters).)

BC -- 28 to 35 inches (71 to 89 centimeters); light yellowish brown (2.5Y 6/4) fine sandy loam; massive; friable; few fine and medium roots; 5 percent gravel; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation and many medium distinct light gray (5Y 7/2) iron depletions; moderately acid; clear wavy boundary. (0 to 20 (0 to 51 centimeters) inches thick.)

2C1 -- 35 to 43 inches (89 to 109 centimeters); light yellowish brown (2.5Y 6/4) gravelly loamy sand; massive; friable; 25 percent gravel; many medium prominent strong brown (7.5YR 5/8) and common fine prominent yellowish red (5YR 5/8) masses of iron accumulation, and many medium distinct light gray (5Y 7/2) iron depletions; moderately acid; clear wavy boundary. (0 to 30 inches (0 to 76 centimeters) thick.)

2C2 -- 43 to 64 inches (109 to 163 centimeters); pale olive (5Y 6/3) gravelly loamy sand; massive; friable; 25 percent gravel; common fine prominent strong brown (7.5YR 5/8) masses of iron accumulation and many medium faint light gray (5Y 7/2) iron depletions; moderately acid.

TYPE LOCATION: Rockingham County, New Hampshire; Town of Atkinson, 300 feet south of Province Hill Road from a point on Province Hill Road .35 mile northeast of the intersection of Salem Road and Province Hill Road; USGS Haverhill, NH topographic quadrangle; Latitude 42 degrees, 49 minutes, 20 seconds North, longitude 71 degrees, 8 minutes, 50 seconds West, NAD 83.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 15 through 36 inches (38 through 91 centimeters). Depth to bedrock is typically greater than 60 inches (1.5 meters). Rock fragments range from 0 through 30 percent in the solum and 5 through 60 percent in the substratum. Rock fragments are dominantly granite, gneiss, schist, and quartzite gravel, but can often include cobbles, stones and boulders. Reaction ranges from extremely acid through slightly acid.

The Ap horizon has hue of 7.5YR or 10YR, value of 2 through 4, and chroma of 2 through 4. Some pedons have an A horizon that has value of 2 through 3 and chroma of 1 through 3. Some pedons have an E horizon that has hue of 10YR or 2.5Y, value of 4 through 7, and chroma of 1 or 2. Texture of the Ap, A and E horizons is fine sandy loam, loam, sandy loam, or very fine sandy loam in the fine-earth fraction.

The Bw horizon has hue of 7.5YR through 2.5Y, value of 4 through 6, and chroma of 3 through 8. Texture is dominantly fine sandy loam in the fine-earth fraction, but includes thin subhorizons of sandy loam and very fine sandy loam in the upper part, with the weighted average of coarse-loamy material containing less than 50 percent fine or coarser sand. Some pedons have a Bs horizon.

The BC horizon has color and texture similar to the Bw horizon.

The 2C horizon has hue of 10YR through 5Y, value of 4 through 7, and chroma of 2 through 4. Texture is loamy sand, loamy fine sand, loamy coarse sand, fine sand, or sand in the fine-earth fraction. Some pedons have lenses of sand and gravel. Structure is weak thin platy or the horizon is massive. Consistence is very friable or friable, but may contain thin subhorizons with firm consistence.

COMPETING SERIES: There are currently no other series in the same family.

The Agawam, Branford, Canton, Deerfield, Haven, Narragansett, Scituate, and Sutton series are in related families. Agawam, Branford, and Haven soils have either stratified sand or sand and gravel in the series control section. The Canton and Narragansett soils do not have redoximorphic features. Deerfield soils have sandy textures in the solum. Scituate and Sutton soils have coarse-loamy particle-size control sections.

GEOGRAPHIC SETTING: Newfields soils are nearly level through moderately steep soils of glaciated uplands and morianes. Slope ranges from 0 through 25 percent. The soils formed in a loamy mantle over acid sandy melt out till of Wisconsin age derived mainly from granite, gneiss, or quartzite. The till generally contains cobbles and stones with some boulders. Mean annual precipitation ranges from 30 through 50 inches (889 through 1270 millimeters), and mean annual temperature ranges from 47 through 52 degrees F. (8 through 11 degrees C.).

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Canton, Leicester, Montauk and Scituate soils. Newfields soils are in a drainage sequence with the well drained Canton soils and the poorly drained Leicester soils. Montauk soils have a dense substratum and are in higher positions on the landscape. Scituate soils have a dense substratum and are in similar positions on the landscape.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Moderately well drained. Runoff ranges from slow to rapid. Saturated hydraulic conductivity is moderately high to very high.

USE AND VEGETATION: Most of these soils are presently forested although some areas were tilled at one time. Common species are northern red oak, eastern white pine, and red maple.

DISTRIBUTION AND EXTENT: Southeastern New Hampshire and southeastern Massachusetts. MLRA's 144A and 149B. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Rockingham County, New Hampshire, 1986.

REMARKS: The 2010 revision reflected changes to the range in characteristics as well as general updating to metric units. This series was classified to the 10th edition of Keys to Soil Taxonomy with that revision. The former classification was coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Dystrochrepts. Historical notes are maintained in the maintenance file, OSD Historical Notes.

There is some debate over the source of the loamy mantle, one theory places it as aeolian.

The diagnostic horizons and features recognized in this pedon are:
1. Ochric epipedon - the zone from 0 to 9 inches (0 to 23 centimeters) (Ap horizon).
2. Cambic horizon - the zone from 9 to 35 inches (23 to 89 centimeters) (Bw1, Bw2, BC horizons).
3. Contrasting particle-size class - both the coarse-loamy part and the sandy part of the particle-size control section are greater than 5 inches (12.5 cm) thick and the transition zone between the two parts is less than 5 inches (12.5 cm) thick.
4) Particle-size control section - the zone from 10 through 40 inches (25 through 100 centimeters) (part of the Bw1, Bw2, BC, 2C1 horizons).
5) Lithologic discontinuity - at a depth of 35 inches (89 centimeters).

National Cooperative Soil Survey
U.S.A.

LOCATION RIDGEBURY MA+CT NH NJ NY RI

Established Series
Rev. WHT-SMF-JTI
09/2014

RIDGEBURY SERIES

The Ridgebury series consists of very deep, somewhat poorly and poorly drained soils formed in till derived mainly from granite, gneiss and schist. They are commonly shallow to a densic contact. They are nearly level to gently sloping soils in low areas in uplands. Slope ranges from 0 to 15 percent. Saturated hydraulic conductivity ranges from moderately low to high in the solum and very low to moderately low in the substratum. Mean annual temperature is about 49 degrees F. and the mean annual precipitation is about 45 inches.

TAXONOMIC CLASS: Loamy, mixed, superactive, acid, mesic, shallow Aeric Endoaquepts

TYPICAL PEDON: Ridgebury sandy loam - on a 3 to 8 percent slope in an extremely stony wooded area at an elevation of about 334 m. (Colors are for moist soil.)

A--0 to 13 cm. (0 to 5 inches); black (N 2/0) fine sandy loam; weak medium and coarse granular structure; friable; many very fine, fine and medium tree roots; 5 percent gravel and 5 percent cobbles; very strongly acid; abrupt smooth boundary. (5 to 25 cm (2 to 10 inches) thick)

Bw--13 to 23 cm. (5 to 9 inches); brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; friable; few fine tree roots; 5 percent gravel and 5 percent cobbles; very strongly acid; abrupt wavy boundary. (8 to 22 cm (3 to 9 inches) thick)

Bg--23 to 46 cm. (9 to 18 inches); dark gray (10YR 4/1) gravelly sandy loam; massive; friable; 10 percent gravel and 5 percent cobbles; common fine prominent yellowish brown (10YR 5/6) and common medium distinct reddish brown (5YR 4/4) masses of iron accumulation; very strongly acid; gradual wavy boundary. (10 to 43 cm (4 to 17 inches) thick)

Cd--46 to 165 cm. (18 to 65 inches); gray (5Y 5/1) gravelly sandy loam; massive; firm; l0 percent gravel and 5 percent cobbles; common fine prominent reddish yellow (7.5YR 6/8) masses of iron accumulation; very strongly acid.

TYPE LOCATION: Hampshire County, Massachusetts; Town of Pelham; 1,600 feet east of Route 202 at a point 3,950 feet south of its junction with Amherst Road; USGS Shutesbury quadrangle; latitude 42 degrees 22 minutes 53 seconds N. and longitude 72 degrees 23 minutes 45 second W., NAD 27.

RANGE IN CHARACTERISTICS: Depth to the dense till commonly is 36 to 48 cm (14 to 19 inches). The A horizon has 5 to 25 percent gravel, 0 to 10 percent cobbles, and 0 to 25 percent stones by volume. The B and C horizons have 5 to 25 percent gravel, 0 to 5 percent cobbles and 0 to 5

percent stones. Rock fragments within the soil range from 5 to 35 percent by volume and are subangular fragments. The unlimed soil ranges from very strongly acid through moderately acid but some horizon within a depth of 100 cm (40 inches) is moderately acid.

The O horizon, where present, has hue of 7.5YR to 2.5Y, value of 2, 2.5, or 3 and chroma of 0 to 2.

The A or Ap horizon is neutral or has hue of 10YR to 5Y, value of 2, 2.5, or 3 and chroma of 0 to 2. Texture is sandy loam, fine sandy loam or loam in the fine-earth fraction.

Some pedons have a thin E horizon with hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. Texture is the same as the A horizon.

The B horizon is neutral or has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 0 to 3. The chroma is 4 in some places. Chroma of 3 or 4 is restricted to subhorizons. Redoximorphic features are few to many and are distinct or prominent. Texture is sandy loam, fine sandy loam, very fine sandy or loam in the fine earth fraction with fifteen percent or more fine sand or coarser and clay content less than 18 percent. The B horizon has subangular blocky structure, weak to moderate very thin to medium platy structure or is massive. It is very friable or friable.

The Cd layer has hue of l0YR to 5Y, value of 3 to 6, and chroma of 1 to 4. It commonly has distinct or prominent redoximorphic features which generally become less abundant with depth but the range includes faint. Texture is coarse sandy loam, sandy loam, fine sandy loam, very fine sandy or loam in the fine-earth fraction. Consistence is firm or very firm and brittle. It is massive or has plates. Any physical aggregation is considered to not be pedogenic.

Some pedons have a C horizon below the Cd that is firm but not brittle.

COMPETING SERIES: There are no series currently in the same family.

The Painesville, Punsit, and Sun series are in a closely related family. Painesville soils lack a densic contact. Punsit soils have more than 60 percent silt plus very fine sand in the particle size control section. Sun soils formed in till derived from limestone and sandstone.

GEOGRAPHIC SETTING: The nearly level to gently sloping Ridgebury soils are in slightly concave areas and shallow drainageways of till uplands. Slope ranges from 0 to 15 percent. The soils formed in loamy till derived mainly from granite, gneiss and schist. Mean annual air temperature ranges from 7 to 11 degrees C (45 to 52 degrees F) and mean annual precipitation ranges from 1016 to 1270 mm (40 to 50 inches). Mean growing season ranges from 100 to 195 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These include the Charlton, Chatfield, Hollis, Leicester, Paxton and Sutton, Whitman and Woodbridge soils. Ridgebury is a member of a drainage sequence that includes the well drained Paxton, moderately well drained Woodbridge, and very poorly drained Whitman soils. Charlton and Sutton soils are better drained and have friable substrata. Chatfield and Hollis soils have bedrock within depths of 100 and 50 cm (40 and 20 inches) respectively. Leicester soils do not have a densic contact.

DRAINAGE AND PERMEABILITY: Commonly poorly drained but the range includes the wetter part of somewhat poorly drained. Runoff is negligible to medium. Saturated hydraulic conductivity ranges from moderately low to high in the solum and very low to moderately low in the substratum. A

perched, fluctuating water table above the dense till saturates the solum to or near the surface for 7 to 9 months of the year.

USE AND VEGETATION: Largely forested to gray birch, yellow birch, red maple, hemlock, elm, spruce and balsam fir. Cleared areas are used mainly for hay and pasture.

DISTRIBUTION AND EXTENT: Glaciated landforms in Connecticut, Massachusetts, New Hampshire, New Jersey, New York, and Rhode Island. (MLRAs 142, 144A, 145, and 149B) The series is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Franklin County, Vermont, 1948.

REMARKS: An analysis of Ridgebury soils in 2002 for 38 surveys showed that this series most commonly has a densic contact at 40 to 60 cm (16 to 24 inches) including 8 surveys with the depth to a densic contact at 50 cm (20 inches). The average depth to a densic contact was 50 cm (20 inches) - the data showed an almost even split between depth class occurrences. A review of characterization data for Ridgebury soils shows a very slight dominance in the acid reaction class. Any physical aggregation in the Cd is considered to not be pedogenic. The type location is currently within the officially designated mesic zone in Massachusetts. Previous revision of this series ws 12/2005.

Diagnostic horizons and features in this pedon include:

1. Ochric epipedon - the zone from 0 to 13 cm (0 to 5 inches) (A horizon).
2. Aeric feature 100 percent of the zone from 13 to 23 cm (5 to 9 inches) has hue of 10YR and both color value moist of 4 and chroma moist of 3 (Bw1 horizon).
3. Cambic horizon - the zone from 13 to 46 cm (5 to 18 inches) (Bw and Bg horizons).
3. Densic contact root limiting material begins at 46 cm (18 inches) (Cd).
4. Endosaturation the zone from 23 to 46 cm (9 to 18 inches) is saturated above the densic contact (Bw2 horizon). A seasonal high water table is perched above the densic materials.
5. Reaction - the pH in the zone from 25 to 46 cm (10 to 18 inches) (control section for reaction) is presumed less than 5.0 in 0.01 M CaCl2 (1:2) (see remarks).
6. Series control section - the zone from 0 to 71 cm (0 to 28 inches).

ADDITIONAL DATA: Reference samples from pedons S00CT013002, S58MA015006, S57MA023004, S77MA005003, S95NH013005, S96NH013002 from Connecticut, Massachusetts, and New Hampshire, samples by NSSL, Lincoln, NE, various years.

National Cooperative Soil Survey
U.S.A.

LOCATION WESTBROOK CT+MA MD NH

Established Series
Rev. MFF
06/2014

WESTBROOK SERIES

The Westbrook series consists of very deep, very poorly drained soils formed in organic deposits over loamy mineral material. They are in tidal marshes subject to inundation by salt water twice daily. Saturated hydraulic conductivity is moderately high to very high in the organic layers and low to high in the underlying mineral sediments. Mean annual temperature is about 10 degrees C and mean annual precipitation is about 1143 mm.

TAXONOMIC CLASS: Loamy, mixed, euic, mesic Terric Sulfihemists

TYPICAL PEDON: Westbrook mucky peat - salt grass tidal marsh, undrained at an elevation of about 37 feet. (Colors are for moist soil unless otherwise noted.)

0e1--0 to 25 cm (0 to 10 in); very dark gray (10YR 3/1) mucky peat; dark gray (10YR 4/1) dry; 65 percent fiber, 30 percent rubbed; dense mat of roots, stems and leaves; massive; slightly sticky; many very fine; fine and medium roots; fibers herbaceous; thin lenses and coatings of silt; 45 percent organic matter; strongly saline (total salts 58 deciSiemens per meter); slightly acid; clear wavy boundary. ((12 to 30 cm (5 to 12 inches thick))

0e2--25 to 102 cm (0 to 40 in); very dark gray (10YR 3/1) mucky peat, dark gray (10YR 4/1) dry; 50 percent fiber, 25 percent rubbed; massive; slightly sticky; few very fine, fine; and medium roots; fibers herbaceous; thin lenses and coatings of silt; 44 percent organic matter; strongly saline (total salts 34 deciSiemens per meter; moderately acid; gradual wavy boundary. ((20 to 100 cm (8 to 40 inches thick))

0e3--102 to 122 cm (40 to 48 in); dark olive gray (5Y 3/2) mucky peat, dark gray (10YR 4/1) dry; 35 percent fiber, 25 percent rubbed; massive; slightly sticky; fibers herbaceous; 24 percent organic matter; strongly saline (total salts 36 deciSiemens per meter); neutral; clear wavy boundary. (0 to 61 inches thick)

Cg1--122 to 163 cm (48 to 64 in); very dark gray (5Y 3/1) silt loam, dark gray (10YR 4/1) dry; massive; slightly sticky; 12 percent organic matter; strongly saline (total salts 28 deciSiemens per meter); neutral; diffuse wavy boundary. ((0 to 51 cm (0 to 20 inches thick))

Cg2--163 to 250 cm (64 to 99 in); dark gray (N 4/) silt loam, dark gray (10YR 4/1) dry; massive; slightly sticky; 10 percent organic matter; few small shell fragments; and very slightly saline to strongly saline; strongly saline (total salts 31 deciSiemens per meter); slightly acid.

TYPE LOCATION: Middlesex County, Connecticut; town of Westbrook, 500 feet south of Route 1

(Boston Post Road) at a point 600 feet southwest along US Route 1 from the intersection with Hammock Road; on the Essex USGS topographic quadrangle, latitude 41 degrees 16 minutes 30 seconds N., longitude 72 degrees 28 minutes 18 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Thickness of the organic deposits ranges from 40 to 130 cm (16 to 51 in). The soil is strongly acid to slightly alkaline and very slightly saline to strongly saline. In a 1:5 soil to water mixture by volume the conductivity ranges from 0.0 to 4.5 deciSiemens per meter. Thin lenses of silt and very fine sand are common in the organic horizons.

The surface tier is neutral or has hue of 5YR to 5Y, value of 2 to 5 and chroma of 0 to 3. It is typically hemic materials but some pedons have fibric materials. Organic matter content ranges from 20 to 80 percent or more.

The subsurface and bottom tiers are neutral or have hue of 5YR to 5Y, value of 2 to 5 and chroma of 0 to 3. The organic materials are dominantly hemic but some pedons have layers of fibric or sapric materials up to 30 cm (12 in) thick. Organic matter content ranges from 20 to 90 percent and generally decreases with depth.

The C horizon is neutral or has hue of 10YR to 5BG, value of 2 to 7 and chroma of 0 to 2. Texture ranges from sandy loam to silty clay loam but typically is silt, silt loam or very fine sandy loam. Organic matter content ranges from less than 5 percent to 20 percent. Shell fragments and herbaceous fibers are common in the C horizon.

COMPETING SERIES: Honga and Mispillon are in the same family. Honga and Mispillon are from outside LRR R and S. Honga soils have an underlying argillic horizon and Mispillion soils have a firmer substratum (n value greater than 0.7).

Bestpitch and Pawcatuck soils are similar soils in related families. Bestpitch soils are underlain by clayey materials. Pawcatuck soils are underlain by sandy materials within a depth of 40 to 130 cm (16 to 51 in).

GEOGRAPHIC SETTING: Westbrook soils are level soils in tidal marshes. They are subject to tidal flooding twice daily except in areas protected by dikes and tide gates. Westbrook soils developed in partially decomposed organic material from salt tolerate herbaceous plants over loamy sediments. Mean annual temperature is 7 to 13 degrees C (45 to 55 degrees F) and mean annual precipitation is 1000 to 1270 mm (40 to 50 in).

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Ipswich , Matunuck, and Pawcatuck soils in nearby tidal marsh areas. Ipswich soils have organic materials deeper than 120 cm (51 in). Matunuck soils are mineral soils and have an organic surface layer less than 40 cm (16 in) thick. Westbrook soils are near a wide variety of soils on nearby uplands formed in a glacial drift or marine deposited mineral materials.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Very poorly drained. Runoff is very slow. Saturated hydraulic conductivity is moderately high to very high in the organic layers and low to high in the underlying mineral sediments. Unless protected, these soils are flooded by tidewaters twice daily.

USE AND VEGETATION: Most areas are in salt marsh and provide food and habitat for fish,

shellfish and wildfowl. Small scattered areas are in saltgrass hay. The most common grasses are salt meadowgrass, salt water grass and spike grass. Other vegetation includes blackgrass, sea lavender, saltwort, seaside goldenrod, aster, and purple gerardi. In areas where the 1:5 EC by volume is below 1.5 deciSiemens per meter, vegetation consists principally of tall reeds and sedges.

DISTRIBUTION AND EXTENT: Coastal areas and along tidally influenced rivers of Connecticut, New Hampshire, Massachusetts, New Jersey, Maryland and Delaware; MLRAs 144A, mesic areas within 144B, 145, 149A, 149B, and 153C. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts

SERIES ESTABLISHED: New Haven County, Connecticut, 1976.

REMARKS: Westbrook soils were formerly mapped as Tidal marsh, undifferentiated. Some of the Westbrook soils are classified and mapped at the great group or subgroup level. Westbrook series was originally described as consisting of fibric organic materials. Current procedures for estimating fibers indicate that the materials are dominantly hemic. These soils become extremely acid when drained.

Diagnostic features and characteristics recognized in this pedon include:

1. Histic epipedon - the zone from 0 to 30 centimeters (Oe horizon).
2. Estimated fiber content indicates that the materials are dominantly hemic.
3. Sulfidic materials are within 100 cm. of the surface. New pedons should include incubation pH measurements to determine if horizons should receive a 'se' subordinate distinction due to sulfate content.
4. Loamy particle size class - mineral layer of silt loam 130 cm. thick within the control section - from 120 to 251 cm (48 to 99 in) (Cg1 and Cg2 horizons)
5. Reaction (pH value) is more than 4.5 throughout the control section.

ADDITIONAL DATA: This pedon is entered as 2008CT007001 in the National Soils Information System from the State of Connecticut Soil Survey manuscript.

Refer to publication "Tidal Marshes of Connecticut and Rhode Island," Hill, D. E. and Shearin, A. E., Connecticut Agricultural Experiment Station Bulletin 709, Feb. 1970.

National Cooperative Soil Survey
U.S.A.

APPENDIX C

DISTURBED SOIL MAPPING UNIT SUPPLEMENT

Supplemental Symbols

The five components of the Disturbed Soil Mapping Unit Supplement are as follows:

Symbol 1: Drainage Class
a-Excessively Drained
b-Somewhat Excessively Drained
c-Well Drained
d-Moderately Well Drained
e-Somewhat Poorly Drained
f-Poorly Drained
g-Very Poorly Drained
h-Not Determined

Symbol 2: Parent Material (of naturally formed soil only, if present)
a-No natural soil within 60"
b-Glaciofluvial Deposits (outwash/terraces of sand or sand and gravel)
c-Glacial Till Material (active ice)
d-Glaciolacustrine very fine sand and silt deposits (glacial lakes)
e-Loamy/sandy over Silt/Clay deposits
f-Marine Silt and Clay deposits (ocean waters)
g-Alluvial Deposits (floodplains)
h-Organic Materials-Fresh water Bogs, etc
i- Organic Materials-Tidal Marsh

Symbol 3: Restrictive/Impervious Layers
a-None
b-Bouldery surface with more than 15% of the surface covered with boulders
c-Mineral restrictive layer(s) are present in the soil profile less than 40 inches below the soil surface such as hard pan, platy structure or clayey texture with consistence of at least firm (i.e. more than 20 newtons). For other examples of soil characteristics that qualify for restrictive layers, see "Soil Manual for Site evaluations in NH" 2nd Ed., (page 3-17, figure 3-14)
d-Bedrock in the soil profile; 0-20 inches
e-Bedrock in the soil profile; 20-60 inches
f-Areas where depth to bedrock is so variable that a single soil type cannot be applied, will be mapped as a complex of soil types
g-Subject to Flooding
h–Man-made impervious surface including pavement, concrete, or built-up surfaces (i.e. buildings) with no morphological restrictive layer within control section

Symbol 4: Estimated Ksat* (most limiting layer excluding symbol 3h above).
a- High.
b-Moderate
c-Low
d-Not determined
*See "Guidelines for Ksat Class Placement" in Chapter 3 of the Soil Survey Manual, USDA

Symbol 5: Hydrologic Soil Group*
a-Group A
b-Group B
c-Group C
d-Group D
e-Not determined

*excluding man-made surface impervious/restrictive layers

APPENDIX D

LIMITATIONS

NATURAL RESOURCE SURVEY AND ASSESSMENT
LIMITATIONS

Use of Report

1. GZA GeoEnvironmental, Inc. (GZA) has prepared this report on behalf of, and for the exclusive use of Altus Engineering, Inc. ("Client") for the stated purpose(s) and location(s) identified in the report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not identified in the agreement, for any use, without our prior written permission, shall be at that party's risk, and without any liability to GZA.

Standard of Care

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Report and/or proposal, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the data gathered and observations made during the course of our work. Conditions other than described in this report may be found at the subject location(s).

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

Limits to Observations

4. Natural resource characteristics are inherently variable. Biological community composition and diversity can be affected by seasonal, annual or anthropogenic influences. In addition, soil conditions are reflective of subsurface geologic materials, the composition and distribution of which vary spatially.

5. The observations described in this report were made on the dates referenced and under the conditions stated therein. Conditions observed and reported by GZA reflect the conditions that could be reasonably observed based upon the visual observations of surface conditions and/or a limited observation of subsurface conditions at the specific time of observation. Such conditions are subject to environmental and circumstantial alteration and may not reflect conditions observable at another time.

6. The conclusions and recommendations contained in this report are based upon the data obtained from a limited number of surveys performed during the course of our work on the site, as described in the Report. There may be variations between these surveys and other past or future surveys due to inherent environmental and circumstantial variability.

Reliance on Information from Others

7. Preparation of this Report may have relied upon information made available by federal, State and local authorities; and/or work products prepared by other professionals as specified in the report. Unless specifically stated, GZA did not attempt to independently verify the accuracy or completeness of that information.

Compliance with Regulations and Codes

8. GZA's services were performed to render an opinion on the presence and/or condition of natural resources as described in the Report. Standards used to identify or assess these resources as well as regulatory jurisdiction, if any, are stated in the Report. Standards for identification of jurisdictional resources and regulatory control over them may vary between governmental agencies at federal, State and local levels and are subject to change over time which may affect the conclusions and findings of this report.

New Information

9. In the event that the Client or others authorized to use this report obtain information on environmental regulatory compliance issues at the site not contained in this report, such information shall be brought to GZA's attention forthwith. GZA will evaluate such information and, on the basis of this work, may modify the conclusions stated in this report.

Additional Services

10. GZA recommends that we be retained to provide further investigation, if necessary, which would allow GZA to (1) observe compliance with the concepts and recommendations contained herein; (2) evaluate whether the manner of implementation creates a potential new finding; and (3) evaluate whether the manner of implementation affects or changes the conditions on which our opinions were made.

APPENDIX E:

SWPPP
for
PEIRCE ISLAND WASTEWATER TREATMENT PLANT

Storm Water Pollution Prevention Plan
For
Peirce Island Wastewater Treatment Plant
Peirce Island Road
Portsmouth, NH 03801

City of Portsmouth, NH

January 2009

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Engineer: David S. Allen, P.E.

Signature: _____

Registration Number: _____

Date: _____

TABLE OF CONTENTS

APPENDIXES

1 – FACILITY OWNER and OPERATOR

Facility Owner, Address, and Telephone

City of Portsmouth
1 Junkins Avenue
Portsmouth, NH 03801
(603) 431-2000

Facility Operator, Address, and Telephone

Peirce Island Wastewater Treatment Plant
Peirce Island Road
Portsmouth, NH 03801
(603) 427-1553

2 – FACILITY CONTACT:

Name	Title	Telephone
David Allen, P.E.	Public Works Deputy Director	(603) 766-1421
Paula Anania	Chief Plant Operator	(603) 427-1553
Eric Taylor	Assistant Chief Plant Operator	(603) 427-1553

3 – STORM WATER POLLUTION PREVENTION TEAM

The Storm Water Pollution Prevention Team is a group of municipal employees, who will develop, implement, maintain and revise the storm water pollution prevention programs. These employees are on site and most familiar with the facility and its operations.

Collectively, the Storm Water Pollution Prevention Team is responsible for the following:

- Implementing all general permit and pollution prevention plan requirements;
- Defining and agreeing upon an appropriate set of goals for the facility storm water management program;
- Being aware of any changes that are made in facility operations to determine whether any changes must be made to the Stormwater Pollution Prevention Plan;
- Maintaining a clear line of communication between facility personnel and management to ensure a cooperative partnership.

The SWPPP team for this facility is:

Public Works Deputy Director
- Sets policy in accord with the storm water pollution prevention regulations
- Signatory authority; overall responsible for the plan.

Engineer for Water & Sewer Division

- Coordinate and ensure consistency of water and sewer projects in accord with the City's SWPPP

Chief Plant Operator

- Responsible for following the preventive maintenance program
- Implementing BMPs within scope of authority
- Oversee maintenance practices identified as BMPs in the overall plan
- Keep records
- Implement and oversee employee training
- Conduct or provide for inspections or monitoring activities

Solid Waste Coordinator

- Designated SWPPP Coordinator
- Write, review, revise SWPPP
- Coordinate plan development and implementation
- Keep records
- Ensure reports submitted
- Evaluate existing environmental management plans (i.e. SPCC) for consistency and coordination
- Facilitate implementation of BMPs

4 – FACILITY DESCRIPTION

The Pierce Island Wastewater Treatment Plant (WWTP) is the City's primary sewage treatment facility with a design flow of 4.8 MGD located on the eastern end of Peirce Island in Portsmouth, New Hampshire. This facility serves a population of approximately 23,000 and discharges treated sewage directly into the Piscataqua River. This facility is permitted by the New Hampshire DES Waste Management Division (Facility Identification Number NH0100234). The Facility is situated on 3.7 acres and is approximately 50% impervious. It is comprised of various operations, including a grit/chemical feed building, a sludge processing building and chlorine tanks.

Grit/Chemical Feed Building

This building receives raw sewage and removes grit and sludge. Sewage is then pumped to a gravity thickener tank and two primary clarifiers. Chemicals associated with this treatment are not exposed to storm water. The chemical feed tanks have secondary containment of at least 110%. The tanks have sensors, which monitor for leakage.

Sludge Processing Building

From the primary clarifiers, settlable solids are pumped to the gravity thickener and then flow to the sludge holding tanks. From the holding tanks, pressed sludge is dropped into a covered 30-yard container via a conveyor ramp. The sludge is then hauled and disposed of at Turnkey Landfill in Rochester, New Hampshire as needed. This process is within the building and nothing is exposed to storm water.

Chlorine Contact Tanks
The remaining liquid sewage is pumped into chlorine contact tanks and disinfected in accordance with industry and regulatory standards. Under the NHDES permit NH0100234 requirements and limiations, the treated liquid is discharged into the Piscataqua River.

5 – SITE DRAINAGE PATTERNS

Precipitation in calendar year 2008 was 63.07".

Drainage Map
Appendix A "Drainage Plan Peirce Island Wastewater Treatment Plant" depicts the Facility and drainage patterns.

Drainage Pattern for Grit/Chemical Feed Building, Control Building, and Filter Building Area (D-01)
Storm water falling in catchment area D-01 is collected via run-off from impervious pavement areas and roof areas into a closed drain system constructed of 12" RCP, 4 catch basins and 3 drain manholes and a series of non-perforated perimeter drains with associated clean-outs. Storm water exits the system outfall into the Piscataqua River.

Drainage Pattern for Sludge Processing Building Area (D-02)
Drainage in area D-02 is collected via run-off from impervious pavement areas and roof areas into a closed drain system constructed of 12" RCP, 1 catch basin. Stormwater exits the system outfall and travels down a high embankment to the Piscataqua River below.

Stormwater Run-on
There is no stormwater run-on from adjacent properties. Minimal sheet flow / over land run off occurs.

6 - RECEIVING WATERS, WETLANDS AND IMPAIRED WATERS

In New Hampshire, water quality standards are used to protect the state's surface waters. Standards consist of three parts:

1. Designated uses, such as fishing or swimming;
2. Numerical or narrative criteria to protect the designated uses; and
3. An anti-degradation policy, which maintains existing high quality water that exceeds the criteria. Criteria are established by statute (http://www.gencourt.state.nh.us/rsa/html/L/485-A/485-A-8.htm) and by administrative rules (http://www.des.state.nh.us/rules/desadmin_list.htm).

Stormwater from the Peirce Island Wastewater Treatment facility discharges to the Lower Piscataqua River.

The Lower Piscataqua River (NHEST600031001-02) is classified as Class B, which means suitable for drinking (after treatment), swimming and fishing. The 303(d) List (Final – 2008) catalogs the Piscataqua River as impaired for polychlorinated biphenyls

(PCBs), enterococcus, dioxin (including 2, 3, 7, 8-TCDD), and mercury. However, as of 2009, no TMDL has been determined for these pollutants of concern. Therefore the WWTP does not have a WLA ascribed.

7 - SUMMARY OF AVAILABLE STORM WATER SAMPLING DATA

Beginning in the first quarter of 2007, samples were collected and analyzed. Samples were analyzed for enterococcus and on a visual basis. Sampling will continue in accord with the 2008 Permit term. See section 11.

All sampling data is maintained at the facility and retained for a period of three (3) years. Cross reference section 10 Record Keeping & Recording.

8 – POTENTIAL STORM WATER CONTAMINANTS

This section identifies significant materials located at the Peirce Island WWTP that may potentially contaminate storm water.

Potential Areas for Storm Water Contamination

The following potential source areas of storm water contamination were identified and evaluated:

The treatment of wastewater is conducted / contained inside the treatment plant facility. Under current operations, there is no chance of storm water becoming contaminated from the internal operations.

Grit/Chemical Feed Building: Ferric Chloride is used to settle out solids. 2 - 4,800 gallon tanks are located on the west side of the Chemical Feed Building. 100% overfill containment is provided.

Administration Building: Trucks deliver supplies to the Administration building. Drips from off-loading vehicles (diesel fuel and/or oil) may occur.

Sludge Processing Building Area: Sodium Hypochlorite and Sodium Bisulfite are substances used in the Sludge Processing Building. There are 2-10,000 gallon chlorine tanks and 1 - 10,000 gallon bisulfite tank. 100% overfill containment is provided. There is also 1 - 2,800 gallon tank of caustic soda for pH control is located outside the filter building, which is surrounded with 100% containment capacity.

Materials Storage: All materials and inventory are warehoused within the facility buildings and are not exposed to storm water.

Locations of Potential Sources of Storm Water Contamination

Drainage Area	Potential Storm Water Contamination Point	Potential Pollutant	Potential Problem
D-01	Grit/Chemical Feed Building, Control Building, and Filter Building	Sewage, Ferric Chloride, Caustic Soda	Overfill/overspills from tank filling operations, sewage overflows from pump failure
D-01	Administration Building	Diesel fuel Oil Automobile Fluids	Leaking fluids from vehicles in loading area
D-02	Sludge Processing Building Area	Sewage, Sodium Hypochlorite, Sodium Bisulfite	Overfill/overspills from tank filling operations, sewage overflows from pump failure

a. SIGNIFICANT MATERIAL INVENTORY

Listed below is a summary of products, which have potential to contaminate storm water run off.

Significant Material Inventory

Trade Name Material	Chemical/Physical Description
Ferric Chloride	Waste water coagulant / amber liquid; slight amine odor
Sodium Hypochlorite	Bleach disinfectant / green to yellow liquid; pungent chlorine-like odor
Sodium Bisulfite	Aqueous solution / yellow liquid; pungent sulfur dioxide gas odor
Sewage	Used water and water carried solids from homes that flow to the treatment plant. Preferred term is wastewater.

b. HISTORIC SPILL and LEAK RECORD

There is no known past spill history associated with this facility.

c. NON-STORM WATER DISCHARGES

The following activities are allowable non-storm water discharges:

- Ground water collected from the drainage system and discharged to the two main out falls located to the east and west of the facility and into the Piscataqua River.

9 – STORMWATER BMPs / CONTROL MEASURES

The following best management practices (BMPs), structural and non-structural, are in place to address the above identified potential and existing sources of stormwater contamination and achieve non-numeric effluent limits.

Good House Keeping

Drainage Area	BMP
D-01 D-02	Exterior areas are swept with the City street sweeper as needed.
D-01 D-02	Quarterly inspections of loading area conducted.
D-01 D-02	All trash is stored indoors to prevent contact with stormwater
D-01 D-02	Within designated areas, oil drums stored on pallets with secondary containment.
	375-gallon polymer totes are stored inside; no exposure to storm water.
	All fill lines are locked to prevent cross over of chemical loads/discharges.
D-01	Chlorine pumps have automated sensor leak detection alarms, which activates the SCADA system (covers after hours on call too.)
	Containment area built around hook up location for ferric chloride and sodium bisulfite

Preventive Maintenance

Drainage Area	BMP
D-01 D-02	Vehicle washing is not allowed at this facility. Work practice is to wash vehicles at DPW.
	Equipment and city vehicles receive 3,000-mile check-ups.
	Grit, screenings and other solids handling storage and disposal areas are located inside to prevent contact with stormwater.
	No sludge drying beds, dried sludge piles, compost piles, septage receiving station, or rail lines are present at the facility.

Salt Storage Pile

Drainage Area	BMP
	Salt and sand are not stored at the WWTP, except in small quantities (bags in interior areas of in covered, labeled drums in exterior areas.

Visual Inspections

Drainage Area	BMP
D-01 D-02	Catch basins will be inspected on a quarterly basis and be cleaned as required.
	System's out falls are inspected in accord with the MSGP 2008 visual assessment requirements (see also section 11.2 of this plan).

Spill Prevention and Response

Drainage Area	BMP
D-01 D-02	Spill response equipment for hydraulic leaks of vehicles and off-loading of diesel fuel is on site.
	The facility has an SOP for spill response and personnel are trained in it.
	Information regarding spill response procedures will be posted in appropriate areas of the Facility, by the hook up locations.
	Primary and secondary contacts for spill response are listed on site.
	After any type of spill incident, the catch basins will always be cleaned – whether spill reached and/or contaminated the catch basin or not.
D-02	The sodium hypochlorite tank is covered and has a secondary containment and an overfill/drip containment system.

Erosion and Sedimentation Controls

Drainage Area	BMP
D-01 D-02	Approximately 50% of the Peirce Island WWTP is paved. Historic observations have shown no areas that are prone to erosion.

Management of Runoff

Drainage Area	BMP
D-01 D-02	There are no structural BMPs present except for the catch basins, pipes and outfalls shown on the site map, i.e. there are no detention ponds.

Employee Training

Drainage Area	BMP
D-01 D-02	All department staff will be trained on the location of materials and method of spill clean-up.
	Monthly Safety Meeting are held between senior and middle management with the crew.

Record Keeping and Recording

Drainage Area	BMP
N/A	The Storm Water Pollution Prevention Plan will be maintained at this facility for the duration of the general permit. The Plan will be reviewed annually by the Storm Water Pollution Prevention Team.
	Spillage of chemicals or sewage is promptly cleaned and reported as required.
	Inspections of the storm water system, catch basins, etc. will be documented and maintained for a minimum of 5 years at the facility.
	All applicable MSDS are kept on site and readily accessible.

10 – RECORD KEEPING AND RECORDING

The Storm Water Pollution Prevention Plan will be maintained at the DPW facility for the duration of the general permit. Copies of the plan are distributed to SWPP Team members. The Plan will be reviewed annually by the Storm Water Pollution Prevention Team.

All monitoring data per Parts 6.2 and 6.3 of the Industrial MSGP and section 11.4 of this SWPPP, shall be submitted to the EPA using the eNOI system (www.epa.gov/npdes/eNOI) no later than 30 days after receiving the laboratory results of the monitoring.

If the eNOI cannot be accessed, paper reporting by the same deadline is allowed. Part 7.6.1 of the Industrial MSGP provides mailing addresses.

Documents, including but not limited to, monitoring, inspections, reports, shall be retained for a period of at least 3 years from the date of the permit's expiration or termination.

11 - FACILITY INSPECTION & MONITORING PLAN

11.1 Routine Facility Inspections

Routine facility inspections of all areas where industrial materials or activities are exposed to stormwater and of all stormwater control measures are to be conducted quarterly.

Inspections shall be performed when the facility is operating and at least once during the calendar year, the inspection shall be conducted when a stormwater discharge is occurring.

Inspections shall be conducted by "Qualified Personnel" as defined in the 2008 Industrial MSGP – those who possess the knowledge and skills to assess conditions and activities that could impact stormwater quality at the facility and who can evaluate the effectiveness of the control measures. In addition, at least one member of the SWPPP team shall also participate.

Per Part 4.1 of the 2008 MSGP, the following areas are to be inspected:

> Treatment Works (Sector T): access roads; grit screenings, and other solids handling, storage, or disposal areas; sludge drying beds; dried sludge piles; septage or hauled waste receiving station..

The form provided in Appendix D shall be used to document the Facility Inspection. Completed Inspection forms shall be maintained, for a minimum of three (3) years, on-site with this SWPPP.

11.2 Quarterly Visual Assessment

Quarterly visual assessments are samples collected, each quarter of the permit term, with the intent of assessing water quality characteristics, such as color, odor, floating solids, oil sheen, foam, etc. The visual inspection shall be conducted on each of the outfalls at the Facility and is intended to be representative of stormwater discharge.

The form provided in Appendix E shall be used to document the Visual Assessment. Completed forms shall be maintained, for a minimum of three (3) years, on-site with this SWPPP.

11.3 Comprehensive Site Inspection

Comprehensive Site Inspections shall be conducted annually beginning with the period authorization to discharge is granted under the Permit (i.e. one year: September 29, 2008 – September 29, 2009). The inspection shall cover all areas of the Facility as described in this SWPPP as having potential pollutant source to precipitation and stormwater run-off. This includes the Grit/Chemical Feed Building; the Sludge Processing Building; and the Chlorine Contact Tanks.

The inspection shall include a review of monitoring data collected (the routine and visual inspection records) as well as impaired waters monitoring as per Section 11.4 of this SWPPP (Cross reference Part 6.2 of the 2008 MSGP.)

11.4 Required Monitoring

The 2008 MSGP includes five (5) types of required analytical monitoring.

a) Quarterly benchmark monitoring

Part 8.T of the Permit specifies benchmark monitoring. There are no additional benchmark monitoring requirements.

b) Annual effluent limitations guidelines monitoring.

There are no effluent limitations guidelines for Waste Water Treatment Plant, Sector T, covered under the MSGP 2008.

c) State or Tribal specific monitoring.

There are no additional State of Tribal monitoring provisions for Waste Water Treatment Plants, Sector T, covered under the MSGP 2008.

d) Impaired waters monitoring

The Peirce Island Waste Water Treatment Plant, through a series of catch basins discharges to the Lower Piscataqua River (Waterbody Id NHEST600031001-02). There is no TMDL yet established for the Lower Piscataqua River. However the Lower Piscataqua River is on the 303(d) list as impaired for polychlorinated biphenyls (PCBs), enterococcus, dioxin (including 2, 3, 7, 8-TCDD), and mercury.

The Peirce Island WWTP has the potential to discharge only enterococcus as a stormwater pollutant. Stormwater at the Peirce Island WWTP is not exposed to PCBs, dioxin or mercury. Further, there is no monitoring requirement for dioxin, mercury and PCBs. Therefore monitoring only for enterococcus at the Peirce Island WWTP is required.

Monitoring shall be conducted once per year at each outfall discharging stormwater into the Lower Piscataqua River. Monitoring shall begin the first full quarter following April 1, 2009 or the date of discharge authorization, whichever comes later.

If the pollutant(s) for Lower Piscataqua River's impairment is not detected above natural background levels after the first year, pollutant monitoring is not required. Proper documentation justifying this shall be written and maintained.

Exceedances of the discharge standards will require this SWPPP to be re-evaluated to determine if concentrations can be reduced through implementing additional BMPs.

e) Other monitoring as required by EPA

There are no additional State of Tribal monitoring provisions for Waste Water Treatment Plants, Sector T, covered under the MSGP 2008.

12 – REVIEW OF DATA

The SWPPP is a "living" document and is required to be updated and/or modified as necessary. The SWPPP shall be reviewed and modified when:

- An authorized release or discharge (i.e. spill or leak) occurs at the facility.
- A discharge violates a numeric effluent limit.
- The Operator becomes aware, or EPA determines, that control measures are not stringent enough for the discharge to meet applicable water quality standards.
- An inspection or evaluation of the facility by EPA, or the State, determines that modifications to the control measures are necessary to meet the non-numeric effluent limits in the permit.

- The Operator determines in the routine facility inspection, quarterly visual assessment or comprehensive site inspection that control measures are not being properly operated and maintained.

13 – ANNUAL REPORT

An Annual Report shall be submitted to the EPA. The EPA provides and strongly recommends using the form provided in the September 29, 2008 Industrial MSGP Appendix I and duplicated in this SWPPP in Appendix F.

14 - TRAINING

The employee training program will be updated and modified to include education regarding storm water pollution prevention regulations and initiatives taken by this facility. The training will discuss the components of the written plan as well as BMPs and procedures to be performed in accord with NPDES Storm Water Phase II requirements. Hands-on training will include petroleum product management; process chemical management; spill prevention and controls; fueling procedures; general good housekeeping; proper procedures for using fertilizer, herbicides and pesticides; and inspection procedures.

15 – ENDANGERED SPECIES

Appendix B contains copies of letters to the U.S. Fish & Wildlife Service, New Hampshire Fish and Game, and NHNHI-DRED documenting the request to evaluate this facility for the presence of endangered species or critical habitat. Response letters are also included.

The United States Department of the Interior, Fish and Wildlife Service indicates there are no federally listed or proposed, threatened, or endangered species under the jurisdiction of the U.S. Fish and Game Service in the facility area. However, there are species identified by the State or other local authorities as endangered and threatened species in proximity to the site:

- Plant Species: Marsh Elder (*Iva frutescens ssp. oraria*). This species is listed on the State of NH Heritage list as threatened but not listed on the Federal list.
- Vertebrate species: Common Tern (*Sterna hirundo*). This species is listed on the State of NH Heritage list as endangered but not listed on the Federal list.

16 – HISTORIC PLACES

Appendix C are letters to the New Hampshire Division of Historical Resources documenting the request to evaluate this facility for the possibility the site is a national historic site. The Historical Resources determined "no adverse effect".

APPENDIX F:

PRE-APPLICATION MEETING MINUTES

AECOM
701 Edgewater Drive
Wakefield, MA 01880
www.aecom.com

781.246.5200 tel
781.245.6293 fax

Meeting Minutes

Date	December 18, 2014
Time	2:00 PM
Project	Peirce Island WWTF Upgrade Portsmouth, NH
JN	60301525
Purpose	Alteration of Terrain Permit Pre-Application Meeting
Attendees	Terry Desmarais – City Engineer Peter Britz – Environmental Planner Ridge Mauck - NHDES Jon Pearson – AECOM Project Manager Erik Meserve – AECOM Project Engineer Jeff Clifford – Altus Engineering

The following is a summary of our meeting held on December 18, 2014. This summary is not a direct transcript, but rather a general summary of the discussion.

ITEM #	DESCRIPTION	ACTION/ACTION BY
1.	Introductions	1. N/A
2.	Overview The City provided an overview of the history of the Peirce Island WWTF, including the 2010 Master Plan, USEPA Consent Decree, piloting, and design of the plant upgrade to date. The City also reviewed the current status of the Pease WWTF evaluation and stated that construction of the Peirce Island WWTF Upgrade would begin between September 2015 and Spring 2016 pending the results of the Pease WWTF evaluation.	1. N/A
3.	Existing Conditions Altus stated that the site is mostly ledge and fill. A soil survey has been completed for the site and the soils on-site are predominantly B and C soils where not ledge. Site constraints include height concerns from nearby neighbors and construction activities	1. N/A

ITEM #	DESCRIPTION	ACTION/ACTION BY
	outside the fence because of the heavy recreational use of the island and archeological considerations. The existing stormwater system divides the site and discharges stormwater to one of two outfalls. One outfall discharges on the river side of the facility while the other discharges towards Shapleigh Island through a swale and wetland.	
4.	Proposed Improvements Altus stated a number of new structures would be constructed on the site, including a new Headworks Building, new BAF Facility, new Solids Building, and a new Gravity Thickener. The new BAF Facility and Solids Building are connected, which effectively divides the site from a stormwater standpoint. The proposed stormwater management upgrades include a rain garden, level spreader for the roof drainage from the Headworks Building, and a 5,000 gallon Water Quality Inlet. Additionally, the BAF Facility is several open-top tanks that will catch and treat the stormwater that falls on it. The amount of stormwater that is projected to be discharged to the river side through the WQI will increase over the existing condition. The amount of stormwater discharged towards Shapleigh Island is projected to decrease. The project will result in a net decrease in stormwater. Lastly, there are two areas that are planned for embankment stabilization. One area on the river side of the plant is eroding due to weak rock. The other area facing Shapleigh Island will be filled in order to provide access around the new BAF Facility. NHDES stated that the goal of the state's stormwater program is to see a net	1. N/A

ITEM #	DESCRIPTION	ACTION/ACTION BY
	improvement in the existing level of treatment and to meet today's criteria for treatment for any increases in impervious area. However, the state has the authority to waive these rules if the proposed improvement are "equally protective" as the current system. NHDES stated that based on the improvements described at the meeting they believe the improvements meet the criteria for being equally protective. NHDES stated that it may be beneficial to mention that the City's future plans include a stormwater treatment system at the snow dump in the permit application.	
5.	Construction Phase Altus stated that while the final WWTF would remain within the existing fence line, construction activities would take place outside the fence. These include staging areas, parking, etc. The Contractor will be required to implement perimeter controls for erosion and sediment control around these areas and comply with a Stormwater Pollution Prevention Plan (SWPPP).	1. N/A
6.	AoT Permit Application NHDES stated that the approach described for the AoT appears to be reasonable and that the project appears to meet the criteria necessary for an expedited permit. It was noted that a permit application may only be expedited with the signature of the head of NHDES. NHDES stated that their current backlog is roughly 50 days but expedited permits are reviewed with approximately 10 days. If the City wishes to pursue the expedited permit option, this should be requested, and justified, at the time the application is submitted to NHDES.	1. N/A