8.D Stormwater Calculations for Engineered Stormwater Management Structures

(See following pages)

Stormwater Management Design Information for Chequessett Neck Road Bridge
Fuss & O'Neill

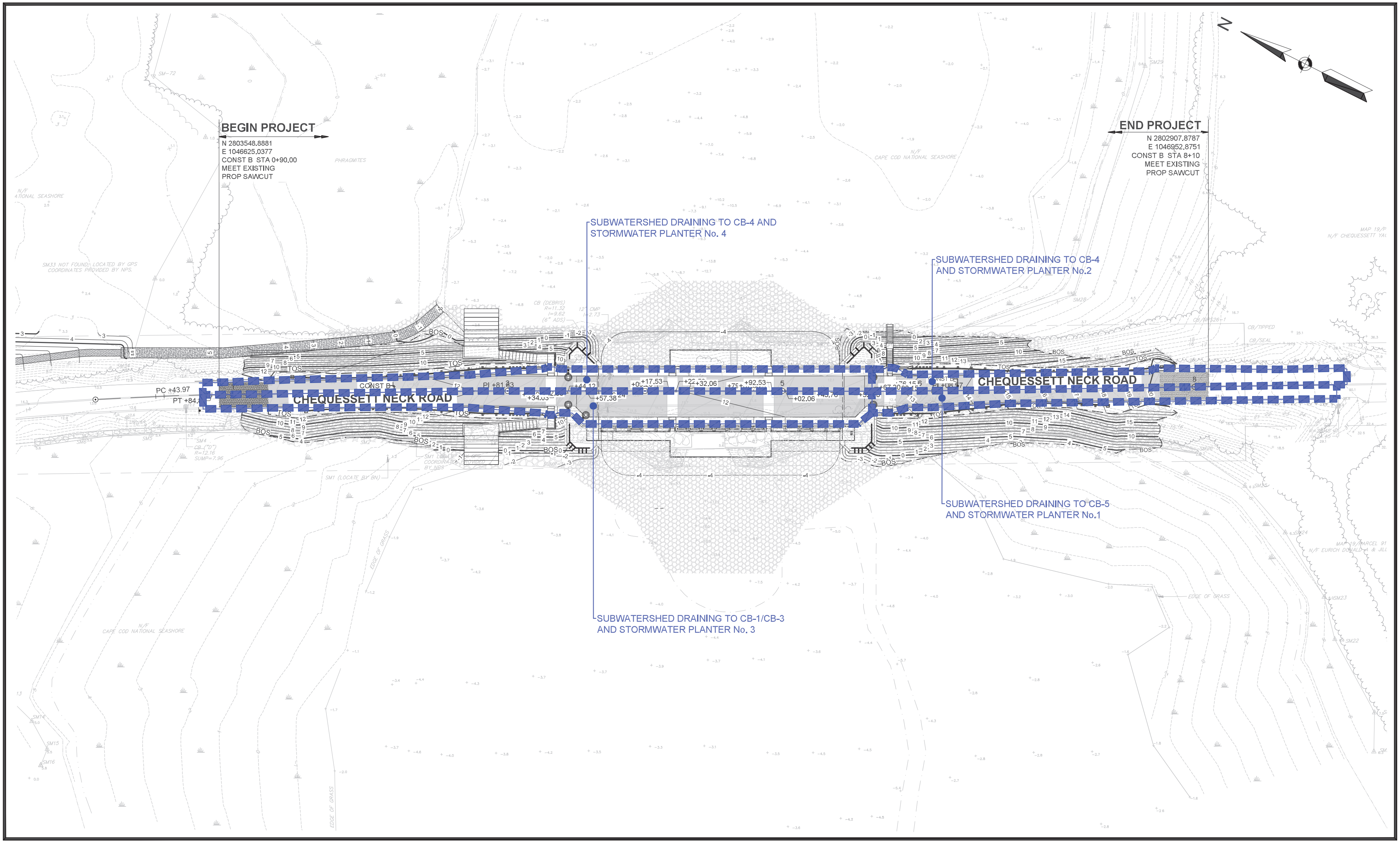
Stormwater Operation & Maintenance Plan, High Toss Road and Hopkins Drive
ESS Group

Attachment F

Stormwater Management System Design Information

Subwatershed Delineation Figure
Runoff Coefficient Calculations
Pipe Sizing Spreadsheet
Stormwater Standard 3 & 4 Compliance Spreadsheet
Supporting Stormwater Planter Sizing Calculations
Stormwater Standard 6 Compliance Spreadsheet
Supporting Proprietary Treatment System Certification and Documentation

Subwatershed Delineation Figure



No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1.				

SEAL

SEAL

SCALE:
HORZ.: 1" = 30'
VERT.: -
DATUM:
HORZ.: NAD83
VERT.: NAVD88

30 15 0 30
GRAPHIC SCALE

FUSS & O'NEILL
317 IRON HORSE WAY, SUITE 204
PROVIDENCE, RI 02908
401.861.3070
www.fando.com

FRIENDS OF HERRING RIVER

POST-IMPROVEMENT SUBWATERSHED MAP

HERRING RIVER TIDAL RESTORATION PROJECT
BRIDGE CONSTRUCTION PROJECT

CHEQUESSETT NECK ROAD WELLFLEET, MASSACHUSETTS

PROJ. No.: 20120636.A17
DATE: JUNE 2016

SUB-1

MS VIEW:
LAYER STATE:
File Path: J:\DWG\P2012\0636\A17\Civil\Figures\20120636.A17_SUB01.dwg Layout: CS-110 Plotted: Mon, September 12, 2016 - 5:13 PM User: samuda
Plotter: NONE CTB File: FO.STB

Runoff Coefficient Calculations

Composite Runoff Calculations
Herring River Tidal Restoration Project
Wellfleet, Massachusetts

Inlet No.	Cover Description	Area (SF)	% of Total Area	Runoff Coefficient (C)	Composite C	Total Area (Acres)	C*A
CB-1 & CB-3	Exist. Impervious	5200.0	62.4	0.95	0.59		
	New Impervious	3130.0	37.6	0.95	0.36		
Totals:		***8330.0***	***100.0***		***0.95***	**0.19**	**0.18**

Inlet No.	Cover Description	Area (SF)	% of Total Area	Runoff Coefficient (C)	Composite C	Total Area (Acres)	C*A
CB-2	Exist. Impervious	5087.0	76.8	0.95	0.73		
	New Impervious	1534.0	23.2	0.95	0.22		
Totals:		***6621.0***	***100.0***		***0.95***	**0.15**	**0.14**

Inlet No.	Cover Description	Area (SF)	% of Total Area	Runoff Coefficient (C)	Composite C	Total Area (Acres)	C*A
CB-4	Exist. Impervious	4270.0	98.6	0.95	0.94		
	New Impervious	62.0	1.4	0.95	0.01		
Totals:		***4332.0***	***100.0***		***0.95***	**0.10**	**0.09**

Inlet No.	Cover Description	Area (SF)	% of Total Area	Runoff Coefficient (C)	Composite C	Total Area (Acres)	C*A
CB-5	Exist. Impervious	3237.0	89.2	0.95	0.85		
	New Impervious	393.0	10.8	0.95	0.10		
Totals:		***3630.0***	***100.0***		***0.95***	**0.08**	**0.08**

FUSS & O'NEILL

Pipe Sizing Spreadsheet

Pipe Sizing Spreadsheet

Herring River Tidal Restoration Project
Chequesset Neck Road, Wellfleet, Massachusetts

PIPE SEGMENT			DRAINAGE AREA		TIME (min)		RUNOFF 100Yr Storm Event		PROPOSED PIPE DESIGN VARIABLES										
U/S Struct.	Pipe	D/S Struct.	Increment CA	CA	Tc	Time In Section	Intensity (In/Hr)	Design Flow	Diam (In.)	Length (Ft.)	Slope (Ft./Ft.)	Manning Coeff.	Capacity (Cfs)	Velocity (Fps)	Depth (Ft.)	Velocity (Fps.)	Angle	Hydraulic Radius
INLET-5	to	Planter No. 1	0.08 0.00 0.08	0.08	5.0 0.0 5.0	0.0 5.0	7.5	0.59	**12**	6	0.020	0.013	**5.05**	6.4	0.26	4.5	2.12	0.15
INLET-4	to	Planter No. 2	0.09 0.00 0.09	0.09	5.0 0.0 5.0	0.0 5.0	7.5	0.71	**12**	6	0.020	0.013	**5.05**	6.4	0.27	4.7	2.18	0.16
INLET-1 & INLET-3	to	Planter No. 3	0.18 0.00 0.18	0.18	5.0 0.0 5.0	0.0 5.0	7.5	1.36	12	6	0.007	0.013	2.92	3.7	0.48	3.6	3.06	0.24
INLET-2	to	Planter No. 4	0.14 0.00 0.14	0.14	5.0 0.0 5.0	0.0 5.0	7.5	1.08	12	6	0.020	0.013	5.05	6.4	0.32	5.1	2.39	0.18

PEAK FLOW SUMMARY:

	100-YEAR FLOW
INLET-1 & INLET-3	1.36 CFS (COMBINED)
INLET-2	1.08 CFS
INLET-4	0.71 CFS
INLET-5	0.59 CFS

Stormwater Standard 3 & 4 Compliance Spreadsheet

Herring River Tidal Restoration Project
Wellfleet, Massachusetts

Objective: Size stormwater planters to infiltrate the required recharge volume (Mass Stormwater Standard 3) and provide treatment for the required water quality volume (Standard 4).

Stormwater Planter No. 1

1) Calculate Water Quality Volume (WQv)

WQv =167.6 cf **(refer to following sheet)**

2) Volume of Storage Provided by Planter

Open Storage Provided =	172.3 cf
Storage Provided within Media =	316.0 cf
Total Storage Provided =	488.3 cf

Since the volume of storage provided by the planter exceeds the WQV, the planter is adequately sized to meet 80% TSS Requirement.

3) Calculate Required Groundwater Recharge Volume (Rev) - Stormwater Standard 3

REv =((1" *(Impervious Area)*Recharge Factor)) / 12=

Impervious Area= 3630 sf (refer to following sheet)
Recharge Factor= 0.6 (from Mass Stormwater Handbook for Type A Soils - Carver Coarse Sand and Ipswich-Pawcatuck Matunuck Complex)

Rev= 182 cf < 488.3 cf provided

Since the volume of storage provided by the planter exceeds the required recharge volume, Standard 3 is met as this volume will be allowed to percolate through the media to the underlying ground. Treated stormwater beyond the capacity will be collected by the underdrain and discharged to the River/Harbor.

Stormwater Planter No. 2

1) Calculate Water Quality Volume (WQv)

WQv =183.1 cf **(refer to following sheet)**

2) Volume of Storage Provided by Planter

Open Storage Provided =	129.0 cf
Storage Provided within Media =	236.7 cf
Total Storage Provided =	365.7 cf

Since the volume of storage provided by the planter exceeds the WQV, the planter is adequately sized to meet 80% TSS Requirement.

3) Calculate Required Groundwater Recharge Volume (Rev) - Stormwater Standard 3

REv =((1" *(Impervious Area)*Recharge Factor)) / 12=

Impervious Area= 4332 sf (refer to following sheet)
Recharge Factor= 0.6 (from Mass Stormwater Handbook for Type A Soils - Carver Coarse Sand and Ipswich-Pawcatuck Matunuck Complex)

Rev= 217 cf < 365.73 cf provided

Since the volume of storage provided by the planter exceeds the required recharge volume, Standard 3 is met as this volume will be allowed to percolate through the media to the underlying ground. Treated stormwater beyond the capacity will be collected by the underdrain and discharged to the River/Harbor.

Stormwater Planter No. 3

1) Calculate Water Quality Volume (WQv)

WQv =477.5 cf **(refer to following sheet)**

2) Volume of Storage Provided by Planter

Open Storage Provided =	172.3 cf
Storage Provided within Media =	312.6 cf
Total Storage Provided =	484.9 cf

Since the volume of storage provided by the planter exceeds the WQV, the planter is adequately sized to meet 80% TSS Requirement.

3) Calculate Required Groundwater Recharge Volume (Rev) - Stormwater Standard 3

REv =((1" *(Impervious Area)*Recharge Factor)) / 12=

Impervious Area= 8330 sf (refer to following sheet)

Recharge Factor= 0.6 (from Mass Stormwater Handbook for Type A Soils - Carver Coarse Sand and Ipswich-Pawcatuck Matunuck Complex)

Rev= 417 cf < 484.9 cf provided

Since the volume of storage provided by the planter exceeds the required recharge volume, Standard 3 is met as this volume will be allowed to percolate through the media to the underlying ground. Treated stormwater beyond the capacity will be collected by the underdrain and discharged to the River/Harbor.

Stormwater Planter No. 4

1) Calculate Water Quality Volume (WQv)

WQv =339.8 cf **(refer to following sheet)**

2) Volume of Storage Provided by Planter

Open Storage Provided =	129.0 cf
Storage Provided within Media =	234.1 cf
Total Storage Provided =	363.1 cf

Since the volume of storage provided by the planter exceeds the WQV, the planter is adequately sized to meet 80% TSS Requirement.

3) Calculate Required Groundwater Recharge Volume (Rev) - Stormwater Standard 3

REv =((1" *(Impervious Area)*Recharge Factor)) / 12=

Impervious Area= 6621 sf (refer to following sheet)

Recharge Factor= 0.6 (from Mass Stormwater Handbook for Type A Soils - Carver Coarse Sand and Ipswich-Pawcatuck Matunuck Complex)

Rev= 331 cf < 484.9 cf provided

Since the volume of storage provided by the planter exceeds the required recharge volume, Standard 3 is met as this volume will be allowed to percolate through the media to the underlying ground. Treated stormwater beyond the capacity will be collected by the underdrain and discharged to the River/Harbor.

FUSS & O'NEILL

Supporting Stormwater Planter Sizing Calculations

PER SECTION 2.2.3 OF THE MASSHIGHWAY STORMWATER HANDBOOK, STORMWATER MANAGEMENT STRUCTURES/PLANTER DESIGNED TO TREAT THE FIRST HALF-INCH OF RUNOFF OVER EXIST. PAVED SURFACES AND THE FIRST ONE-INCH OF RUNOFF OVER NEW PAVED SURFACES (OR AREA OF PAVEMENT IN EXCESS OF EXIST. PAVED AREA).

PLANTER NO. 1

WQV = $\left[3237\text{ SF (EXIST. PAVEMENT)} \times \frac{0.5''}{12}\right] + \left[393\text{ SF (NEW PAVEMENT)} \times \frac{1''}{12}\right] = 167.6\text{ CF}$

PLANTER SURFACE AREA = 344.5 SF

VOL. CONTAINED IN MEDIA = 344.5 SF × (EL. 8.63 - EL. 5.85) × 0.33 = 316.0 CF

OPEN STORAGE IN PLANTER = 344.5 SF × (EL. 9.13 - EL. 8.63) = 172.3 CF

316.0 CF + 172.3 CF = 488.3 CF

∴ VOL. OF STORAGE PROVIDED (488.3 CF) > VOL. OF STORAGE REQD. (167.6 CF)

PLANTER NO. 2

WQV = $\left[4270\text{ SF (EXIST. PAVEMENT)} \times \frac{0.5''}{12}\right] + \left[62\text{ SF (NEW PAVEMENT)} \times \frac{1''}{12}\right] = 183.1\text{ CF}$

PLANTER SURFACE AREA = 258 SF

VOL. CONTAINED IN MEDIA = 258 SF × (EL. 8.63 - EL. 5.85) × 0.33 = 236.7 CF

OPEN STORAGE IN PLANTER = 258 SF × (EL. 9.13 - EL. 8.63) = 129.0 CF

236.7 CF + 129.0 CF = 365.7 CF

∴ VOL. OF STORAGE PROVIDED (365.7 CF) > VOL. OF STORAGE REQD. (183.1 CF)

PLANTER NO. 3

WQV = $\left[5200\text{ SF (EXIST. PAVEMENT)} \times \frac{0.5''}{12}\right] + \left[3130\text{ SF (PROP. PAVEMENT)} \times \frac{1''}{12}\right] = 477.5\text{ CF}$

PLANTER SURFACE AREA = 344.5 SF

VOL. CONTAINED IN MEDIA = 344.5 SF × (EL. 8.00 - EL. 5.25) × 0.33 = 312.6 CF

OPEN STORAGE IN PLANTER = 344.5 SF × (EL. 8.50 - EL. 8.00) = 172.3 CF

484.9 CF

∴ VOL. OF STORAGE PROVIDED (484.9 CF) > VOL. OF STORAGE REQD (477.5 CF)

FUSS & O'NEILL	Prepared By	Date	Checked By	Date	Project No
	SDA	6/20/16	NSW	9/15/16	20120636.A17

Herring River Restoration - CNR Bridge

PLANTER NO. 4

$$WQV = \left[5087\,SF\,(\text{EXIST. PAVEMENT}) \times \frac{0.5''}{12}\right] + \left[1534\,SF\,(\text{PROP. PAVEMENT}) \times \frac{1''}{12}\right] = 339.8\,CF$$

PLANTER SURFACE AREA = 258SF

$$\left.\begin{array}{l} \text{VOL. CONTAINED IN MEDIA} = 258SF \times (EL.8.00 - EL.5.25) \times 0.33 = 234.1CF \\ \text{OPEN STORAGE IN PLANTER} = 258SF \times (EL.8.50 - EL.8.00) = 129.0\,CF \end{array}\right\} 234.1CF + 129CF = 363.1CF$$

∴ VOL. OF STORAGE PROVIDED (363.1CF) > VOL. OF STORAGE REQD. (339.8CF)

Stormwater Standard 6 Compliance Spreadsheet

Herring River Restoration Project
High Toss Road & Hopkins Drive Stormwater Management Report

Wellfleet, Massachusetts

PREPARED FOR:
Friends of Herring River
PO Box 796
Wellfleet, Massachusetts 02667

PREPARED BY:
ESS Group, Inc.
100 Fifth Avenue, 5th Floor
Waltham, Massachusetts 02451

ESS Project No. F451-004

June 30, 2017

COMMONWEALTH OF MASSACHUSETTS
JASON M. GOLD
CIVIL
No. 52768
REGISTERED
PROFESSIONAL ENGINEER

Jason Gold
2017.06.29
20:01:24
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Stormwater Management Report
Herring River Restoration Project
High Toss Road & Hopkins Drive

Prepared For:

Friends of Herring River
PO Box 796
Wellfleet, Massachusetts 02667

Prepared By:

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100 Fifth Avenue, 5th Floor
Waltham, Massachusetts 02451

ESS Project No. F451-004

June 30, 2017

TABLE OF CONTENTS

1.0 INTRODUCTION

ESS Group, Inc. has performed a stormwater management analysis on behalf of The Friends of Herring River for a segment of the proposed Herring River restoration project, specifically the portion of the project located on High Toss Road and Hopkins Drive in Wellfleet, Massachusetts (referred to as the “Site”). The objective at this Site is to elevate the High Toss Road travelway in advance of restoration of tidal flow to the Herring River and to improve stormwater runoff control on a portion of Hopkins Drive (the “Project”).

The goal of the proposed stormwater management system is to implement low impact development (LID) techniques to the maximum extent practicable within the constraints of the proposed High Toss Road roadway design. The proposed stormwater management system is designed to provide treatment of stormwater runoff through detention and infiltration into the existing subsurface soils.

The following sections describe the proposed stormwater management plan and analysis conducted to ensure compliance with the stormwater requirements of the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards, which apply a different set of criteria to projects that meet the definition of redevelopment with respect to stormwater management. Through its design, the stormwater management system will mitigate stormwater runoff impacts on water quantity and quality and provide water quality treatment to the maximum extent practicable, as is the requirement for redevelopment. A water quality analysis was performed to estimate the extent to which the required sediment removal can be achieved by the stormwater management system.

2.0 EXISTING STORMWATER CONDITIONS

High Toss Road is an unpaved public way approximately 200 feet easterly of Snake Creek Lane, running westerly to the end at Duck Harbor Lane. Refer to Figure 1, Site Locus. This site falls within the limits of a FEMA flood hazard zone AE as depicted in the FEMA Flood Insurance Rate Map (FIRM) included in Appendix E. Under MassDEP Wetlands Protection regulations, land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record or storm of record, whichever is greater, is protected as Land Subject to Coastal Strom Flowage (LSCSF)

The entire project area is located within the Wellfleet Harbor Area of Critical Environmental Concern (ACEC). The Wellfleet Harbor ACEC, established in 1989, consists of approximately 12,500 acres in the towns of Wellfleet, Truro, and Eastham. The ACEC was established to protect important habitats including barrier beaches, islands, marsh ecosystems, saltwater and freshwater ponds, rivers, bays, and tidal flats.

The Site’s topographic elevation as indicated by the site survey ranges from approximately 2 to 30 feet above the North American Vertical Datum of 1988 (NAVD 88).

High Toss Road does not have any open or closed drainage systems. Hopkins Drive, which is paved, has six leaching basins installed in the shoulder of the road that will upgraded and replaced in proposed conditions.

This section of the report summarizes specific predevelopment site conditions related to stormwater management including hydrologic soil type, presence of wetlands and vegetation, and drainage to discharge points on site.

The existing stormwater system in Hopkins Drive is comprised of three sets of catch basins (one on each side of the road) between Quail Run and High Toss Road. The catch basins have Massachusetts standard grates with no apparent pipe connection between the catch basins, and no apparent outfall, based on our site observations. Therefore, it appears the catch basins are leaching catch basins. ESS did observe that the catch basins contained accumulated sediment and some standing water, indicating that they need to be cleaned out. It was also noted that pine needles and other vegetative debris accumulate around each catch basin. Pictures of the catch basins from December 2015 are shown below.

Catch basins at High Toss Road-Hopkins Drive intersection (note accumulated sediment in road and erosion of High Toss Road)

Catch basin on east side of Hopkins Drive midway between High Toss Road and Quail Run

Catch basin on west side of Hopkins Drive midway between High Toss Road and Quail Run

Catch basin at northwest corner of High Toss Road-Hopkins Drive intersection (note reflection indicating standing water in catch basin)

Quail Run appears to only have one catch basin, and it is located on the south side of the road about midway between Hopkins Drive and the Quail Run cul-de-sac.

2.1 Soils

The Site is generally characterized as low density development with moderate to flat slopes and forested areas with well drained soils. According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the soils within the majority of the watershed are comprised of Carver Coarse Sand. These soil types are classified as Hydrologic Soil Group A. The low lying wetland areas are comprised of Maybid variant silty clay loam and Freetown and Swansea mucks coastal lowland which are classified as Hydrologic Soil Groups A/D and B/D, respectively, The NRCS Soil Survey of the Site is provided in Appendix D.

2.2 General Characterization of Wetlands and Vegetation

The existing conditions watershed is comprised of woods and roads with varying surface treatments. Jurisdictional vegetated wetland resource areas in the vicinity of the project area were delineated by others in 2015 and were subsequently field-verified by an ESS wetland scientist in 2016.

The project area is also located entirely within the Cape Cod National Seashore Outstanding Resource Water (ORW). ORWs are established by MassDEP and include Class A Public Water Supplies and their tributaries and other waters that provide outstanding socio-economic, recreational, ecological, and/or aesthetic values.

Primary vegetation species along High Toss Road include pitch pine (*Pinus rigida*), pin oak (*Quercus palustris*), red maple (*Acer rubrum*), white oak (*Quercus alba*), black cherry (*Prunus serotina*), black locust (*Robinia pseudoacacia*), shadbush (*Amelanchier* sp.), winterberry (*Ilex verticillata*), highbush blueberry (*Vaccinium corymbosum*), lowbush blueberry (*Vaccinium angustifolium*), scrub oak (*Quercus ilicifolia*), bayberry (*Myrica pennsylvanica*), sweet pepperbush (*Clethra alnifolia*), southern arrowwood (*Viburnum recognitum*), poison ivy (*Toxicodendron radicans*), Tatarian honeysuckle (*Lonicera tatarica*) and Japanese honeysuckle (*Lonicera japonica*).

3.0 PROPOSED STORMWATER CONDITIONS AND MANAGEMENT

3.1 Proposed Conditions

The proposed development includes raising the elevation of High Toss Road to 7.5 feet NAVD88 to prevent inundation of the roadway. A portion of Hopkins Drive will also be raised to tie into the proposed elevation of High Toss Road, and to reduce the velocity and volume of Hopkins Drive runoff that crosses High Toss Road.

3.2 Proposed BMPs

The stormwater management system for the High Toss Road travelway is designed to mimic existing conditions due to the limited right-of-way width available, the presence of wetlands resources directly adjacent to the travelway, and the Town's objective to elevate the road while maintaining its current rural character.

The stormwater management system for Hopkins Drive is designed to improve conditions by reducing the amount of runoff that currently is not collected and runs across and erodes the High Toss Road travelway gravel surface. The design also includes improvements in terms of suspended solids collection and runoff infiltration.

High Toss Travelway Level Spreaders

Construction of the Travelway will require earthwork on both sides of the travelway to allow the raised travelway grades to meet the existing ground elevations. Where necessary, level spreaders – a low point with a level lip - will be placed between the shoulder and the adjacent slopes to capture runoff and reduce its velocity and encourage sheet flow prior to crossing the travelway surface. Level spreaders will be installed in accordance with the latest Massachusetts Stormwater Handbook. Runoff that does not overtop the lip of the level spreaders will infiltrate.

Hopkins Drive Drywells

There are two leaching catch basins approximately midway up the roadway slope between Quail Run and High Toss Road. These structures will be removed and replaced with solid bottom, deep sump catch basins to provide for sediment collection. Each catch basin structure will also have a vented hooded inlet to reduce the amount of floatables, trash, free oils, etc. leaving the deep dump catch basin. The new catch basins will be connected to new drywell structures that will be installed beneath the Hopkins Drive pavement. Dry well structures are pre-cast concrete barrels with uniform perforations surrounded with stone designed to infiltrate captured stormwater.

Hopkins Drive ChamberMaxx Infiltration Chamber

At the bottom of Hopkins Drive, the four existing catch basins will be replaced with four solid bottom, deep sump catch basins, which will also be equipped with oil hoods. The four new catch basins will be connected to a ChamberMaxx infiltration chamber that will be installed below the Hopkins Drive pavement via 10 inch high-density polyethylene (HDPE) header pipes at each end of the chamber. Three rows of chambers will be used, and the footprint of the chamber system and surrounding stone will be approximately 16 feet wide by 31 feet long (496 square feet). The chamber system will accommodate the 10-year storm event.

4.0 MASSDEP STORMWATER MANAGEMENT STANDARDS

The Project has been designed to meet the MassDEP Stormwater Management Standards to the maximum extent practicable in accordance with Standard 7 Redevelopment. A synopsis of how each standard is met is summarized below; Standard 7 is presented first because its provisions affect the other standards.

Standard 7: *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

For purposes of the Stormwater Management Standards, redevelopment projects are defined to include maintenance and improvement of existing roadways, including improving existing drainage systems. As described below, the Project meets the requirements of Standards 1, 2, 3, 4, 5, and 6 to the maximum extent practicable.

The two primary constraints for this project are the limited right of way and adjacent resource areas. Practices that would require either additional resource area impacts or impacts to private property would be defined as not practicable for the purposes of stormwater compliance. The stormwater management plan attempts to meet each of the standards, adequately document standards that could be met, and is designed at a minimum to improve existing conditions.

Standard 1: *No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

No new discharges from stormwater conveyances are proposed for this project.

Standard 2: *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

The High Toss Road travelway is located within Land Subject to Coastal Storm Flowage. In addition, once the Herring River restoration is implemented, the wetlands along High Toss Road will be subject to daily tidal action. The Project will not change the amount of impervious cover in the Project Area. For these reasons, the Project is not required to match post-development peak discharge rate to the pre-development peak discharge rate. However, where possible, the design seeks to maintain or improve post-development peak discharge rates to the maximum extent practicable.

Standard 3: *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from the pre-development site conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*

The MassDEP Stormwater Handbook states that, for sites comprised solely of C and D soils and bedrock at the land surface, proponents are required to infiltrate the required recharge volume only to the maximum extent practicable. The High Toss Road and Hopkins Drive site is comprised solely of A soils surrounded by A/D and B/D soils within resource areas. The footprint of the proposed level spreader improvement of High Toss Road and of the catch basin and infiltration improvements of Hopkins Drive have been minimized in an attempt to meet this standard to the maximum extent practicable. Infiltration from the BMPs will further aid in groundwater recharge as ground conditions permit.

Standard 4: *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when: (a.) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained; (b.) Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and (c.) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

Suitable practices for source control and pollution prevention are identified in the attached long-term pollution prevention plan included in Appendix F. Infiltration Stormwater BMPs with a minimum of 80 percent TSS removal rates were selected for use on Hopkins Drive. This removal rate is accomplished with a treatment train comprising a deep sump catch basin pretreatment (25 percent TSS removal) dry wells, and ChamberMaxx storm chambers. The treatment train will provide the required water quality volume. Stormwater runoff along the High Toss Road travelway will either sheet flow across the travelway as it does in the existing condition or naturally infiltrate on the landward side of the travelway.

Standard 5: *For land uses with higher potential pollutant loads source control and pollution prevention shall be implemented. The use of infiltration practices without pretreatment is prohibited.*

The project does involve land uses with higher potential pollutant loads.

Standard 6: *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas.*

Specific source control and pollution prevention measures are identified in the attached long-term pollution prevention plan included in Appendix F.

The site is located within the following resource areas:

- Wellfleet Harbor Area of Critical Environmental Concern (ACEC)
- Cape Cod National Seashore Outstanding Resource Water (ORW)

The Project involves elevating the High Toss Road travelway along its existing alignment and improving the existing stormwater system at the lower end of Hopkins Drive to reduce sheet flow runoff across High Toss Road to the wetlands. The Project will not adversely affect these resources areas and will provide stormwater management improvements where possible.

Standard 7 *– see above.*

Standard 8: *A plan to control construction related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

A comprehensive system of erosion and sedimentation controls will be implemented during construction to minimize short-term, construction-related impacts as well as stabilize conditions for permanent operation of the development. These measures include silt fence and silt sock placement along disturbed areas of the property, site stabilization, and a stabilized construction entrance. An online registration and Stormwater Pollution Prevention Plan (SWPPP) in accordance with the National Pollutant Discharge Elimination System (NPDES) Construction General Permit will be submitted prior to construction.

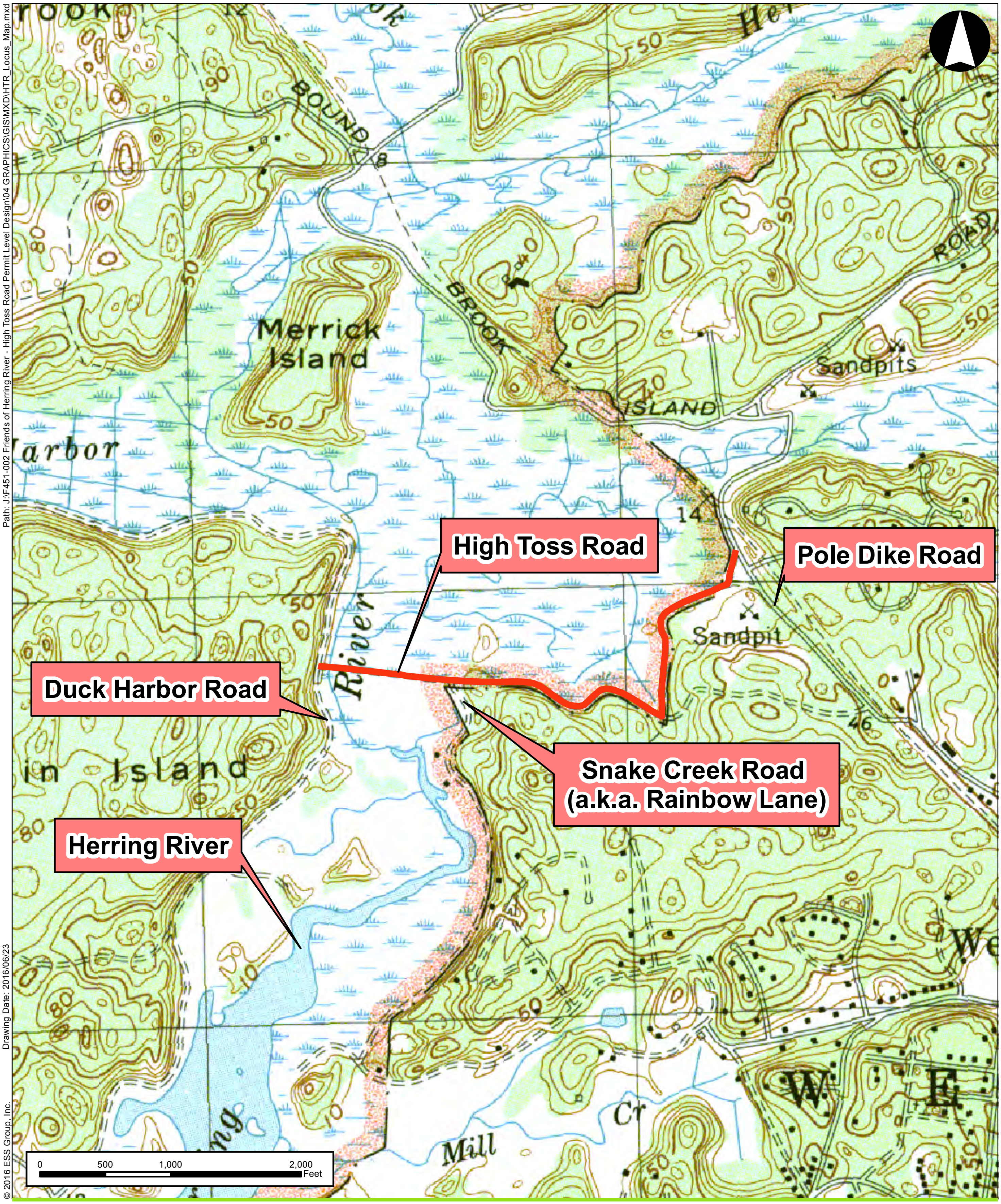
Standard 9: *A long term operation and maintenance plan shall be developed and implemented.*

An operations and maintenance plan for the proposed stormwater BMPs is attached.

Standard 10: *All illicit discharges to the stormwater management system are prohibited.*

No known illicit discharges currently exist on the Site. There will be no illicit discharges allowed into the stormwater management system.

Figures



Path: J:\F451-002 Friends of Herring River - High Toss Road Permit Level Design\04 GRAPHICS\GIS\MXD\HTR_Locus_Map.mxd

Drawing Date: 2016/06/23

Herring River Restoration Project

Wellfleet and Truro, Massachusetts

1 inch = 1,000 feet

Source: 1) ESRI, Basemap 2016

Legend

Project Location

High Toss Road Locus Map

Figure 1

Appendix A
MassDEP Checklist for Stormwater Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

---

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
JASON M. GOLD
CIVIL
No. 52768
REGISTERED PROFESSIONAL ENGINEER

Jason Gold 2017.06.29 20:02:50 -04'00'

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☐ No disturbance to any Wetland Resource Areas

☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☒ Use of “country drainage” versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Deep sump catch basins, dry wells, ChamberMaxx storm chambers.

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist (continued)

Standard 2: Peak Rate Attenuation

☒ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

☐ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

  ☐ is within the Zone II or Interim Wellhead Protection Area

  ☐ is near or to other critical areas

  ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

  ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☒ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Appendix B
Operation & Maintenance Plan

Stormwater Operation & Maintenance Plan
High Toss Road & Hopkins Drive

Wellfleet, Massachusetts

PREPARED FOR:
Friends of Herring River
PO Box 796
Wellfleet, Massachusetts 02667

PREPARED BY:
ESS Group, Inc.
100 Fifth Avenue, 5th Floor
Waltham, Massachusetts 02451

ESS Project No. F451-004

June 2017

www.essgroup.com

STORMWATER OPERATION & MAINTENANCE PLAN
High Toss Road and Hopkins Drive

Prepared for:

Friends of Herring River
PO Box 796
Wellfleet, Massachusetts 02667

Prepared by:

ESS Group, Inc.
100 Fifth Avenue, 5th Floor
Waltham, Massachusetts 02451

ESS Project No. F451-004

June 2017

TABLE OF CONTENTS

ATTACHMENTS

OPERATION AND MAINTENANCE PLAN

The operation and maintenance (O&M) plan is required by the Stormwater Management Plan subject to the Massachusetts Department of Environmental Protection (MADEP) Stormwater Handbook. The plan for the proposed infiltrating BMPs is included below.

Contact Information

Parties Responsible for Maintenance:

Town of Wellfleet Department of Public Works
220 West Main Street
Wellfleet, MA 02667

Hopkins Drive Homeowner's Association
Wellfleet, MA 02667

Prepared By:

ESS Group, Inc.
100 Fifth Avenue, 5th Floor
Waltham, MA 02451

Access and Safety Issues

No access or safety issues are anticipated due to the nature of the proposed BMP. No public safety features will be present.

Applicable Easements

No easements will be required for this proposed project.

Funding Source

Funding for Project construction will come from the Friends of Herring River. The Town of Wellfleet and the Hopkins Drive Homeowner's Association will be responsible for all maintenance activities thereafter the project.

Maintenance Activities Description:

Maintenance activities are adapted from the MADEP Stormwater Handbook.

Deep Sump Catch Basins and Dry Wells

Regular maintenance is essential. Deep sump catch basins remain effective at removing pollutants only if they are cleaned out frequently. Inspect or clean deep sump basins at least four times per year and at the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Dry wells shall be inspected after every major storm in the first few months after construction to ensure proper stabilization and function. Thereafter, dry wells shall be inspected annually.

ChamberMaxx Stormwater Chamber System

Refer to the Attachment A: ChamberMaxx Inspection and Maintenance Guide provided by Contech.

Operations and Maintenance Budget

The Operations and Maintenance Budget will be determined as part of the annual budgeting processes performed by the Town of Wellfleet and the Hopkins Drive Homeowner's Association.

O&M Plan Appendix A
ChamberMaxx Inspection and Maintenance Guide

CONTECH®
ENGINEERED SOLUTIONS

ChamberMaxx® Inspection and Maintenance Guide

CHAMBERMaxx®

ChamberMaxx®

Safety

Before entering into any storm sewer or underground retention/detention system check to make sure all OSHA and local safety regulations and guidelines are observed during the maintenance process. Hard hats, safety glasses, steel-toed boots and any other appropriate personal protective equipment shall be worn at all times.

Inspection Frequency

Inspections are recommended at a minimum annually. The first year of operation may require more frequent inspections. Frequency of inspections will vary significantly on the local site conditions. An individual inspection schedule should be established for each site.

Inspections

Inspection is the key to effective maintenance and is easily performed. Inspections may need to be performed more often in the winter months in climates where sanding operations may lead to rapid sediment accumulations, or in equipment washdown areas. It is very useful to keep a record of each inspection. A sample inspection log is included for your use.

The entire treatment train should be inspected and maintained. The treatment train may consist of an upstream sump manhole, manifold system or pre-treatment HDS device. Inspections should start at the upstream device and continue downstream to the discharge orifice if incorporated into the chamber system.

Pre-Treatment Device Inspection

Inspection and maintenance procedures provided by the manufacturer should be followed for pre-treatment systems such as a CDS®, Vortechs®, VortSentry® or VortSentry® HS. Expected pollutants will be floatable trash, sediment and oil and grease. Pre-treatement devices are recommended for all detention/retention devices regardless of type.

Containment Row™ Inspection

The optional Containment Row consists of a diversion concrete manhole with a weir and a drain down orifice, and a row of chambers placed on woven geotextile. The diversion weir directs the first flush flows into the Containment Row of chambers. The majority of sediment will be captured in the Containment Row due to the extended detention time which allows the particles to settle out. Higher flows overtop (bypass) the weir into the manifold system.

The Containment Row will typically be located in the first row of chambers connected to the diversion manhole. Inspection can be done through accessing the diversion manhole and visually inspecting the Containment Row through the inlet pipe. Inspection ports throughout the system can be used for visual observation and measurement of sediment accumulation using a stadia rod. When the depth of sediment accumulates over 4-inch (102 mm), cleanout is recommended.

Manifold System Inspection

The main manifold pipe can be inspected from the diversion manhole upstream. When a quarter of the pipe volume has been filled with sediment the header system should be maintained.

Visual Inspection

Maintenance or further investigation may be required if any of the following conditions exist:

- Evidence of an unusual amount of silt and soil build-up on the surface.
- Clogged outlet drainpipe.
- System does not drain to the elevation of the lowest pipe in dry conditions.
- Evidence of potholes or sinkholes

Maintenance

Underground stormwater retention/detention systems should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities rather than the size or configuration of the system. If accumulated silt is interfering with the operation of the detention system (i.e.: blocking outlet pipes or deposits significantly reduce the storage capacity of the system) it should be removed.

It is easiest to maintain a system when there is no flow entering. For this reason, cleanout should be scheduled during dry weather.

A vacuum truck or other similar devices can be used to remove sediment from the treatment train. Starting upstream, maintain manholes with sumps and any pre-treatment devices (following manufacturer recommended procedures). Once maintenance is complete, replace all caps, lids and covers. It is important to document maintenance events on the Inspection and Maintenance Log.

Header System Maintenance:

If maintenance is required, use a high pressure nozzle with rear facing jets to wash the sediments and debris into the diversion manhole. Use the vacuum hose stinger nozzle to remove the washed sediments from the sump of the diversion manhole. It is important to not flush sediments into the chamber system during the maintenance process.

Containment Row™ Maintenance

If maintenance is required, a JetVac truck utilizing a high pressure nozzle (sledge dredging tool) with rear facing jets will be required. Insert the nozzle from the diversion manhole into the Containment Row through the inlet pipe. Turn the water feed hose on and feed the supply hose until the nozzle has reached the end of the Containment Row. Withdraw the nozzle slowly.

Figure 1— Containment Row shown with high pressure cleaning nozzle

The tool will backflush the Containment Row forcing debris into the diversion manhole sump. Use the stringer vacuum hose to remove the sediments and debris from the sump of the diversion manhole. Multiple passes may be required to fully cleanout the Containment Row. Vacuum out the diversion manhole and remove all debris. See Figure 1.

Inspection & Maintenance Log Sample Template

ChamberMaxx **Location:**

Date	Depth of Sediment	Accumulated Trash	Name of Inspector	Maintenance Performed/Notes

CHAMBERMaxx®

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific support is available from our engineers.

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www.ContechES.com

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater management, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122.

O&M Plan Appendix B
O&M Checklist

Infiltration System Operation, Maintenance, and Management Inspection Checklist

Project:

Location:

Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Annual)		
Trench/chamber or basin surface clear of debris		
Inflow pipes clear of debris		
Overflow spillway clear of debris		
Inlet area clear of debris		
2. Deep Sump Catch Basin (Annual)		
Obviously trapping sediment		
Greater than 50% of storage volume remaining		
3. Dewatering (Annual)		
Trench/chamber or basin dewaters between storms		
4. Sediment Cleanout of Trench/Chamber or Basin (Annual)		

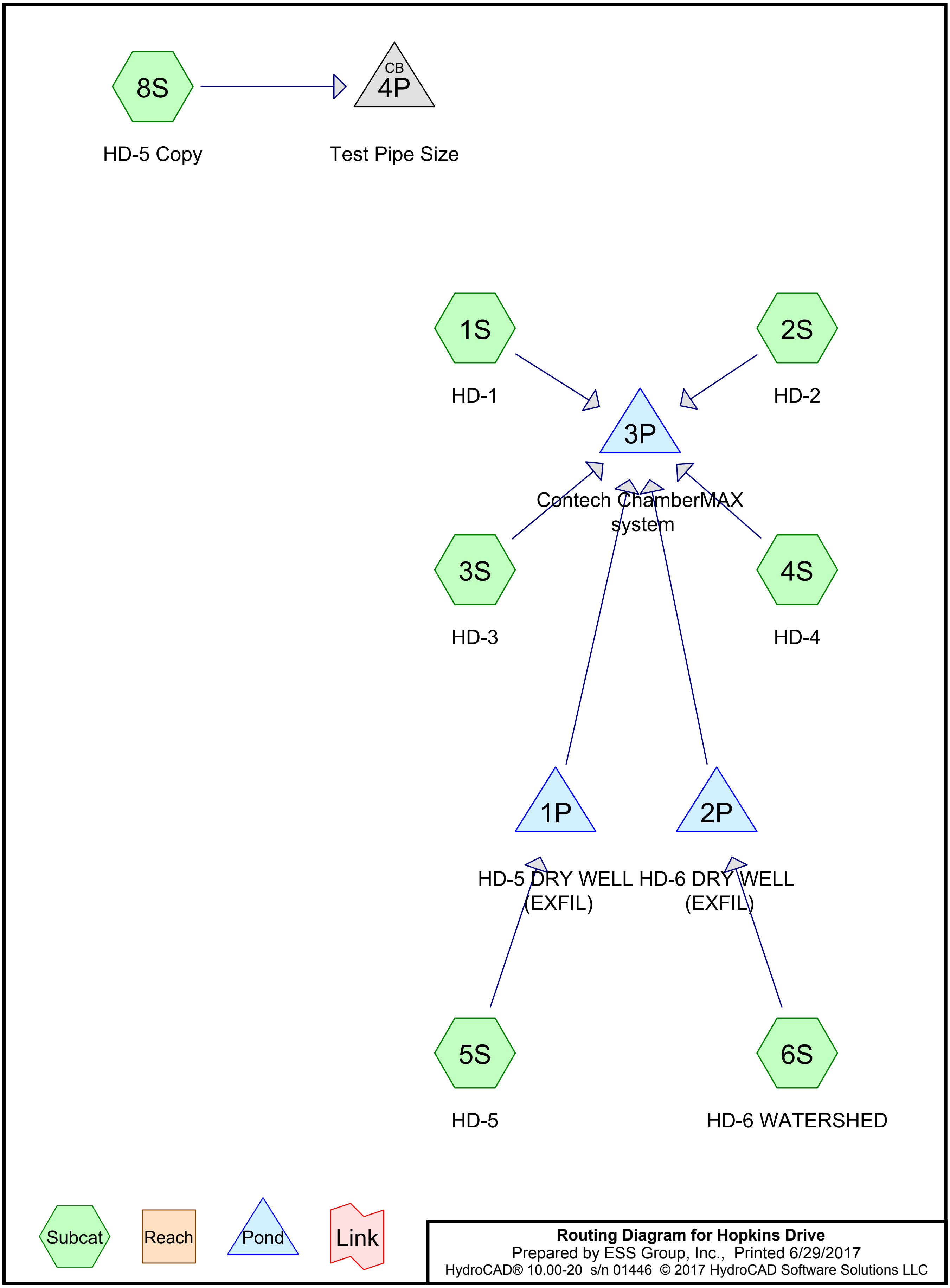
MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
No evidence of sedimentation in trench/chamber or basin		
Sediment accumulation doesn't yet require cleanout		
5. Inlets (Annual)		
Good condition		
No evidence of erosion		
6. Outlet/Overflow Spillway (Annual)		
Good condition, no need for repair		
No evidence of erosion		
7. Aggregate Repairs (Annual)		
Surface of aggregate clean		
Top layer of stone does not need replacement		
Trench/Chamber or basin does not need rehabilitation		

Comments:

Actions to be Taken:

End of Operations & Maintenance Plan

Appendix C
Stormwater Calculations



Routing Diagram for Hopkins Drive
Prepared by ESS Group, Inc., Printed 6/29/2017
HydroCAD® 10.00-20 s/n 01446 © 2017 HydroCAD Software Solutions LLC

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: HD-1 Runoff Area=7,914 sf 6.87% Impervious Runoff Depth=0.47"
Flow Length=321' Tc=0.9 min CN=47 Runoff=0.05 cfs 0.007 af

Subcatchment 2S: HD-2 Runoff Area=8,646 sf 6.55% Impervious Runoff Depth=0.47"
Flow Length=170' Tc=7.8 min CN=47 Runoff=0.04 cfs 0.008 af

Subcatchment 3S: HD-3 Runoff Area=11,730 sf 9.51% Impervious Runoff Depth=0.51"
Flow Length=214' Tc=0.6 min CN=48 Runoff=0.09 cfs 0.012 af

Subcatchment 4S: HD-4 Runoff Area=9,570 sf 11.70% Impervious Runoff Depth=0.56"
Flow Length=222' Tc=10.0 min CN=49 Runoff=0.07 cfs 0.010 af

Subcatchment 5S: HD-5 Runoff Area=4,262 sf 61.52% Impervious Runoff Depth=2.46"
Flow Length=45' Slope=0.1330 '/' Tc=4.3 min CN=77 Runoff=0.30 cfs 0.020 af

Subcatchment 6S: HD-6 WATERSHED Runoff Area=9,333 sf 6.85% Impervious Runoff Depth=0.47"
Flow Length=144' Tc=11.4 min CN=47 Runoff=0.05 cfs 0.008 af

Subcatchment 8S: HD-5 Copy Runoff Area=4,262 sf 61.52% Impervious Runoff Depth=2.46"
Flow Length=45' Slope=0.1330 '/' Tc=4.3 min CN=77 Runoff=0.30 cfs 0.020 af

Pond 1P: HD-5 DRY WELL (EXFIL) Peak Elev=22.00' Storage=0.009 af Inflow=0.30 cfs 0.020 af
Discarded=0.01 cfs 0.019 af Primary=0.02 cfs 0.001 af Outflow=0.03 cfs 0.020 af

Pond 2P: HD-6 DRY WELL (EXFIL) Peak Elev=22.00' Storage=0.005 af Inflow=0.05 cfs 0.008 af
Discarded=0.00 cfs 0.007 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.007 af

Pond 3P: Contech ChamberMAX system Peak Elev=5.22' Storage=0.016 af Inflow=0.22 cfs 0.038 af
Discarded=0.03 cfs 0.038 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.038 af

Pond 4P: Test Pipe Size Peak Elev=7.00' Inflow=0.30 cfs 0.020 af
10.0" Round Culvert n=0.013 L=5.0' S=0.0000 '/' Outflow=0.30 cfs 0.020 af

Summary for Subcatchment 1S: HD-1

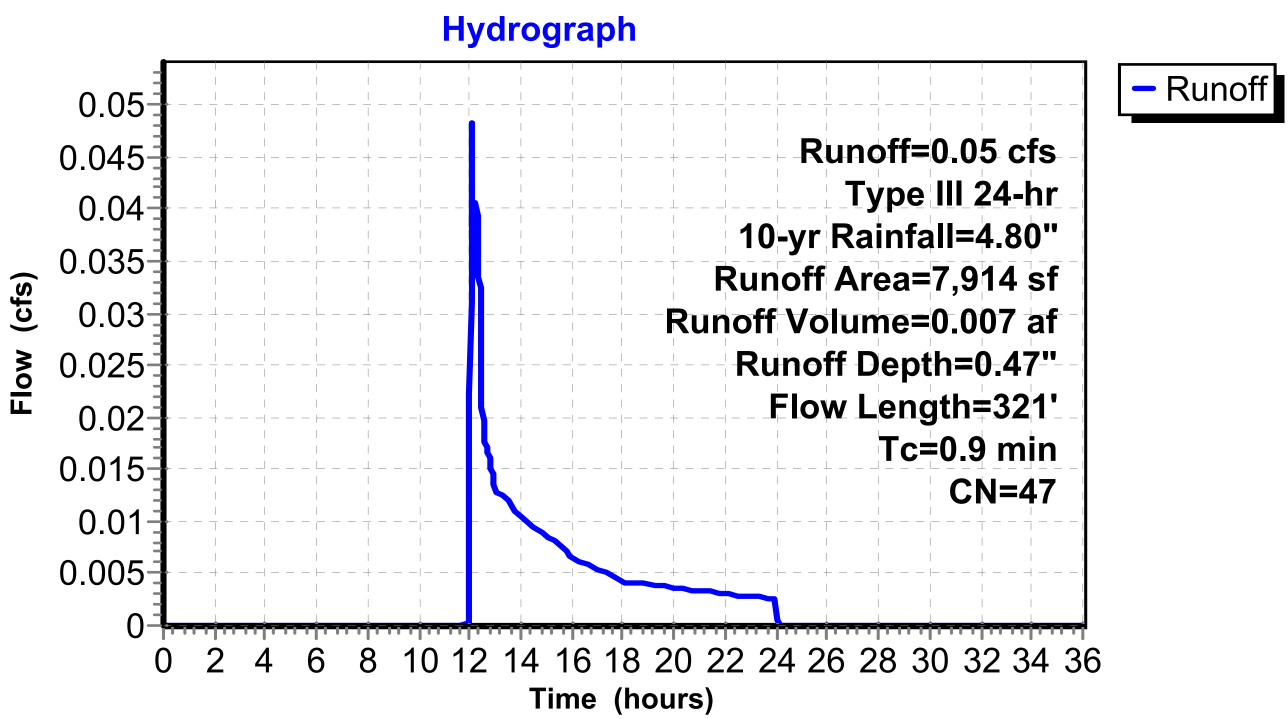
Runoff = 0.05 cfs @ 12.07 hrs, Volume= 0.007 af, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
7,370	43	Woods/grass comb., Fair, HSG A
544	98	Paved parking, HSG A
7,914	47	Weighted Average
7,370		93.13% Pervious Area
544		6.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	124	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	106	0.1100	5.34		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	91	0.2600	8.21		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.9	321	Total			

Subcatchment 1S: HD-1



Summary for Subcatchment 2S: HD-2

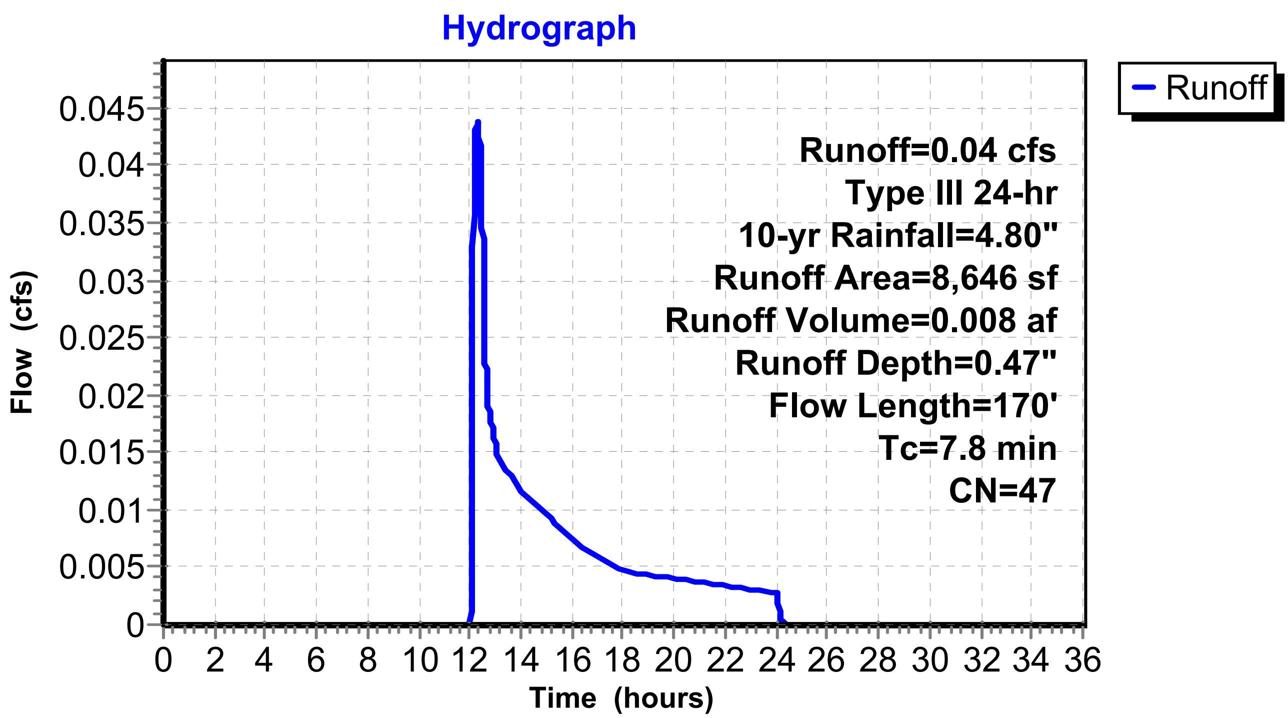
Runoff = 0.04 cfs @ 12.30 hrs, Volume= 0.008 af, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
8,080	43	Woods/grass comb., Fair, HSG A
566	98	Paved parking, HSG A
8,646	47	Weighted Average
8,080		93.45% Pervious Area
566		6.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	100	0.1600	0.22		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.80"
0.2	70	0.1300	5.80		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.8	170	Total			

Subcatchment 2S: HD-2



Summary for Subcatchment 3S: HD-3

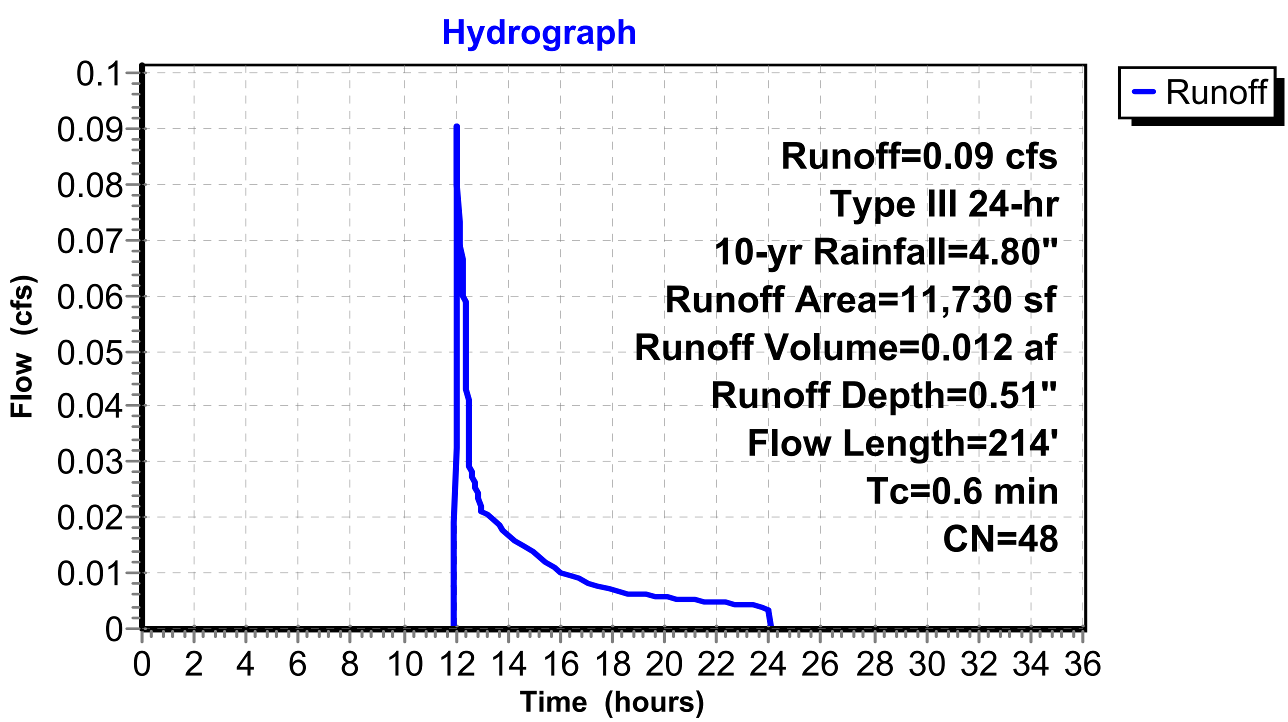
Runoff = 0.09 cfs @ 12.06 hrs, Volume= 0.012 af, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
10,615	43	Woods/grass comb., Fair, HSG A
1,115	98	Paved parking, HSG A
11,730	48	Weighted Average
10,615		90.49% Pervious Area
1,115		9.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	83	0.0720	4.32		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	131	0.2300	7.72		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	214	Total			

Subcatchment 3S: HD-3



Summary for Subcatchment 4S: HD-4

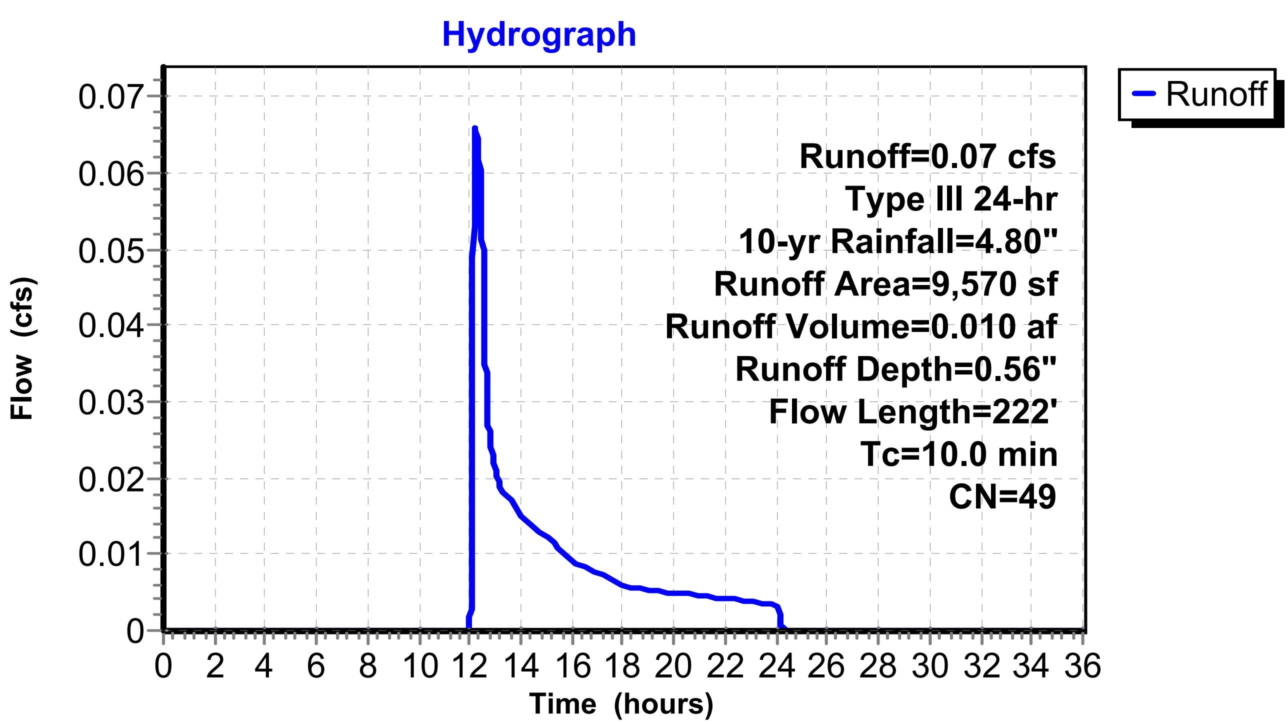
Runoff = 0.07 cfs @ 12.22 hrs, Volume= 0.010 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
8,450	43	Woods/grass comb., Fair, HSG A
1,120	98	Paved parking, HSG A
9,570	49	Weighted Average
8,450		88.30% Pervious Area
1,120		11.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	92	0.0760	0.16		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.80"
0.2	40	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	90	0.1100	6.73		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
10.0	222	Total			

Subcatchment 4S: HD-4



Summary for Subcatchment 5S: HD-5

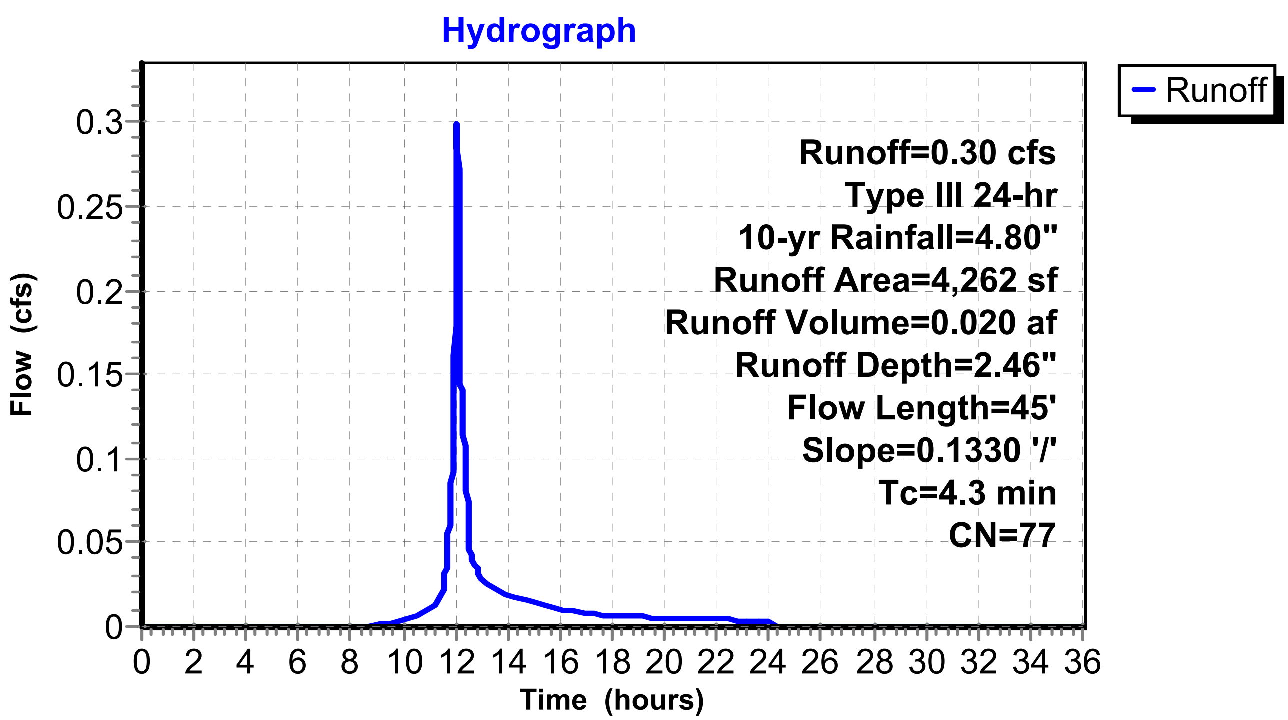
Runoff = 0.30 cfs @ 12.07 hrs, Volume= 0.020 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
1,640	43	Woods/grass comb., Fair, HSG A
2,622	98	Paved parking, HSG A
4,262	77	Weighted Average
1,640		38.48% Pervious Area
2,622		61.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	45	0.1330	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.80"

Subcatchment 5S: HD-5



Summary for Subcatchment 6S: HD-6 WATERSHED

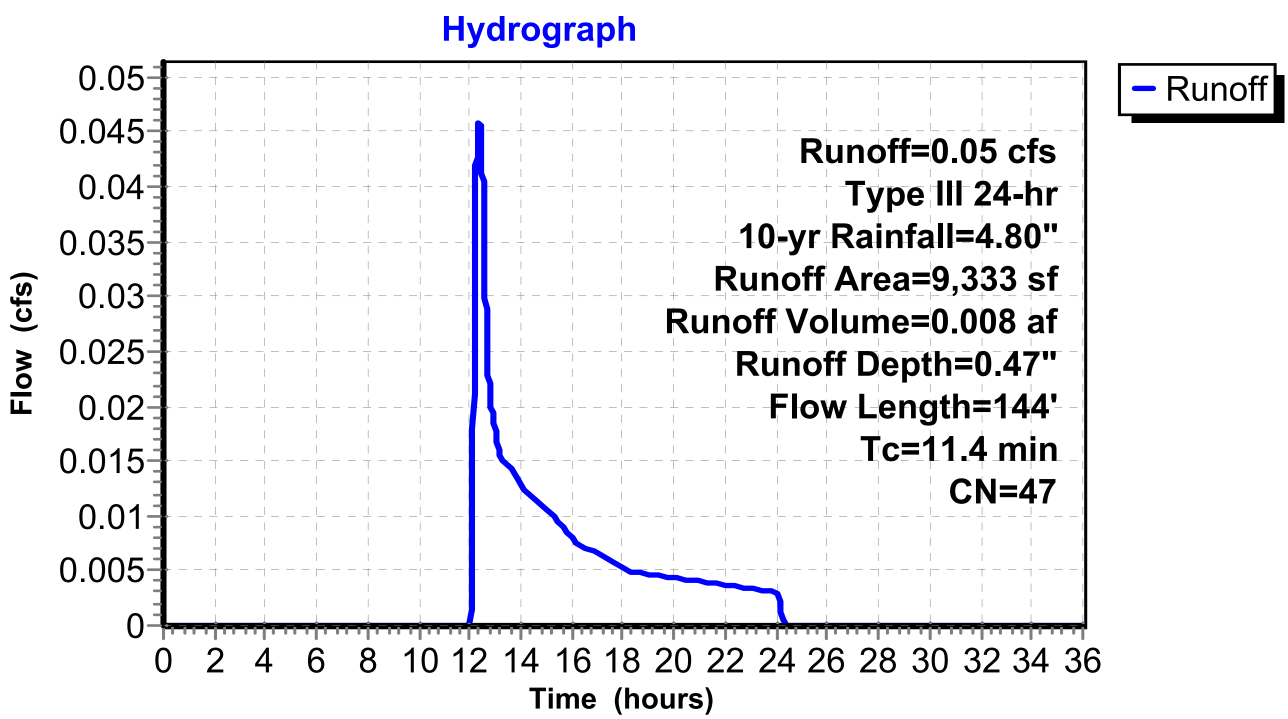
Runoff = 0.05 cfs @ 12.37 hrs, Volume= 0.008 af, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
8,694	43	Woods/grass comb., Fair, HSG A
639	98	Paved parking, HSG A
9,333	47	Weighted Average
8,694		93.15% Pervious Area
639		6.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.3	100	0.0600	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.80"
0.1	29	0.0600	3.94		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.0	15	0.0670	5.25		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.4	144	Total			

Subcatchment 6S: HD-6 WATERSHED



Summary for Subcatchment 8S: HD-5 Copy

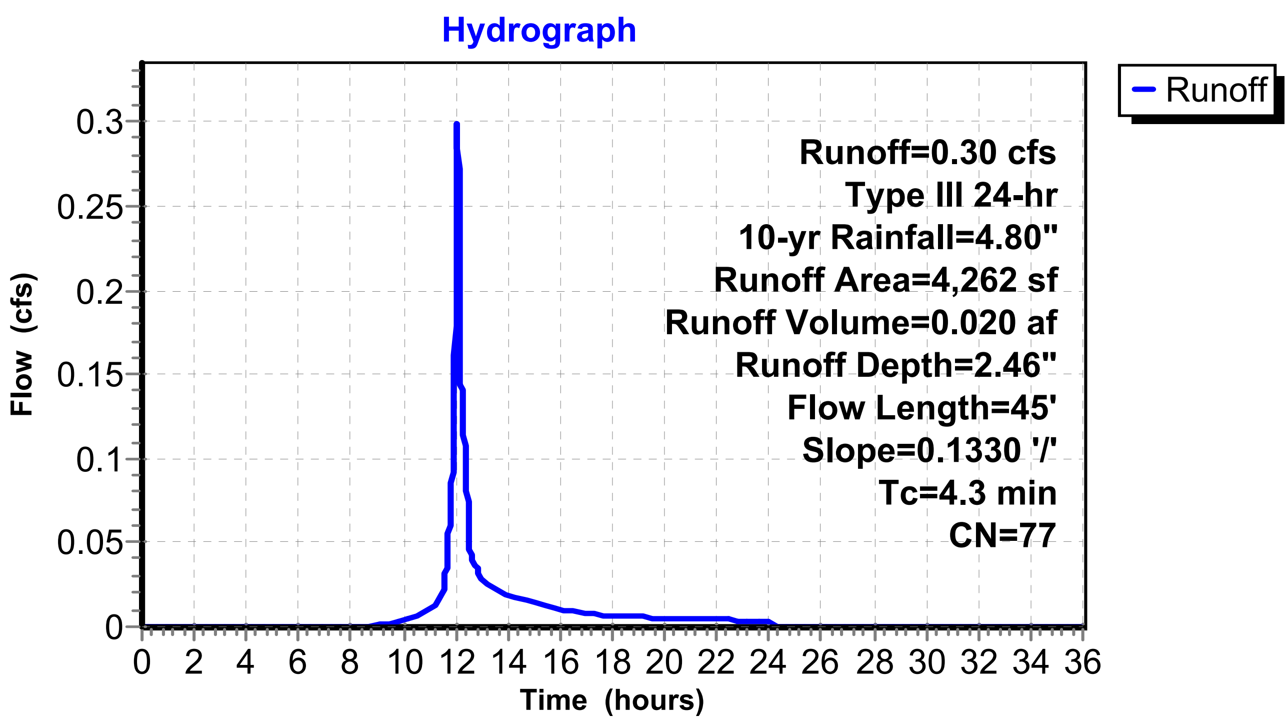
Runoff = 0.30 cfs @ 12.07 hrs, Volume= 0.020 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
1,640	43	Woods/grass comb., Fair, HSG A
2,622	98	Paved parking, HSG A
4,262	77	Weighted Average
1,640		38.48% Pervious Area
2,622		61.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	45	0.1330	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.80"

Subcatchment 8S: HD-5 Copy



Summary for Pond 1P: HD-5 DRY WELL (EXFIL)

Inflow Area = 0.098 ac, 61.52% Impervious, Inflow Depth = 2.46" for 10-yr event
Inflow = 0.30 cfs @ 12.07 hrs, Volume= 0.020 af
Outflow = 0.03 cfs @ 13.18 hrs, Volume= 0.020 af, Atten= 89%, Lag= 66.8 min
Discarded = 0.01 cfs @ 11.33 hrs, Volume= 0.019 af
Primary = 0.02 cfs @ 13.18 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 22.00' @ 13.18 hrs Surf.Area= 0.003 ac Storage= 0.009 af
Flood Elev= 22.00' Surf.Area= 0.003 ac Storage= 0.009 af

Plug-Flow detention time= 278.6 min calculated for 0.020 af (100% of inflow)
Center-of-Mass det. time= 278.7 min (1,108.8 - 830.0)

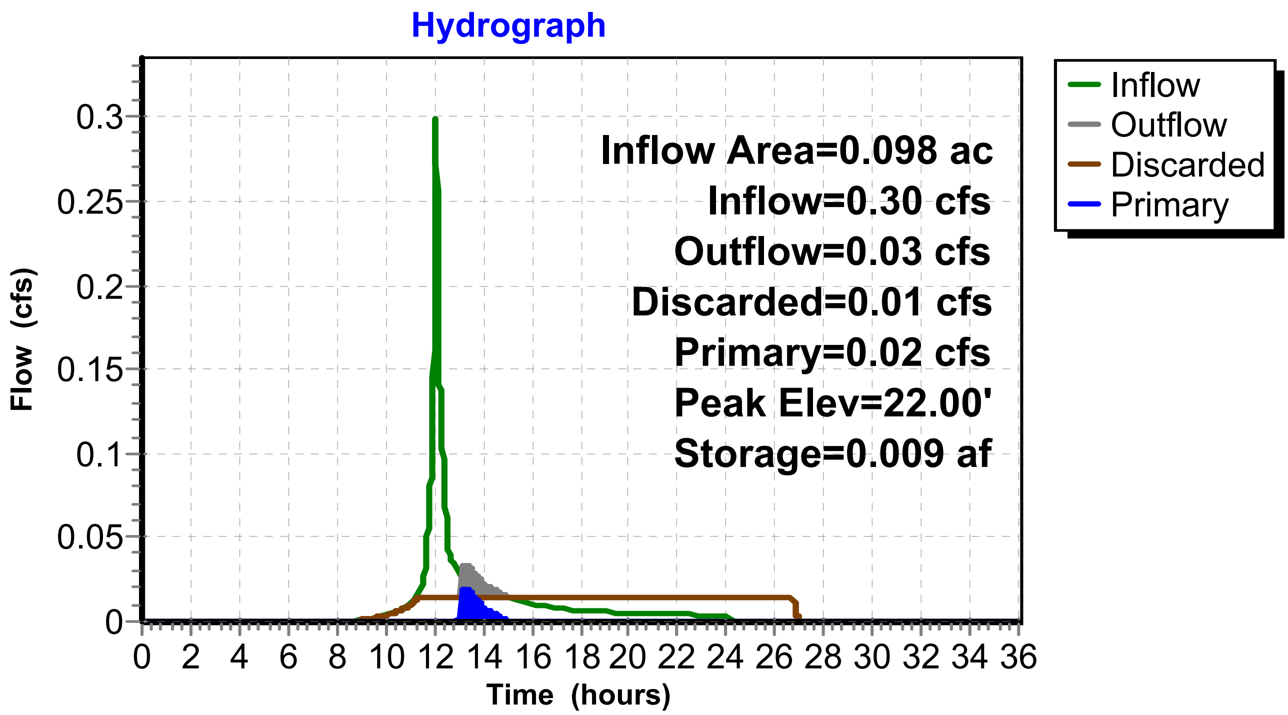
Volume	Invert	Avail.Storage	Storage Description
#1	13.50'	0.002 af	**8.00'W x 8.00'L x 4.50'H Prismatoid** x 2
			0.013 af Overall - 0.009 af Embedded = 0.004 af x 39.0% Voids
#2	14.00'	0.008 af	**7.33'D x 4.00'H Vertical Cone/Cylinder** x 2 Inside #1
			0.009 af Overall - 4.0" Wall Thickness = 0.008 af
		0.009 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	13.50'	**2.410 in/hr Exfiltration X 2.00 over Horizontal area**
			Phase-In= 0.01'
#2	Primary	22.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Discarded OutFlow Max=0.01 cfs @ 11.33 hrs HW=13.59' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 13.18 hrs HW=22.00' (Free Discharge)
└─**2=Orifice/Grate** (Weir Controls 0.00 cfs @ 0.17 fps)

Pond 1P: HD-5 DRY WELL (EXFIL)



Summary for Pond 2P: HD-6 DRY WELL (EXFIL)

Inflow Area = 0.214 ac, 6.85% Impervious, Inflow Depth = 0.47" for 10-yr event
Inflow = 0.05 cfs @ 12.37 hrs, Volume= 0.008 af
Outflow = 0.01 cfs @ 18.54 hrs, Volume= 0.007 af, Atten= 89%, Lag= 370.3 min
Discarded = 0.00 cfs @ 12.14 hrs, Volume= 0.007 af
Primary = 0.00 cfs @ 18.54 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 22.00' @ 18.54 hrs Surf.Area= 0.001 ac Storage= 0.005 af
Flood Elev= 22.00' Surf.Area= 0.001 ac Storage= 0.005 af

Plug-Flow detention time= 551.8 min calculated for 0.007 af (87% of inflow)
Center-of-Mass det. time= 492.2 min (1,436.4 - 944.1)

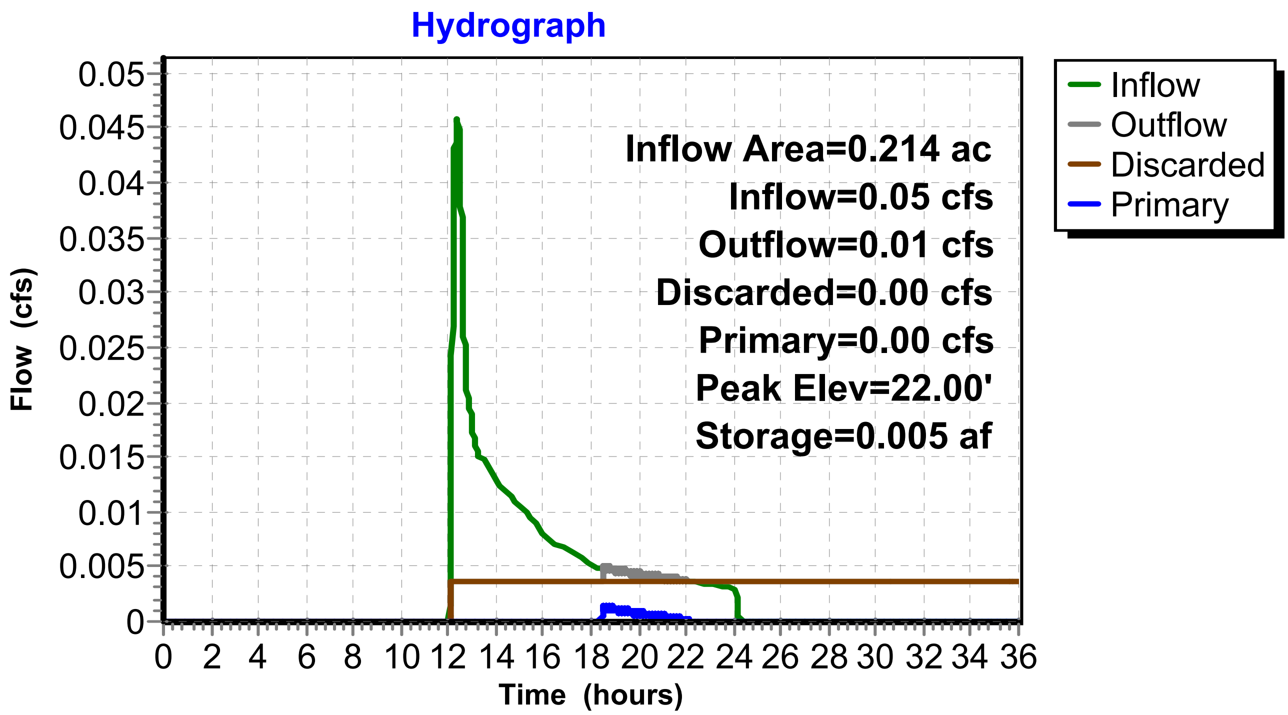
Volume	Invert	Avail.Storage	Storage Description
#1	13.50'	0.001 af	**8.00'W x 8.00'L x 4.50'H Prismatoid**
			0.007 af Overall - 0.005 af Embedded = 0.002 af x 39.0% Voids
#2	14.00'	0.004 af	**7.33'D x 4.00'H Vertical Cone/Cylinder** Inside #1
			0.005 af Overall - 4.0" Wall Thickness = 0.004 af
		0.005 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	13.50'	**2.410 in/hr Exfiltration over Horizontal area** Phase-In= 0.01'
#2	Primary	22.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 12.14 hrs HW=13.60' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 18.54 hrs HW=22.00' (Free Discharge)
↑—**2=Orifice/Grate** (Weir Controls 0.00 cfs @ 0.05 fps)

Pond 2P: HD-6 DRY WELL (EXFIL)



Summary for Pond 3P: Contech ChamberMAX system

Inflow Area = 1.181 ac, 12.84% Impervious, Inflow Depth = 0.38" for 10-yr event
Inflow = 0.22 cfs @ 12.21 hrs, Volume= 0.038 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.038 af, Atten= 88%, Lag= 0.0 min
Discarded = 0.03 cfs @ 12.03 hrs, Volume= 0.038 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 5.22' @ 17.05 hrs Surf.Area= 0.011 ac Storage= 0.016 af

Plug-Flow detention time= 292.1 min calculated for 0.038 af (100% of inflow)
Center-of-Mass det. time= 292.1 min (1,223.6 - 931.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	3.15'	0.010 af	**15.78'W x 30.78'L x 3.52'H Field A**
			0.039 af Overall - 0.014 af Embedded = 0.026 af x 40.0% Voids
#2A	3.65'	0.013 af	**Contech ChamberMaxx 2016** x 12 Inside #1
			Inside= 49.6"W x 25.2"H => 6.63 sf x 7.12'L = 47.2 cf
			Outside= 49.6"W x 30.0"H => 6.92 sf x 7.12'L = 49.3 cf
			Row Length Adjustment= +0.32' x 6.63 sf x 3 rows
		0.023 af	Total Available Storage

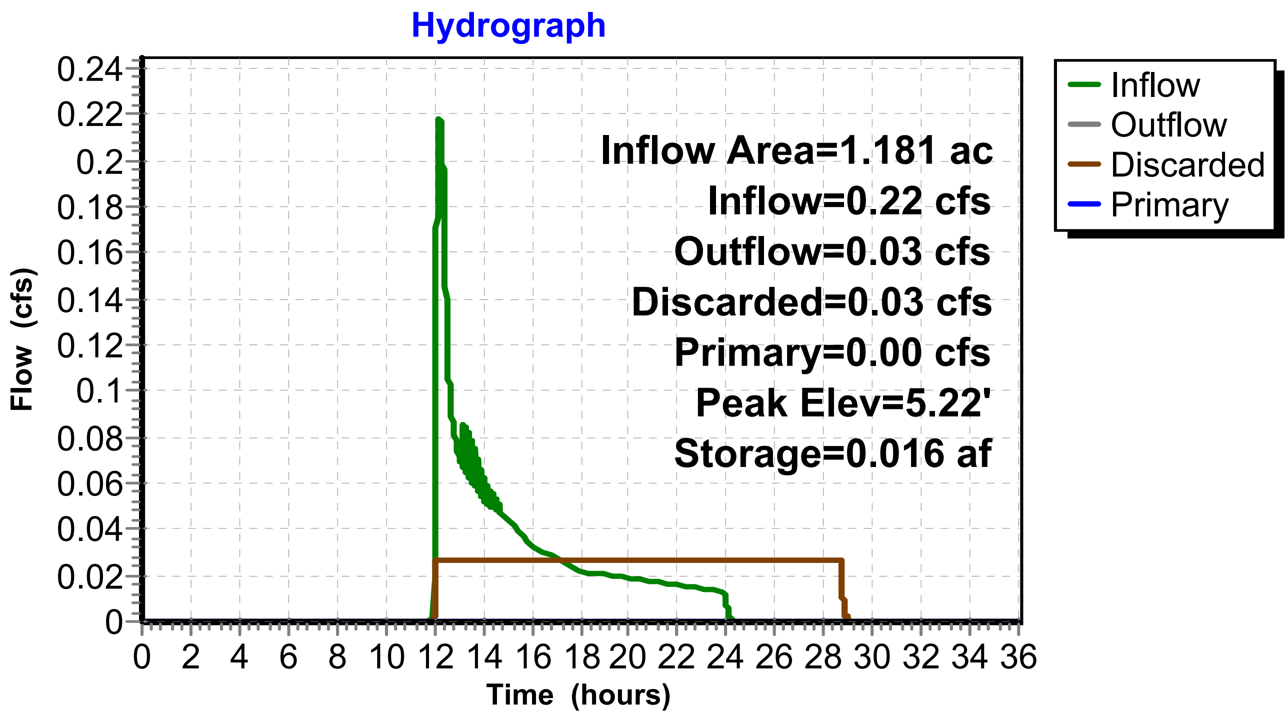
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	3.15'	**2.410 in/hr Exfiltration over Horizontal area**
#2	Primary	7.90'	**24.0" x 24.0" Horiz. Orifice/Grate X 2.00** C= 0.600
			Limited to weir flow at low heads

Discarded OutFlow Max=0.03 cfs @ 12.03 hrs HW=3.21' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=3.15' (Free Discharge)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: Contech ChamberMAX system



Summary for Pond 4P: Test Pipe Size

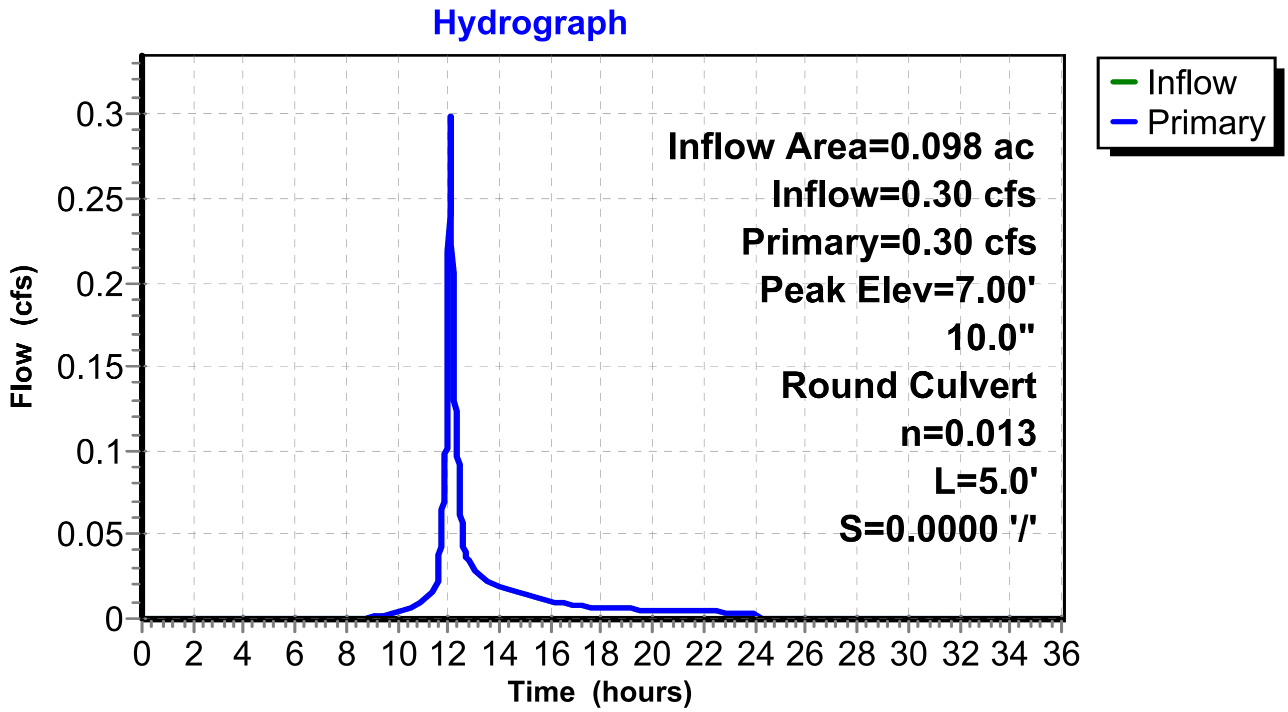
Inflow Area =	0.098 ac, 61.52% Impervious, Inflow Depth = 2.46" for 10-yr event			
Inflow =	0.30 cfs @	12.07 hrs,	Volume=	0.020 af
Outflow =	0.30 cfs @	12.07 hrs,	Volume=	0.020 af, Atten= 0%, Lag= 0.0 min
Primary =	0.30 cfs @	12.07 hrs,	Volume=	0.020 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 7.00' @ 12.07 hrs
Flood Elev= 7.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	3.65'	**10.0" Round Culvert** L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 3.65' / 3.65' S= 0.0000 '/' Cc= 0.900 n= 0.013, Flow Area= 0.55 sf

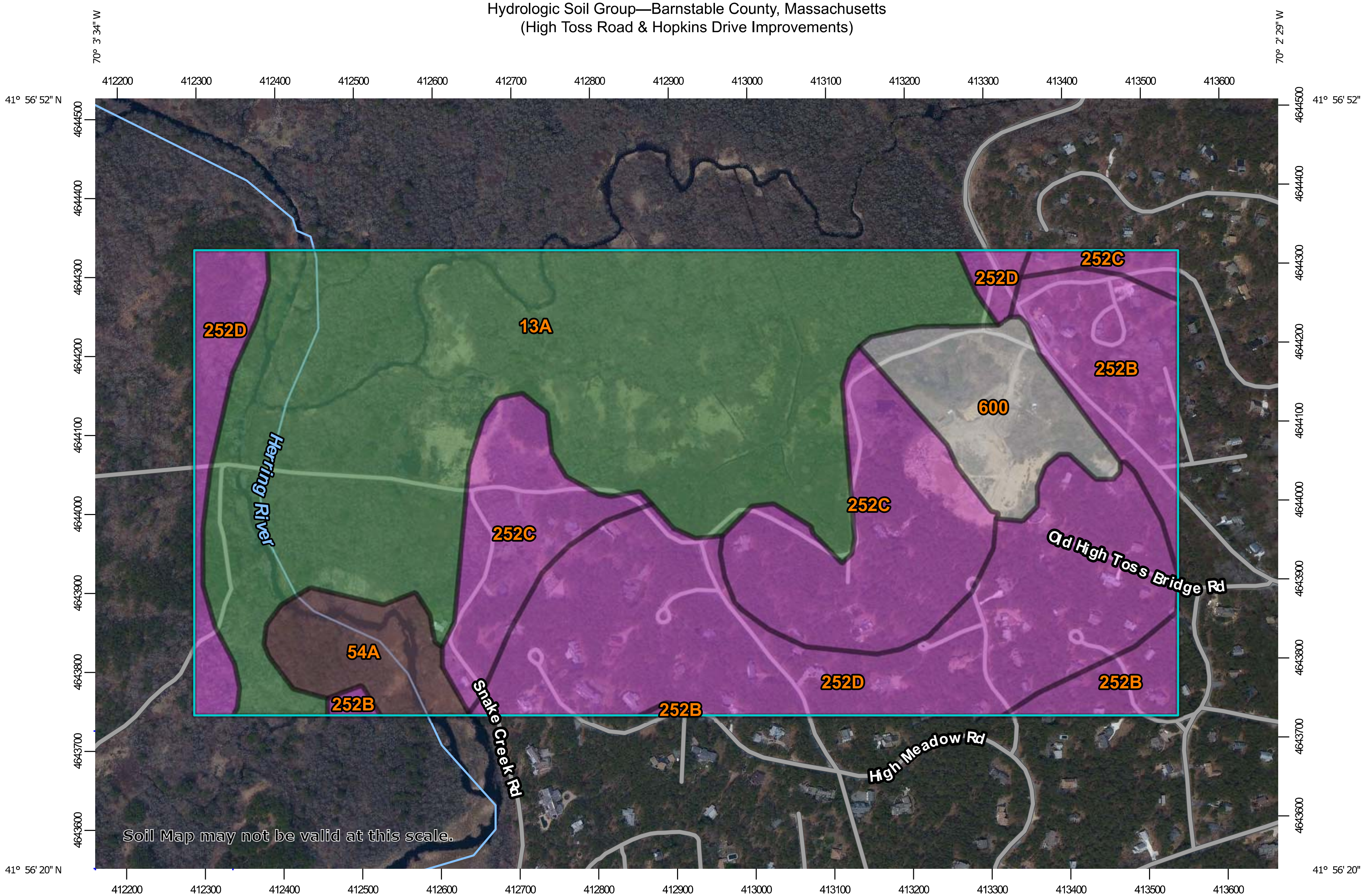
Primary OutFlow Max=0.32 cfs @ 12.07 hrs HW=7.00' TW=6.98' (Fixed TW Elev= 6.98')
└─**1=Culvert** (Inlet Controls 0.32 cfs @ 0.59 fps)

Pond 4P: Test Pipe Size

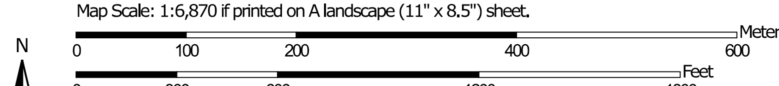


Appendix D
NRCS Soil Report

Hydrologic Soil Group—Barnstable County, Massachusetts
(High Toss Road & Hopkins Drive Improvements)



Map Scale: 1:6,870 if printed on A landscape (11" x 8.5") sheet.



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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

> Warning: Soil Map may not be valid at this scale.
>
> Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Barnstable County, Massachusetts
Survey Area Data: Version 13, Sep 14, 2016

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

Date(s) aerial images were photographed: Mar 30, 2011—Oct 8, 2011

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Barnstable County, Massachusetts (MA001)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
13A	Maybid variant silty clay loam, 0 to 1 percent slopes	A/D	76.9	42.1%
54A	Freetown and Swansea mucks, coastal lowland, 0 to 1 percent slopes	B/D	7.1	3.9%
252B	Carver coarse sand, 3 to 8 percent slopes	A	13.9	7.6%
252C	Carver coarse sand, 8 to 15 percent slopes	A	29.1	15.9%
252D	Carver coarse sand, 15 to 35 percent slopes	A	45.2	24.7%
600	Pits, sand and gravel		10.6	5.8%
Totals for Area of Interest			**182.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

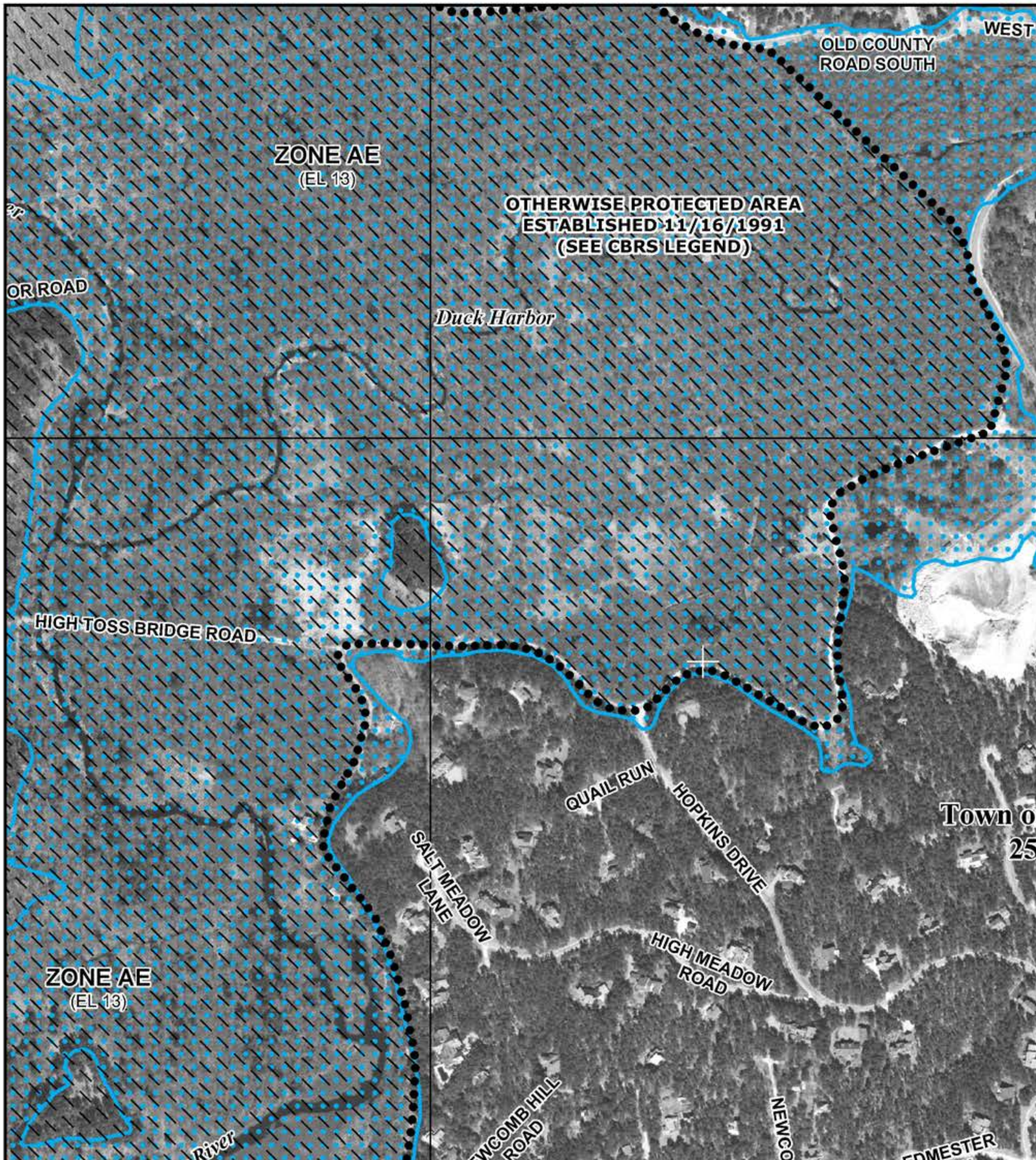
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix E
FEMA Flood Insurance Rate Map

www.essgroup.com



MAP SCALE 1" = 500'

250 0 500 1000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0233J

FIRM

FLOOD INSURANCE RATE MAP

BARNSTABLE COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 233 OF 875

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
TRURO, TOWN OF	255222	0233	J
WELLFLEET, TOWN OF	250014	0233	J

-NOTE-
THIS MAP INCLUDES BOUNDARIES OF THE COASTAL BARRIER RESOURCES SYSTEM ESTABLISHED UNDER THE COASTAL BARRIER RESOURCES ACT OF 1982 AND/OR SUBSEQUENT ENABLING LEGISLATION.

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25001C0233J

EFFECTIVE DATE
JULY 16, 2014

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix F
Long Term Pollution Prevention Plan

Long-Term Pollution Prevention Plan – High Toss Road and Hopkins Drive

Herring River Restoration Project
Truro and Wellfleet, Massachusetts

PREPARED FOR:
Don Palladino
President
Friends of Herring River
PO Box 496
Wellfleet, Massachusetts 02667

PREPARED BY:
ESS Group, Inc.
10 Hemingway Drive, 2nd Floor
East Providence, Rhode Island 02915

ESS Project No. F453-002

June 30, 2017

Long-Term Pollution Prevention Plan
Herring River Restoration Project
Truro and Wellfleet, Massachusetts

Prepared For:

Friends of Herring River
Don Palladino, President
PO Box 496
Wellfleet, Massachusetts 02667

Prepared By:

ESS Group, Inc.
10 Hemingway Drive, 2nd Floor
East Providence, Rhode Island 02915

ESS Project No. F453-002

June 30, 2017

TABLE OF CONTENTS

PURPOSE

The Long-Term Pollution Prevention Plan has been prepared in general compliance with Minimum Standards 4 and 6 of the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook, which states:

Standard 4:

The Long-Term Pollution Prevention Plan shall include the proper procedures for the following:

- Good housekeeping;
- Storing materials and waste products inside or under cover;
- Vehicle washing;
- Routine inspections of stormwater Best Management Practices (BMPs);
- Spill prevention and response;
- Maintenance of lawns, gardens, and other landscaped areas;
- Storage and used fertilizers, herbicides, and pesticides;
- Pet waste management;
- Operation and management of septic systems;
- Proper management of deicing chemicals and snow;

Standard 6:

Source control and pollution prevention are particularly important for critical areas. All projects that have the potential to impact critical areas shall implement a source control and pollution prevention program that includes proper management of snow and deicing chemicals. To protect critical areas, road salt must be properly stored within a Zone II or Interim Wellhead Protection Area or near an Outstanding Resource Water, Special Resource Water, shellfish growing area, bathing beach or cold-water fishery. The use of salt for the deicing of impervious surfaces must be minimized within water supply protection areas and any area near an Outstanding Resource Water, Special Resource Water, fresh water beach, or coldwater fishery. The long-term pollution prevention strategies for sites near critical areas must also incorporate designs that allow for shutdown and containment where appropriate to isolate the system in the event of an emergency spill or other unexpected event.

The Plan is intended to cover High Toss Road and the elevated portion of Hopkins Drive (Project Area)

1.0 INTRODUCTION

This Long-Term Pollution Prevention plan was prepared by ESS Group, Inc. for the High Toss Road and Hopkins Drive portion of the Herring River Restoration Project at the Herring River estuary in the Town of Wellfleet, Massachusetts.

The Town and Hopkins Drive Subdivision (Owners) shall implement this Long-Term Pollution Prevention Plan and proactively conduct operations at the site in an environmentally responsible manner. Compliance with this Long-Term Pollution Prevention Plan does not in any way dismiss the Owner from compliance with other applicable Federal, State or local laws. Certain conditions of other approvals affecting the long term management of the property will be considered part of this Long-Term Pollution Prevention Plan. The owner will become familiar with those documents and comply with the guidelines set forth in those documents.

2.0 GOOD HOUSEKEEPING

The Owners will follow good housekeeping procedures to reduce the possibility of accidental releases and to reduce safety hazards within the Project Area.

2.1 Material Handling and Waste Management

No waste materials will be handled or stored within the Project Area.

2.2 Equipment/Vehicle Fueling

There is no anticipated equipment or vehicle fueling within the Project Area.

3.0 ROUTINE INSPECTION AND MAINTENANCE OF STORMWATER BMPS

Catch basin grates shall be inspected a minimum of twice per year. Catch basin grates shall be inspected in the spring following snow-melt and in the fall following leaf-drop to verify that inlet openings are not clogged by debris. Additionally, catch basin grates shall be inspected following heavy rainfalls, defined as a storm event exceeding one inch of rainfall within a 24-hour period, to verify that inlet openings are not clogged with debris. Debris shall be removed and disposed of properly.

Refer to the Operation and Maintenance Plan in Appendix B for information regarding stormwater BMPs maintenance requirements.

4.0 SPILL PREVENTION AND RESPONSE

Refer to the most recent version of the *Massachusetts Unified Response Manual for the Massachusetts Highway System* for spill response procedures, as applicable.

Should materials be used or stored within the Project Area, the following material management practices will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff:

1. An effort will be made to store only enough products required to complete the job.
2. All materials stored on site must be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
3. Materials will be kept in their original containers with the original manufacturer's label.
4. Substances will not be mixed with one another, unless recommended by the manufacturer.
5. Manufacturer's recommendations for proper use and disposal will be followed.
6. The Operator will perform inspections to ensure the proper storage, use and disposal of materials.
7. Whenever possible, materials which are considered hazardous will be used per the manufacturer's recommendations in their entirety before disposing of the container.
8. On-site vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage.
9. Petroleum products will be stored in tightly sealed containers that are clearly labeled.
10. All containers will be tightly sealed and stored when not in use. Excess paint will be properly disposed of according to the manufacturer's instructions or state and local regulations.

The Owner will be responsible for preventing spills in accordance with the project specifications and applicable federal, state and local regulations and will identify an appropriately trained site employee involved with the day-to-day site operations to be the Spill Prevention and Cleanup Coordinator. The name(s) of the responsible spill personnel will be posted in the material storage area(s) and the on-site office. Each employee will be instructed that all spills are to be reported to the Spill Prevention and Cleanup Coordinator.

Materials and equipment necessary for spill cleanup and control will be kept in the on-site material storage area. Equipment and materials will include, but not be limited to, absorbent booms or mats, brooms, dust pans, mops, rags, gloves, goggles, sand and plastic and metal trash containers, specifically for this purpose. It is the responsibility of the Operator to ensure the inventory will be readily accessible and maintained.

Spills will be contained with granular sorbent materials, sand, sorbent pads, booms, or all of the above to prevent spreading. Spill clean-up should be completed by trained, certified clean-up contractors. Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies. Following a spill of oil or hazardous material the Operator will fill out a spill report form. Upon completion of clean-up, spill reports and appropriate completion forms shall be provided to the proper authorities.

5.0 MAINTENANCE OF LANDSCAPED AREAS

The maintenance of landscaped areas in the Project Area Right of Way should use a system that reduces the amount of pesticides and fertilizers used. Pesticide and fertilizer should be avoided. Grass clippings, pruned branches, and any other landscaped waste should be disposed of or composted in an appropriate location. Avoid application of chemicals prior to rainfall events.

6.0 STORAGE OF FERTILIZERS, HERBICIDES, AND PESTICIDES

No fertilizers, herbicides, or pesticides will be stored in the Project Area.

7.0 PET WASTE MANAGEMENT

Residents should be encouraged to pick up after their pets and dispose of waste in the trash.

8.0 MANAGEMENT OF DEICING CHEMICALS AND SNOW

Roadways shall be maintained by the Owners. Snow will not be stock piled on top of stormwater BMPs or near wetland resource areas.

Sand and salt for roadway deicing will not be stored in the Project Area.

Alternatives to sodium chloride (commonly used salt) such as sand or calcium chloride, and reduced application, should be considered and implemented if public safety is not jeopardized.

Before winter begins, the Owners should review snow plowing, deicing, and stockpiling procedures. Areas designated for stockpiling should be cleaned of any debris.

9.0 EMERGENCY CONTACT

TBD

Stormwater Standard Compliance (Standard 6)
Herring River Tidal Restoration Project
Wellfleet, Massachusetts

STANDARD:

STORMWATER DISCHARGES TO OUTSTANDING RESOURCE WATERS, SHELLFISH GROWING AREA, ZONE II OR INTERIM WELLHEAD PROTECTION AREAS, COLD-WATER FISHERIES, BATHING BEACHES, ETC. MUST ACHIEVE AT LEAST 44% TSS REMOVAL PRIOR TO DISCHARGE TO INFILTRATION BMP.

CONFORMANCE:

IN LIEU OF USING DEEP-SUMP, HOODED CATCH BASINS THAT ONLY PROVIDE 25% TSS REMOVAL, PROPRIETARY STORMWATER INLET DEVICES (FIRST DEFENSE HC BY HYDRO INTERNATIONAL OR APPROVED EQUAL) ARE PROPOSED. THESE PRETREATMENT INLET DEVICES ARE CERTIFIED BY NJDEP AT A TSS REMOVAL RATE OF 50%. THE FD-4HC MODEL IS REQUIRED TO TO ACHIEVE THIS TSS REMOVAL RATE GIVEN A MAXIMUM PEAK FLOW RATE OF 0.76 CFS DURING THE WATER QUALITY STORM EVENT AND 1.36 CFS DURING THE 100-YEAR STORM EVENT.

THUS, 50% TSS REMOVAL WILL BE ACHIEVED PRIOR TO DISCHARGE TO STORMWATER PLANTERS (WHICH EXCEEDS 44% TSS REMOVAL REQUIREMENT). THE STORMWATER PLANTERS, IN CONJUNCTION WITH THE PROPRIETARY INLET TREATMENT DEVICES, WILL PROVIDE A TOTAL OF 80% TSS REMOVAL PRIOR TO DISCHARGE TO THE HERRING RIVER AND WELLFLEET HARBOR.

FUSS & O'NEILL

Supporting Proprietary Treatment System Certification and Documentation

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

April 4, 2016

Lisa Lemont, CPSWQ
Business Development Manager
Hydro International
94 Hutchins Drive
Portland, ME 04102

Re: MTD Lab Certification
First Defense® HC (FDHC) Stormwater Treatment Device by Hydro International

TSS Removal Rate 50%

Dear Ms. Lemont:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7 (c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Hydro International has requested an MTD Laboratory Certification for the First Defense® HC Stormwater Treatment Device.

The projects falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated February 2016) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the First Defense® HC Stormwater Treatment Device by Hydro International at a TSS removal rate of 50% when designed, operated and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The First Defense® HC Stormwater Treatment Device shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.

3. This First Defense® HC Stormwater Treatment Device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using the First Defense® HC Stormwater Treatment Device shall incorporate, at a minimum, the maintenance requirements noted in the attached document. However, it is recommended to review the maintenance website at http://www.hydro-int.com/UserFiles/downloads/FD_O%2BM_F1512.pdf for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for the First Defense® HC Stormwater Treatment Device:

   Example: A 0.25 acre impervious site is to be treated to 50% TSS removal using a First Defense® HC Stormwater Treatment Device. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
   c=0.99 (curve number for impervious)
   Q=ciA=0.99x3.2x0.25=0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the First Defense® HC Model 4-ft with a MTFR of 1.5 cfs would be the smallest model approved that could be used for this site that could remove 50% of the TSS from the impervious area without exceeding the MTFR.

   The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1 and Table A-2 of the NJCAT Verification Report.

Table 1 First Defense® HC Models

First Defense® Model	Manhole Diameter (ft)	Maximum Treatment Flowrate, MTFR (cfs)
4-ft	4-ft	1.50
6-ft	6-ft	3.38
8-ft	8-ft	6.00

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance of the New Jersey Stormwater Best Management Practices Manual.

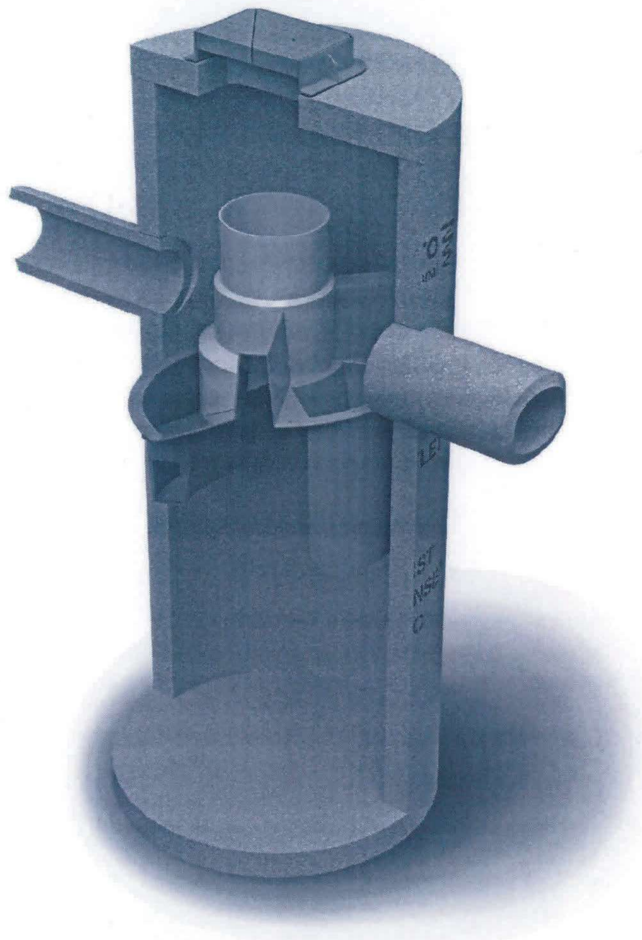
If you have any questions regarding the above information, please contact Mr. Titus Magnanao of my office at (609) 633-7021.

Sincerely,

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan
C: Chron File
Richard Magee, NJCAT
Vince Mazzei, DLUR
Ravi Patraju, NJDEP
Gabriel Mahon, BNPC
Titus Magnanao, BNPC

Hydro International®



Operation and Maintenance Manual

First Defense® and First Defense®-HC

Vortex Separator for Stormwater Treatment

Stormwater Solutions

Turning Water Around ...®

Table of Contents

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations (refer to *Section II. Model Sizes & Configurations*, page 4) to accommodate a wide range of pipe sizes, peak flows and depth constraints.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

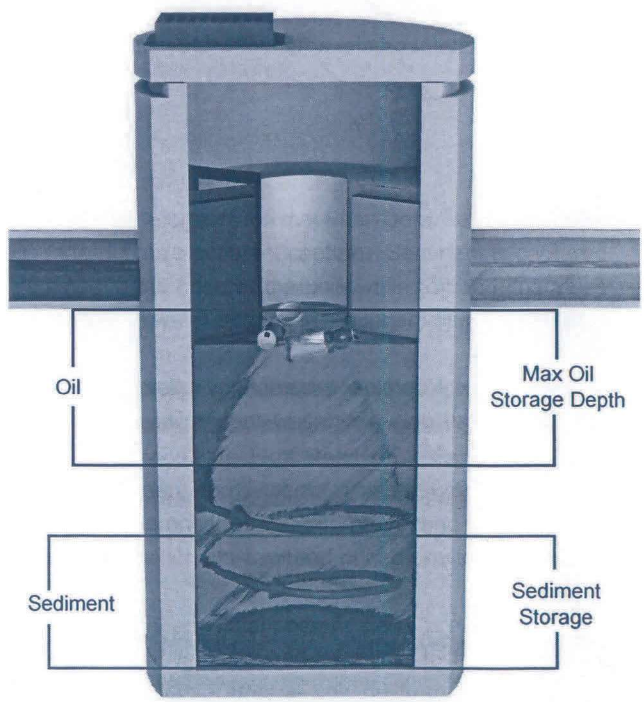


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components of the First Defense®-4HC and First Defense®-6HC have modified geometries as to allow greater design flexibility needed to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2a - 2b). First Defense® model parameters and design criteria are shown in Table 1.

First Defense® Components

1. **Built-In Bypass**
2. **Inlet Pipe**
3. **Inlet Chute**
4. **Floatables Draw-off Port**
5. **Outlet Pipe**
6. **Floatables Storage**
7. **Sediment Storage**
8. **Inlet Grate or Cover**

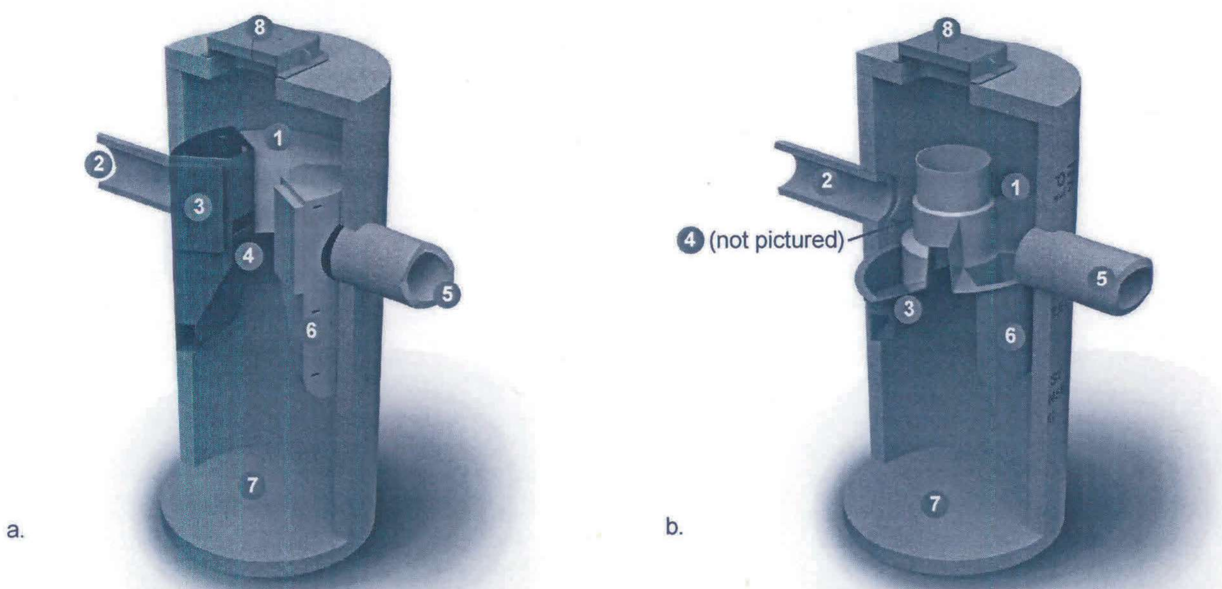


Fig.2a) First Defense®-4 and First Defense®-6; b) First Defense®-4HC and First Defense®-6HC, with higher capacity dual internal bypass and larger maximum pipe diameter.

Table 1. First Defense® Pollutant Storage Capacities and Maximum Clean out Depths

First Defense® Model Number	Diameter	Oil Storage Capacity	Oil Clean Out Depth	Maximum Sediment Storage Capacity[1]		Recommended Sediment Clean-out Capacity	
				Volume	Depth	Volume	Depth
	(ft / m)	(gal / L)	(in / cm)	(yd³ / m³)	(in / cm)	(yd³ / m³)	(in / cm)
FD-4	4 / 1.2	180 / 681	<23.5 / 60	1.3 / 1.0	33 / 84	0.7 / 0.5	18 / 46
FD-4HC		191 / 723	<24.4 / 62				
FD-6	6 / 1.8	420 / 1,590	<23.5 / 60	3.3 / 2.5	37.5 / 95	1.6 / 1.2	18 / 46
FD-6HC		496 / 1,878	<28.2 / 72				

NOTE

[1] Sediment storage capacity and clean out depth may vary, as larger sediment storage sump volumes are provided when required.

III. Maintenance

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense®-HC have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

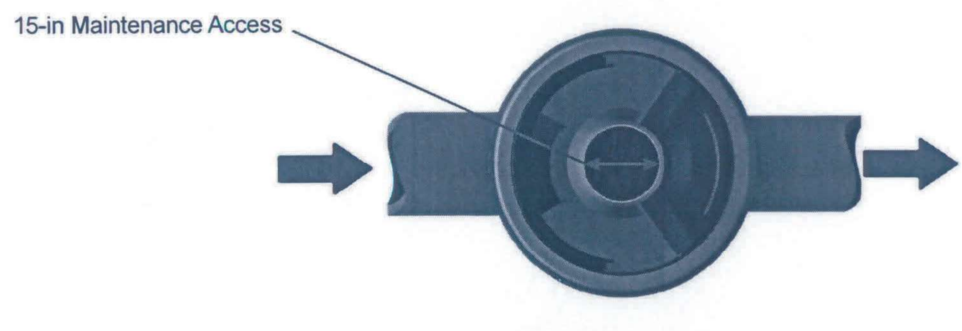


Fig.3 The central opening to the sump of the First Defense®-HC is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for a 6-ft First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

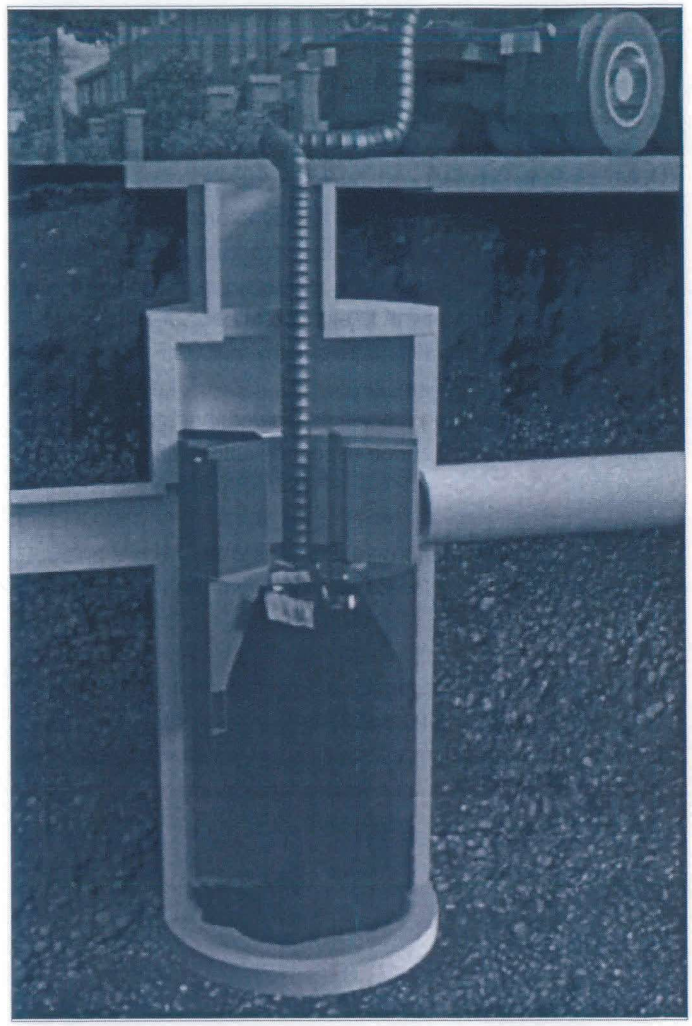


Fig.4 Floatables are removed with a vactor hose (First Defense model FD-4, shown).

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.5).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.

- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Remove oil and floatables stored on the surface of the water with the vactor hose (Fig.5) or with the skimmer or net (not pictured).

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor (Fig.5).

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

9. Securely replace the grate or lid.

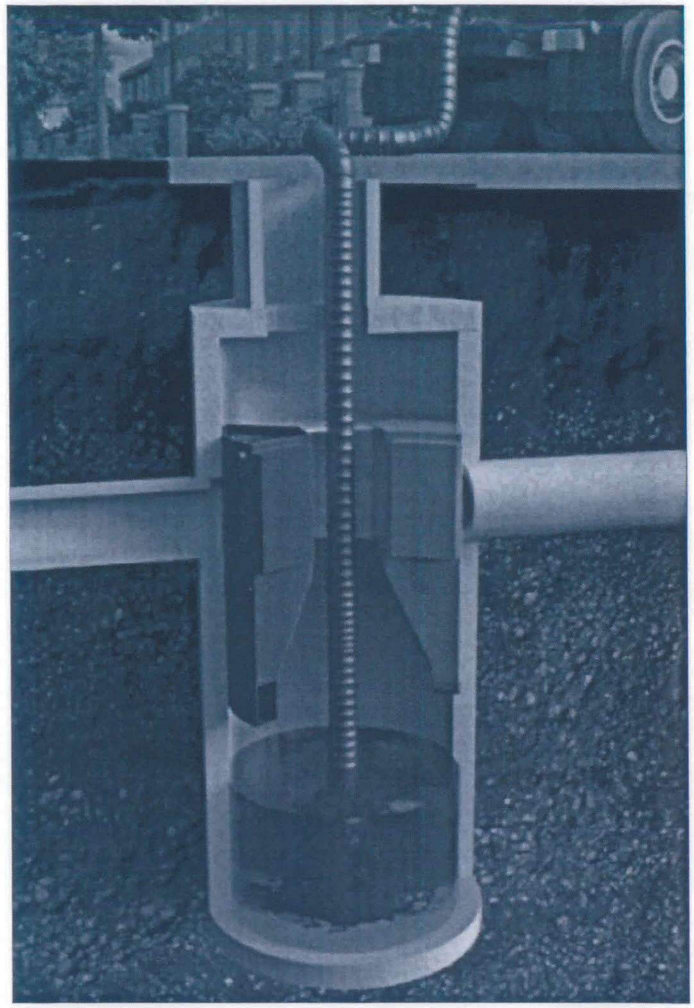


Fig.5 Sediment is removed with a vactor hose (First Defense model FD-4, shown).

Maintenance at a Glance

Activity	Frequency
Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	

Hydro International

First Defense® High Capacity

A Simple Solution for your Trickiest Sites

Product Profile

The First Defense® High Capacity is an enhanced vortex separator that combines an effective stormwater treatment chamber with an integral peak flow bypass. It efficiently removes sediment total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® High Capacity is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints (**Table 1**, next page).

Applications

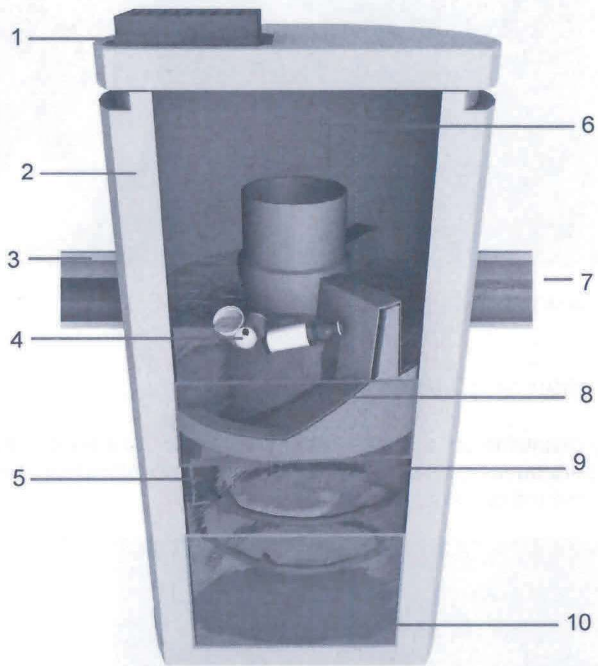
- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 450% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

Verified by NJCAT and NJDEP

Fig.1 The First Defense® High Capacity has internal components designed to efficiently capture pollutants and prevent washout at peak flows.



Components

1. Inlet Grate (optional)
2. Precast chamber
3. Inlet Pipe (optional)
4. Floatables Draw Off Slot (not pictured)
5. Inlet Chute
6. Internal Bypass
7. Outlet pipe
8. Oil and Floatables Storage
9. Outlet chute
10. Sediment Storage Sump

How it Works

The First Defense® High Capacity has internal components designed to remove and retain gross debris, total suspended solids (TSS) and hydrocarbons (**Fig.1**).

Contaminated stormwater runoff enters the inlet chute from a surface grate and/or inlet pipe. The inlet chute introduces flow into the chamber tangentially to create a low energy vortex flow regime (magenta arrow) that directs sediment into the sump while oils, floating trash and debris rise to the surface.

Treated stormwater exits through a submerged outlet chute located opposite to the direction of the rotating flow (blue arrow). Enhanced vortex separation is provided by forcing the rotating flow within the vessel to follow the longest path possible rather than directly from inlet to outlet.

Higher flows bypass the treatment chamber to prevent turbulence and washout of captured pollutants. An internal bypass conveys infrequent peak flows directly to the outlet eliminating the need for, and expense of, external bypass control structures. A floatables draw off slot functions to convey floatables into the treatment chamber prior to bypass.

First Defense® High Capacity

Sizing & Design

This adaptable online treatment system works easily with large pipes, multiple inlet pipes, inlet grates and now, contains a high capacity bypass for the conveyance of large peak flows. Designed with site flexibility in mind, the First Defense® High Capacity allows engineers to maximize available site space without compromising treatment level.

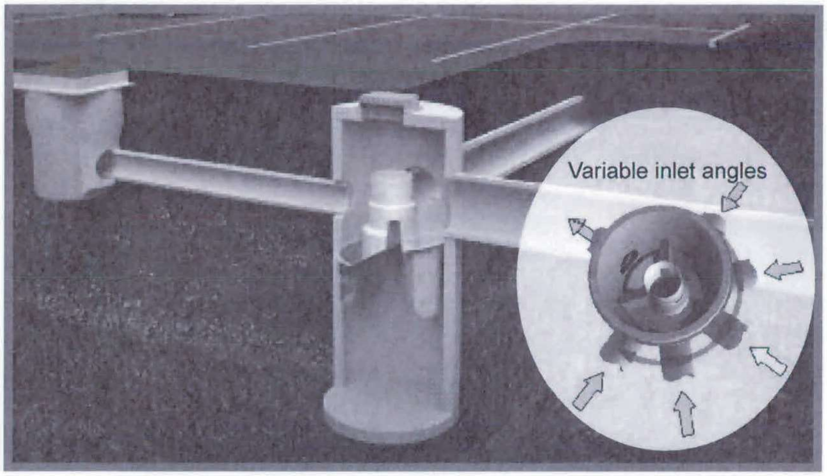


Fig 2. Works with multiple inlet pipes and grates

Inspection and Maintenance

Nobody maintains our systems better than we do. To ensure optimal, ongoing device performance, be sure to recommend Hydro International as a preferred service and maintenance provider to your clients.

Call **1 (800) 848-2706** to schedule an inspection and cleanout or learn more at **hydro-int.com/service**

Free *Stormwater Separator Sizing Calculator* for Engineers

This simple online tool will recommend the best separatror, model size and online/offline arrangement based on site-specific data entered by the user.

Go to hydro-int.com/sizing to access the tool.

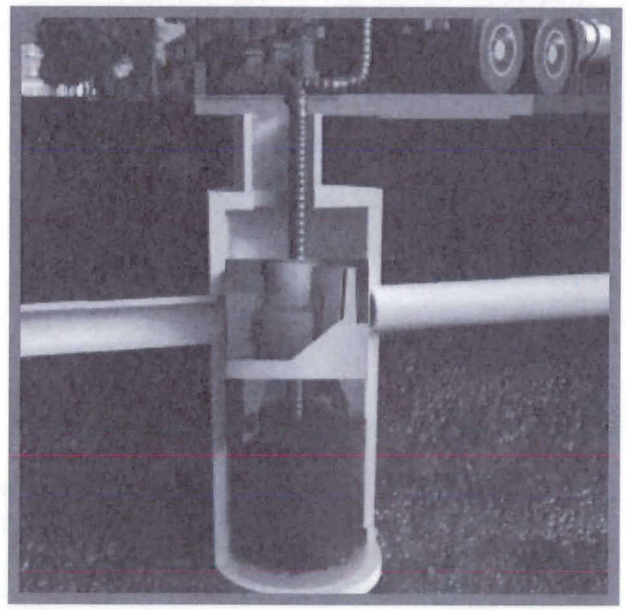


Fig 3. Maintenance is done with a vactor truck

Table 1. First Defense® High Capacity Design Criteria.

First Defense® High Capacity Model Number	Diameter	Typical TSS Treatment Flow Rates			Peak Online Flow Rate	Maximum Pipe Diameter[1]	Oil Storage Capacity	Typical Sediment Storage Capacity[2]	Minimum Distance from Outlet Invert to Top of Rim[3]	Standard Distance from Outlet Invert to Sump Floor
		NJDEP Certified	106µm	230µm						
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd^3 / m^3)	(ft / m)	(ft / m)
FD-3HC	3 / 0.9	0.84 / 23.7	0.3 / 8.77	0.53 / 15.0	15 / 424	18 / 457	125 / 473	0.4 / 0.3	2.0 - 3.5 / 0.6 - 1.0	3.71 / 1.13
FD-4HC	4 / 1.2	1.50 / 42.4	0.7 / 20	1.2 / 34	18 / 510	24 / 600	191 / 723	0.7 / 0.5	2.3 - 3.9 / 0.7 - 1.2	4.97 / 1.5
FD-5HC	5 / 1.5	2.34 / 66.2	1.3 / 37.9	2.2 / 62.2	20 / 566	24 / 609	300 / 1135	1.1 / .84	2.5 - 4.5 / 0.7 - 1.3	5.19 / 1.5
FD-6HC	6 / 1.8	3.38 / 95.7	2.2 / 63	3.8 / 108	32 / 906	30 / 750	496 / 1,878	1.6 / 1.2	3.0 - 5.1 / 0.9 - 1.6	5.97 / 1.8
FD-8HC	8 / 2.4	6.00 / 169.9	5.1 / 144	8.6 / 243	50 / 1,415	48 / 1219	1120 / 4239	2.8 / 2.1	3.0 - 6.0 / 0.9 -1.8	7.40 / 2.2

[1]Contact Hydro International when larger pipe sizes are required.
[2]Contact Hydro International when custom sediment storage capacity is required.
[3]Minimum distance for models depends on pipe diameter.

8.E NHESP Correspondence and Draft Habitat Management Plan Outline

(See following pages)

July 8, 2016

Secretary Matthew A. Beaton
Executive Office of Environmental Affairs
Attention: MEPA Office
Holly Johnson, EOEA No. 14272
100 Cambridge St, Suite 900
Boston, MA 02114

Project Name:	*Herring River Restoration Project*
Proponent:	*Cape Cod National Seashore and the Herring River Restoration Committee*
Project Location:	*Truro & Wellfleet*
Project Description:	*Tidal restoration of large portions of the Herring River flood plain*
Document Reviewed:	*Final Environmental Impact Report/ Final Environmental Impact Statement*
EEA File Number:	*14272*
NHESP Tracking No:	*04-15126*

Dear Secretary Beaton:

The Natural Heritage & Endangered Species Program (NHESP) of the Massachusetts Division of Fisheries & Wildlife has reviewed the Final Environmental Impact Report (FEIR) / Final Environmental Impact Statement (FEIS) for the *Herring River Restoration Project.* At this time, the NHESP would like to offer the following comments regarding state-listed species and their habitats.

The project site is located within *Priority* and *Estimated Habitat* as indicated in the 13th Edition of the MA Natural Heritage Atlas and therefore requires review by the NHESP for compliance with the Massachusetts Endangered Species Act (MESA 321 CMR 10.00).

The NHESP has been actively involved in the review of the proposed restoration plan through on-going participation in the Herring River Restoration Technical Working Group. While the NHESP strongly supports habitat restoration, care must be taken to reduce impacts to state-listed species and their habitats. It appears that the proposed project will qualify for a MESA Habitat Management Exemption (321 CMR 10.14 (15)), however, the proposed Habitat Management and Monitoring Plan must be submitted to the NHESP for final review and approval. As stated in Chapter 5, the NHESP is continuing to work closely with the proponent to establish appropriate monitoring and survey activities, as well as design specific sampling protocols. Preliminary data collected to date and over the course of the project implementation will assist in identifying opportunities for avoiding, minimizing, and mitigating impacts to state-listed species.

The NHESP looks forward to continued careful coordination with the proponent on the proposed project. We appreciate the opportunity to comment on this project. Please contact Eve Schlüter, Ph.D., Chief of

Division of Fisheries and Wildlife
Field Headquarters, 1 Rabbit Hill Road, Westborough, MA 01581 (508) 389-6300 Fax (508) 389-7890
An Agency of the Department of Fish and Game

Regulatory Review, of our office with any questions about this letter at (508) 389-6346 or eve.schluter@state.ma.us

Sincerely,

Thomas W. French

Thomas W. French, Ph.D.
Assistant Director

cc: Margo Fenn, Herring River Restoration Committee
George Price, Cape Cod National Seashore
Truro Board of Selectmen
Truro Conservation Commission
Truro Planning Board
Wellfleet Board of Selectmen
Wellfleet Conservation Commission
Wellfleet Planning Board
Heather McElroy, Cape Cod Commission
DEP Southeastern Regional Office, MEPA Coordinator

Herring River Restoration Project Habitat Management Plan for Phase One Project Activities

for

MA Natural Heritage and Endangered Species Program

Outline, DRAFT – October 2, 2018

1. Introduction
    - 1.1. Brief Phase One Project Description
    - 1.2. Purpose of Habitat Management Plan
    - 1.3. Integration with CCNS Natural Resource Management Program
    - 1.4. Habitat Management In Relation to Adaptive Management Plan
        - 1.4.1. Tidegate Management Policies
        - 1.4.2. Vegetation Management
        - 1.4.3. Marsh Management

2. Historic Habitat Conditions
    - 2.1. Ecological Setting Prior to Dike Construction
    - 2.2. Ecological Change Since 1909

3. Current Status of Listed Species
    - 3.1. Diamond-back terrapin
        - 3.1.1. Brief species description
        - 3.1.2. Preferred Habitat(s)
        - 3.1.3. Pre-restoration monitoring data
            - 3.1.3.1. Brennessel data?
            - 3.1.3.2. Wellfleet dredge project data?
    - 3.2. Eastern box turtle
        - 3.2.1. Brief species description
        - 3.2.2. Preferred Habitat(s)
        - 3.2.3. Pre-restoration monitoring data
            - 3.2.3.1. R. Cook Database (NPS)
            - 3.2.3.2. Oxbow data since 2015
    - 3.3. American Bittern
        - 3.3.1. Brief species description
        - 3.3.2. Preferred Habitat(s)
        - 3.3.3. Pre-restoration monitoring data
            - 3.3.3.1. Erwin et. alt. 2002
            - 3.3.3.2. MacDougall 2015
            - 3.3.3.3. Broker Observations

- 3.3.3.4. MASSBird Records
- 3.4. Least Bittern; **treat bitterns separate or together?**
  - 3.4.1. Brief species description
  - 3.4.2. Pre-restoration monitoring data
  - 3.4.3. Status in Herring River
    - 3.4.3.1. Erwin et. alt. 2002
    - 3.4.3.2. MacDougall 2015
    - 3.4.3.3. Broker Observations
    - 3.4.3.4. MASSBird Records
- 3.5. Northern Harrier
  - 3.5.1. Brief species description
  - 3.5.2. Preferred Habitat(s)
  - 3.5.3. Pre-restoration monitoring data
    - 3.5.3.1. Byrne 2006
    - 3.5.3.2. Bowen 2006
    - 3.5.3.3. MacDougall 2015
    - 3.5.3.4. MASSBird Records
- 3.6. Water Willow Stem-borer
  - 3.6.1. Brief species description
  - 3.6.2. Preferred Habitat(s)
  - 3.6.3. Pre-restoration monitoring data
    - 3.6.3.1. Mello 2006
    - 3.6.3.2. Mello 2015
- 3.7. Northern Long-eared Bat
  - 3.7.1. Brief species description
  - 3.7.2. Preferred Habitat(s)
  - 3.7.3. Pre-restoration monitoring data
    - 3.7.3.1. SUNY-ESF Data?

4. Habitat Delineation for Each Species in Herring River (**habitat types based on SLAMM categories**)
   - 4.1. Diamond-back Terrapin: Marine Subtidal, Brackish Marsh, Low Salt Marsh, High Salt Marsh, Tidal Flat
   - 4.2. Eastern Box Turtle: Upland, Non-tidal Wooded Swamp, Scrub-Shrub Freshwater Wetland
   - 4.3. American and Least Bittern (nesting): Brackish Marsh, Tidal Fresh Emergent Marsh, Fresh Emergent Marsh; **is there enough overlap to treat these species together or should they be separate?**
   - 4.4. Northern Harrier (nesting): Tidal Fresh Emergent Marsh, Fresh Emergent Marsh
   - 4.5. Water Willow Stem-borer (Decodon): Non-tidal Wooded Swamp, Scrub-Shrub Freshwater Wetland
   - 4.6. Long-eared Bat: Non-tidal Wooded Swamp

5. GIS Analysis of NHESP Priority/Estimated Habitats Incrementally Restored to Tidal Marsh

5.1. SLAMM Derived Habitat Changes at Selected Restoration Increments
5.2. Implications of Tidegate Management Policies/Temporal Analysis
5.3. Vegetation Management
5.4. Marsh Management
5.5. Direct Impacts vs. Indirect Effects of Restored Tidal Habitat

6. Monitoring
6.1. Species Monitoring During Adaptive Management Phase; **Each species to include methods, locations, time of year, frequency, and assessments occupied and unoccupied habitat**
6.1.1. Diamond-back terrapin
6.1.2. Eastern box turtle
6.1.3. American bittern
6.1.4. Least bittern; **treat bitterns together or separate?**
6.1.5. Northern harrier
6.1.6. Water willow stem-borer
6.1.7. Northern long-eared bat
6.2. Long-term Monitoring Regional: Population Trend/Context

7. Potential Habitat Management Actions to Minimize Adverse Effects
7.1. Direct Construction Impacts
7.1.1. Time of Year Restrictions
7.1.2. Pre-construction "Sweeps" Prior to Activities in Designated Habitats
7.1.3. Construction Practices That Minimize Ground Disturbance and Erosion
7.2. Effects of Tidal Marsh Habitat Restoration
7.2.1. Recognition That Any Agreed Upon Management Is Commensurate With Effects
7.2.2. Threshold Effects Where Management May Be Appropriate
7.2.3. Potential Management Practices
7.2.3.1. Translocation of Decodon to Unoccupied Habitat
7.2.3.2. Habitat Enhancement in Areas Outside Herring River Project Area
7.2.3.3. Support for Increased Habitat Protection **(i.e. working with CYCC on voluntary land conservation)**
7.2.3.4. Support for Species-focused Public Education and Outreach
7.2.3.5. Support for Targeted Research, Long-term Monitoring

8.F Project Chronology

(See following pages)

Project Chronology

2005

August 2005
Cape Cod National Seashore (CCNS) and Town of Wellfleet Board of Selectmen entered into an MOU (MOU I) to review and summarize the scientific and technical information on the Herring River systems and study whether restoration of Herring River is feasible.

Pursuant to MOU I, the Wellfleet Board of Selectmen appointed the Herring River Technical Committee (HRTC) to carry out the feasibility study. HRTC included representatives of CCNS, MA Coastal Zone Management's (CZM) Wetlands Restoration Program, the Wellfleet Conservation/Health Agent, Wellfleet Open Space Committee, Wellfleet Shellfish Advisory Committee, Wellfleet Shellfish Constable, Wellfleet Herring Warden, Wellfleet Natural Resources Advisory Committee, the Chequessett Yacht and Country Club, the Truro Board of Selectmen, the US Fish & Wildlife Service (USFWS), the Natural Resources Conservation Service (NRCS), the Cape Cod Cooperative Extension Service, the National Oceanic and Atmospheric Administration's (NOAA) Restoration Center, the Barnstable County Health and Human Services Department, and the Chair of the Herring River Stakeholders Group.

A Herring River Stakeholders Group was appointed and charged with conveying public input about the restoration to the HRTC. The Group met separately and consisted of representatives of the towns, CCNS, potentially affected landowners, the shellfish/fishing community, the Cape Cod Mosquito Control Project, the MA Division of Marine Fisheries, the National Oceanic and Atmospheric Administration (NOAA) Restoration Center, and the Natural Resources Conservation Service (NRCS).

October 2005
The first HRTC and Stakeholders Group meetings were held on October 12, 2005. The HRTC held five additional meetings in 2005, including a joint meeting with the Stakeholders Group. The Stakeholders Group met three more times in 2005.

2006

January 2006
A Full Report of the HRTC was submitted to the Wellfleet Selectmen, finding that tidal restoration of the Herring River salt marsh is feasible and would provide substantial public benefits.

The HRTC met thirteen times throughout 2006 to continue work in developing the plan, including meetings with consultants, local stakeholders, property owners and local boards.

August 2006
A public informational meeting was held with landowners in or near the 100-year flood plain on August 21, 2006.

Members of the HRTC provided updates to the Wellfleet Non-resident Taxpayers Association and Wellfleet Conservation Trust.

September 2006
Members of HRTC provided an update to the Wellfleet Conservation Commission.

October 2006
Representatives of The Nature Conservancy were given a tour of the site by HRTC, MA Coastal Zone Management, NOAA, and local officials.

Senator Kennedy and Congressman Delahunt addressed restoration partners at the Herring River Dike on their efforts to obtain funding.

2007

HRTC met eight times in 2007 to continue technical work, including meetings with staff from NOAA, Cape Cod National Seashore, USFWS, Mass Natural Heritage and Endangered Species Program, local Departments of Public Works and project consultants.

March 5, 2007
Members of HRTC provided an update to the Cape Cod National Seashore Advisory Commission.

July 2007
The National Park Service committed funding to prepare the draft and final Environmental Impact Statement/Report (EIS/EIR).

Woods Hole Group was selected to undertake two-dimensional modeling with a grant from NOAA to the Town of Wellfleet.

August 13, 2007
HRTC met with Mill Creek abutters to discuss sensitivity of water supply wells.

October 2007
The HRTC completed the Herring River Conceptual Restoration Plan (CRP), which describes several possible ways to restore the estuary.

November 2007
MOU II was signed by CCNS, Truro and Wellfleet to accept the CRP and move forward with a detailed restoration plan. HRTC, having fulfilled its charge, was dissolved and the Herring River Restoration Committee (HRRC) was formed to develop the detailed restoration plan and oversee the environmental review process under the National and Massachusetts Environmental Policy Acts (NEPA and MEPA). Members include representatives of the Towns of Wellfleet and Truro, CCNS, USFWS, the MA Division of Ecological Restoration (MA DER), NOAA's Restoration Center and NRCS.

From 2008-2016 HRRC conducted monthly 1-2 daylong meetings to review technical studies and develop project plans for the environmental assessments.

2008

2008 – 2016
Representatives of the Project participated in and placed informational displays at Annual *State of Wellfleet Harbor* conferences.

June 2008
The MA Secretary of Environmental Affairs approved a Special Review Procedure to allow a coordinated environmental review process between federal and state agencies.

July 2008
On behalf of project partners, HRRC submitted an Environmental Notification Form (ENF) to the MA Secretary of Energy and Environmental Affairs pursuant to the MA Environmental Policy Act, to determine whether the Project requires preparation of an Environmental Impact Report and, if so, specify the scope. A public comment session was opened until October 2008.

August and September 2008
Two public scoping sessions were held to explain the planning process and solicit public comments on the Project. Additional written comments (43 letters containing 288 separate comments) were submitted following the scoping sessions.

November 2008
MA Secretary of Environmental Affairs issued a Certificate on the ENF outlining the required scope for the Draft Environmental Impact Report, requiring evaluation of four different restoration alternatives, including no action.

November 2008
Friends of Herring River (FHR) was formed as a 501 (c)(3) non-profit organization dedicated to restoring the ecological integrity of the Herring River watershed.

2008-2012
Project partners contracted with the Woods Hole Group to develop a detailed hydrodynamic model of the Herring River estuary. The Final Woods Hole Group Modeling Report was delivered to HRRC in 2012 and its findings incorporated into the Draft EIS/EIR.

2009 - 2013

August 18, 2009
The FHR Annual Meeting at Wellfleet Council on Aging facility featured a presentation by members of the HRRC on the progress of the joint state/federal Environmental Review Process. Each member explained their agency's role and presented information on the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA) processes. A demonstration was provided on the hydrodynamic model showing sample tidal effects in the estuary.

August 18, 2010

The FHR Annual Meeting at Wellfleet Council on Aging facility featured a presentation by a HRRC member on alternatives to return a tidal flow to the river.

August 16, 2011
The FHR Annual Meeting at Wellfleet Council on Aging facility featured a presentation detailing the benefits of the Herring River restoration to the community, water quality, and health of Wellfleet Harbor and Cape Cod Bay. A panel of HRRC members participated in a question and answer session.

August 21, 2012
The FHR Annual Meeting at Wellfleet Council on Aging facility featured a presentation of the historical, environmental, and cultural impact of the Herring River on Bound Brook Island and the vibrant community that once existed there.

October 2012
The Draft EIS/EIR was released; a 60-day public comment period commenced. HRRC sent a letter to all private landowners who abut the Herring River estuary prior to the hearing, describing the Project and potential impacts to private properties, and inviting landowners to contact the HRRC for further information.

November 2012
MEPA and the Cape Cod Commission held a public hearing in Wellfleet on the DEIS/EIR. Over 100 people attended and 43 pieces of correspondence with 161 separate comments were received following the hearing.

2013
NOAA awarded a three-year grant of $3 million to FHR to prepare design/engineering plans and conduct scientific analyses for the Herring River Restoration Project.

2012-2016
HRRC and FHR contracted with Woods Hole Group for additional hydrodynamic and sediment modeling, and contracted with the Louis Berger Group to develop survey plans and engineering designs for structurally affected private properties.

HRRC and FHR contacted, and in many instances met directly with, over 100 property owners to discuss their questions and concerns about the project and to seek permission for survey work on specific properties. This work is on-going.

August 2013
The FHR Annual Meeting at Wellfleet Council of Aging included a presentation on project plans and a presentation by Bill Burke, the Cape Cod National Seashore Historian about the history of the Herring River Estuary and nearby uplands based on a recently compiled park service archeological report.

2014

2014-2017

The Consensus Building Institute facilitated discussions between HRRC and Chequessett Yacht and Country Club (CYCC) to enable restoration of the Herring River ecosystem, including Mill Creek, while providing necessary flood protection for CYCC's golf facilities. The Project funded surveys, engineering, land planning and appraisals needed to develop a golf course protection plan for CYCC.

August 2014
The FHR Annual Meeting at Wellfleet Council of Aging featured a presentation on the Conceptual Design for Chequessett Neck Road Dike.

October 2014
MA Executive Office of Energy and Environmental Affairs awarded the first of a series of grants to FHR for Project design and engineering and environmental assessments.

October 2014 and November 2015
The U.S. Geological Survey (USGS) Adaptive Management Team held two stakeholders meetings to explain the adaptive management process for the Restoration Project and engage stakeholders in developing the adaptive management plan.

2015

February 4, 12 and 25, 2015
Public forums on roadway alternation for the Herring River Restoration Project were held in Wellfleet (Low roads and High Toss Road).

June 2 and 24, 2015
Public forums on Low-lying roadway alterations for the Herring River Restoration Project were held in Wellfleet (Low roads and High Toss Road).

August 18, 2015
The FHR Annual Meeting at Wellfleet Council on Aging facility featured a presentation by the Association to Preserve Cape Cod; a look at river herring experience in the estuary by the Wellfleet Herring warden; a report on
changes to Chequessett Neck Road Bridge Plans, including kayak portage access provisions in response to public comments solicited during public meetings;
and planned funding.

October 22, 29 and November 5, 2015
The Herring River – a journey through history from our past to the present seminar series was presented at the Wellfleet Public Library**.**

2016

February 11, 2016
A public meeting on High Toss Road marsh crossing was held in Wellfleet.

March 2016
The Wellfleet Board of Selectmen received additional comments on High Toss Road marsh crossing.

April 14, 2016
FHR held a public informational meeting in Wellfleet prior to the Annual Town Meeting. The plan for removing High Toss Road was overwhelmingly approved by a vote of the Town Meeting.

June 2016
The Final EIS/EIR was published in the Federal Register and the Massachusetts Environmental Monitor.

The Cape Cod Commission held a Joint Review hearing with the Massachusetts Environmental Policy Act Unit to review the Final EIS/EIR. More than 100 people attended the hearing and 12 comment letters were submitted following the hearing.

July 2016
The MA Secretary of Energy and Environmental Affairs issued a Certificate on the Final Environmental Report (FEIR) finding that it adequately and properly complies with MEPA, and establishing a new Regulatory Oversight Group (ROG) for the Project.

July – August 2016
FHR hosted a summer program series at Wellfleet Public Library to explore facets of the restoration project including: Herring River Tidal Restoration Effects: Current and planned monitoring projects; Salt Meets Fresh: Tidal seawater, fresh groundwater, and the Herring River restoration; Tidal Water: A History of Wellfleet's Herring River; horseshoe crab research; and marsh birds of Herring River.

August 2016
Cape Cod Commission opened a public hearing (procedural only) on the Herring River Restoration Project as a Development of Regional Impact. This public hearing was continued.

August 16, 2016
The FHR Annual Meeting at Wellfleet Council on Aging facility featured a project update, announcement of the publication of a book on the history of Herring River, a summary of current conditions and rationale for restoration including social, economic and ecological benefits.

September 2016
The Record of Decision on the Final EIS/EIR was signed by the National Park Service Northeast Regional Director.

September 2016
MOU III was executed by Wellfleet and Truro Boards of Selectmen and the NPS Northeast Regional Director, setting forth the management structure for the next phase of the Restoration Project. MOU III called for the creation of the Herring River Executive Council (HREC) to provide Project policy direction and coordinate Project implementation.

2017

The HREC met four times in 2017 (January 9, March 9, June 7 and September 25). During this time the HREC appointed the Herring River Stakeholder Group. (HRSG) to provide advisory input on key implementation issues. The HRSG consists of nineteen members representing broad interests in the community: shellfish/fisheries, conservation/environmental protection, flood plain property owners, businesses, navigation, recreation, mosquito control, and the Cape Cod National Seashore Advisory Commission.

The HRRC continued monthly meetings to advance project design and permitting activities.

The ROG will meet in January to review permitting issues.

February 2017

A briefing for Senator Cyr and Representative Peake was heald at the Friends of Herring River office.

March 2017

The Friends of Herring River and Wellfleet Shellfish Advisory Board hosted a forum on the science behind the benefits of tidal restoration for shellfish resources.

The Herring River Restoration Committee (HRRC) made a recommendation to the Herring River Executive Council (HREC) that the permit applications seeking authorization to implement the Restoration Project not include the use of any herbicides in the Herring River Restoration Project area. These permit applications will specify other non-chemical methods of *Phragmites* control. The HREC unanimously supported this recommendation.

The newly designed Friends of Herring River website was launched, including up to date information about meetings held by the HRRC, HREC and HRSG, and also new reports and pubic informational materials.

April 2017

Wellfleet Town Meeting rejected one petitioned warrant article which sought to stop permit applications for improving Herring River, and indefinitely postponed another article with a similar purpose.

Truro Town Meeting rejected a petitioned warrant article which sought to stop permit applications for improving Herring River.

A public presentation on the Herring River Restoration Project was held in the Truro Town Hall.

A new project brochure was mailed to all households in Truro and Wellfleet.

May 2017

The HRRC and Chequessett Yacht & Country Club (CYCC) executed a memorandum of understanding (MOU) to advance the Herring River Restoration Project. The MOU spells out the flood protection measures the project will provide to CYCC before tidal flow is partially restored in the Mill Creek sub-basin.

June – August

The Friends of Herring River sponsored monthly summer field trips to explain the effects of tidal restoration and restriction.

In August, the Friends of Herring River Annual Meeting featured a presentation on "Blue Carbon" the carbon storage benefits of salt marsh restoration.

November - December

Friends of Herring River published a newsletter explaining Phase 1 of the project, which was mailed to all households and businesses in Truro and Wellfleet. Individual letters were sent with the newsletter to all 300+ property owners in the Herring River flood plain.

2018

The HRRC continued monthly meetings to advance project design and permitting activities.

March 2018

The Friends of Herring River co-sponsored a forum on monitoring to protect shellfish resources with the Wellfleet Shellfish Advisory Board.

The Friends of Herring River co-sponsored a forum on Blue Carbon, the carbon storage benefits of salt marsh restoration with Climate Mobilization Outer Cape Mobilization.

A new video entitled *Herring River Estuary: Restoring and Ecological Treasure* was released and premiered at the Cape Cod Natural History Conference.

May 2018

The Friends of Herring River co-sponsored a forum on wildlife in Herring River and habitat changes resulting from restoration with the Wellfleet Conservation Trust, Wellfleet Natural Resources Advisory Board, Wellfleet Bay Wildlife Sanctuary.

The HREC met on May 16 to launch the HRSG.

The HRSG held its first meeting on June 21st. The HRSG met again on July 25th, and October 11th.

July – August 2018

The Friends of Herring River sponsored monthly summer field trips to explain the effects of tidal restoration and restriction.

September 2018

Friends of Herring River celebrates 10th anniversary annual meeting. Guest speakers include Senator Julian Cyr, Superintendent Brian Carlstrom, and Massachusetts Division of Ecological Restoration Assistant Director Hunt Durey.

December 2018

Truro Board of Selectmen vote to remove Truro as project partner.

2018

January 2019

Town of Wellfleet files an application with the Cape Cod Commission for a Limited Scope Decision.

March 2019

March 7, 2019, public hearing on Limited Scope application before the Cape Cod Commission Regulatory Subcommittee. Following the public hearing the subcommittee voted unanimously to ratify the proposed Limited Scope Decision. The decision was issued March 7, 2019.

June 2019

Herring River Stakeholder Group meets.

A fourth Memorandum of Understanding (MOU IV) is signed by the Town of Wellfleet and Cape Cod National Seashore. MOU IV becomes the new governing document for project implementation.

July-August 2019

A newsletter containing updated project information is mailed to all households and homeowners in Wellfleet and Truro.

Friends of Herring River Board members meet with various neighborhood associations and civic groups to update them about the project.

September 2019

Town of Wellfleet submits Development of Regional Impact application to the Cape Cod Commission.

8.G Support Letters

(See following pages)

Hon. Julian Cyr, Senator and Hon. Sarah Peake, Representative

Wellfleet Shellfish Advisory Board

Wellfleet Open Space Committee

Wellfleet Natural Resources Advisory Board

Dennis O'Connell, Wellfleet Conservation Trust

Andrew Gottlieb, Association to Preserve Cape Cod

John J. Clarke, Massachusetts Audubon

Richard Delaney, Center for Coastal Studies

Wayne Klockner, The Nature Conservancy

Great Pastures Homeowners Association, Wellfleet

Gail Ferguson, Wellfleet

The Cumblers, Wellfleet

THE GENERAL COURT OF MASSACHUSETTS
STATE HOUSE, BOSTON 02133-1053

Superintendent Brian Carlstrom
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667

Wellfleet Select Board
300 Main Street
Wellfleet, MA 02667

September 16, 2019

Re: Support of the Herring River Restoration Project

Dear Superintendent and Select Board Members,

Over the past decade, the Herring River restoration has grown from a visionary idea, to a carefully planned and rigorously designed project. It embodies the goals of resiliency, stewardship, and partnership that are vital to our region's – and the Commonwealth's future.

We are pleased to reaffirm our strong support for this regionally significant project as it embarks on a new phase of permitting and fundraising necessary for implementation.

The return of tidal flow to Herring River would restore approximately 1,000 acres of tidal marsh and numerous ecosystem services these resources provide. Healthy salt marshes and other forms of estuarine wetlands provide critical habitat for a wide variety of birds and wildlife; and serve as nurseries for fish and shellfish. Estuarine habitats are more resilient to coastal flooding; and they help to filter nutrients and other pollutants from run-off and rainfall before they enter the estuary.

Healthy tidal marshes also play a key role in combating climate change. Preliminary estimates based on current science indicate that restoration of salt marsh in the Herring River would result in a substantial reduction in the net volume of greenhouse gases released into the atmosphere.

A collaboration of local state and federal partners has been central to the project's success. This partnership has enabled the project to benefit from vast technical knowledge and experience while ensuring that decisions about project design and implementation remain local and responsive to community needs.

As residents of the Outer Cape, we have a deep appreciation of the link between the health of our coastal environment to the economic opportunities and quality of life in our communities.

The Herring River Restoration stands out as one of the most significant projects of its time in the Northeast. It exemplifies the exciting potential of the emerging Blue Economy on Cape Cod, by utilizing modeling and management techniques that are at the leading edge of coastal restoration science. The example set by and the lessons learned from the successful Herring River coastal restoration project will benefit other estuaries on Cape Cod and beyond.

For all of these reasons we believe that the Herring River Restoration is a rare and significant opportunity to restore a native ecosystem and the many environmental and economic benefits it provides to our communities, the region and the Commonwealth.

Sincerely,

Julian Cyr

Julian Cyr
State Senator
Cape and Islands District

Sarah K Peake

Sarah K. Peake
State Representative
4th Barnstable District

Cc:
Congressman William Keating
Senator Elizabeth Warren
Senator Edward Markey
Friends of Herring River

TOWN OF WELLFLEET

300 MAIN STREET WELLFLEET MASSACHUSETTS 02667
Tel (508) 349-0300 Fax (508) 349-0305
www.wellfleet-ma.gov

To: The Wellfleet Selectboard
Brian Carlstrom, Superintendent, Cape Cod National Seashore

October 10, 2019

Cc: Congressman William Keating
Senator Julian Cyr
Senator Elizabeth Warren
Senator Edward Markey
Representative Sarah Peake
Friends of Herring River

From: The Wellfleet Shellfish Advisory Board

Dear Superintendent Carlstrom, and members of the Wellfleet Selectboard:

The Wellfleet shellfish Advisory Board at its October 9, 2019 meeting voted unanimously to convey our continued support for the Herring River restoration project as originally conveyed in a letter dated June 19, 2017. Since that time, the makeup of our board has undergone some changes, and we felt it was time to restate our strong support for the project. All in all, there have been over 100 meetings regarding this project including public meetings, and one-on-one individual meetings with private landowners, as well as in other public venues in Wellfleet and Truro. We still believe that restoring controlled tidal flow in line with current science, and closer to a flow rate that existed before installation of the Chequessett Neck Road tide gate will benefit those in the shellfishing community, the residents of Wellfleet, and those species of anadromous fish that use the Herring River estuary to spawn each year. Ever since the original structure was installed over 100 years ago, shellfishing has suffered in the area adjacent to the tide gate due to high levels of fecal coliform present resulting from restricted tidal flushing. Improving the amount of water flowing upstream and downstream of the new dike will surely be of great service towards improving water quality to provide for the needs of the shellfish, anadromous fish and wildlife native to the area.

In an era when going GREEN has become all the rage, and climate change is an increasingly apparent threat, it is of particular concern to our board - for the obvious reasons associated with changes in sea level, ocean temperature and acidification, to do anything that would help slow the effects of a changing climate to maintain our robust shellfishing resource. One of the ancillary benefits of salt marsh restoration is in reducing methane emissions (a major contributor in climate change) as outlined in a University of Chicago Marine Biological Laboratory report. In it is a detailed scientific report which considers "The benefits of Restoring tides to reduce methane emissions in impounded wetlands: A new and potent Blue Carbon climate change intervention". That report could have been written with the Herring River in mind. The Herring River estuary could indeed become a shining example of a successful salt marsh restoration by reversing the negative consequences of blocking tidal flow all those years ago.

Please move forward as previously requested in obtaining the necessary permits for the timely construction of a new dike at Chequessett Neck Road. Our board looks forward to seeing a new and improved structure completed within the next 5 years.

Sincerely,

John Duane - on behalf of:

The Wellfleet Shellfish Advisory Board

Dave Seitler - Chair, Chip Benton, Zack Dixon, John Duane
Jacob Puffer, Tom Siggia, Rebecca Taylor

Town of Wellfleet Selectboard
Brian Carlstrom, Superintendent, Cape Cod National Seashore

The Wellfleet Open Space Committee is a town committee dedicated to land protection for the benefit of conservation, recreation, and natural resource protection. At our meeting on October 8, 2019 the Committee voted to send this letter of support for the Hearing River Restoration Project. The timing of this is to ensure ongoing support for the project as it moves forward with permit applications and fundraising.

The Herring River Restoration Project is an unmatched opportunity to restore 1,000 acres of estuarine marsh, and the many ecosystem services that marshes provide to the environment and greater community. These services include enhancements to habitat for a wide range of animals, birds and aquatic life. A healthy marsh also helps to mitigate flooding from storms, and filter pollutants from run-off before they reach estuarine waters. We are also impressed with the potential for a healthy Herring River marsh system to absorb carbon and reduce existing methane emissions, which in combination will help to combat the effects of climate change.

As a committee dedicated to preserving the natural environment for the benefit of the Wellfleet community, we see tremendous benefit in the enhanced recreational opportunities afforded by restoring six miles of river way for canoeing, kayaking and fishing. Improvements to water quality from restoration of tidal flushing will reduce fecal coliform concentrations in the river, which are now contaminating shellfish beds downstream of the Chequessett Neck Road Dike. Improved water quality resulting from the restoration is expected to lead to the re-opening of shellfish beds downstream of Herring River which have been closed for decades, and could help to revitalize local river herring populations.

Restoring Herring River will bring significant benefits to our community and environment, and will serve as a model for coastal restoration elsewhere on Cape Cod, and beyond. The Wellfleet Open Space Committee strongly supports the Herring River Restoration Project.

Sincerely,
Bruce Hurter, Chairman Wellfleet Open Space Committee

cc: Senator Elizabeth Warren
Senator Edward Markey
Congressman William Keating
Senator Julian Cyr
Representative Sarah Peake
Friends of Herring River

NATURAL RESOURCES ADVISORY BOARD

Wellfleet, Massachusetts

300 Main Street
Wellfleet, MA, 02667

Wellfleet Board of Selectmen
Wellfleet Town Hall
300 Main Street
Wellfleet, MA, 02667

October 14 2019

Brian Carlstrom, Superintendent
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA, 02667

Representing the Wellfleet Natural Resources Advisory Board (NRAB), I am writing to express our continued strong support for the Herring River Restoration Project.

NRAB has long been an advocate for restoration of the Herring River estuary. Salt marsh protection was a priority in both Harbor Management Plans (HMP) submitted to the Board of Selectmen/Wellfleet in 1995 and 2006. Both reports are on the Town website, under NRAB. The recommendation to restore the Herring River was a top priority in the 2006 HMP.

The Herring River today is in poor health due to more than a century of tidal restriction caused by the construction of the Chequessett Neck Road dike. Tidal restriction has caused poor water quality, loss of salt marsh, degradation of habitat, and contamination of shellfish beds downstream of the dike in Wellfleet Harbor. These conditions will continue as long as the existing Chequessett Neck Road dike remains in place.

The Towns of Wellfleet and Truro with the Cape Cod National Seashore had the foresight to develop a restoration plan to reverse these degraded conditions.

The Herring River Restoration Project will result in significant improvements in water quality, fisheries and wildlife habitat, and the overwhelming benefits these resources provide to the community and the region.

- Roughly 1,000 acres of salt marsh and other estuarine wetlands-and the habitat and food sources they provide-will be restored;
- Expanded habitat for many species of birds, mammals and reptiles—including rare species—that thrive in salt/brackish marsh;
- 11+ river miles for fish passage will be restored, along with access to 160 pond acres

for spawning.

- Water quality will improve in Herring River and Wellfleet Harbor, to the benefit of residents, shellfishermen, and visitors;
- Restored salt marsh will enhance the ability to adapt to sea level rise;
- Recreational access to 6 miles of waterways will be restored;
- Restoration of healthy salt marsh will capture carbon and reduce methane, resulting in a substantial reduction of the net volume of greenhouse gases released to the atmosphere.
- The existing Chequessett Neck Road dike, which is no longer functioning to control tidal flow, will be replaced with a state-of-the-art tide control structure, which can be used to limit any storm surge in the estuary.

The Herring River Restoration Project is the result of scientific study and extensive community discussions. Changes in tide levels will be made incrementally, while carefully modeling and monitoring of system responses will allow the project to adjust the rate of change and take other management actions to achieve the benefits of restoration while avoiding or minimizing unintended outcomes.

In particular, as Wellfleet is a shellfishing town the project managers have made an especial effort to keep the shellfish community informed on the project and the planned restoration process.

The Herring River Restoration Project will restore the health of a unique and environmentally significant resource for the benefit of the community today and for years to come.

Sincerely,

John Riehl

John Riehl,
Chair, Natural Resources Advisory Board

Cc:
Senators Elizabeth Warren and Edward Markey
Congressman William Keating
Senator Julian Cyr
Representative Sarah Peake
Friends of Herring River

NATURAL RESOURCES ADVISORY BOARD

Wellfleet, Massachusetts

300 Main Street
Wellfleet, MA, 02667

Wellfleet Board of Selectmen
Wellfleet Town Hall
300 Main Street
Wellfleet, MA, 02667

October 14 2019

Brian Carlstrom, Superintendent
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA, 02667

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In particular, as Wellfleet is a shellfishing town the project managers have made an especial effort to keep the shellfish community informed on the project and the planned restoration process.

The Herring River Restoration Project will restore the health of a unique and environmentally significant resource for the benefit of the community today and for years to come.

Sincerely,

John Riehl

John Riehl,
Chair, Natural Resources Advisory Board

Cc:
Senators Elizabeth Warren and Edward Markey
Congressman William Keating
Senator Julian Cyr
Representative Sarah Peake
Friends of Herring River

WELLFLEET CONSERVATION TRUST
PO Box 84 Wellfleet MA 02667 www.wellfleetconservationtrust.org

September 4, 2019

Town of Wellfleet Selectboard
Superintendent, Cape Cod National Seashore
- by electronic delivery-

Dear Selectboard Members and Superintendant:

The Board of Trustees of the Wellfleet Conservation Trust (WCT) wishes to demonstrate our support for the progress made by the **Herring River Restoration Project** and to support the plans to continue to evaluate and proceed as the project goes into the permitting and funding phases.

This Board has been continuously aware of the progress of the HR Restoration Project for more than 10 years. In fact, WCT funded the first widely distributed information sheet during the early evaluation period, before the Friends of Herring River was formed and funded. Also, we own several parcels of land within the anticipated flood zone of the project.

We have been impressed with the efforts for transparency, for public awareness, and, especially for the degree of scientific research that has gone into the development of restoration plans. Also, we are impressed by the opportunities to improve the environmental conditions and water quality of the estuary and of the Harbor. We have great confidence in the leadership structure that has evolved. We believe that the leadership team will continue its practice of understanding all aspects of the project and will do what is best for the citizens of the Towns of Wellfleet and the interests of the Cape Cod National Seashore, taking into consideration all those who are impacted by the project.

We urge continuing efforts to progress this project through the permitting and funding stages.

Sincerely,

THE GENERAL COURT OF MASSACHUSETTS
STATE HOUSE, BOSTON 02133-1053

Superintendent Brian Carlstrom
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667

Wellfleet Select Board
300 Main Street
Wellfleet, MA 02667

September 16, 2019

Re: Support of the Herring River Restoration Project

Dear Superintendent and Select Board Members,

Over the past decade, the Herring River restoration has grown from a visionary idea, to a carefully planned and rigorously designed project. It embodies the goals of resiliency, stewardship, and partnership that are vital to our region's – and the Commonwealth's future.

We are pleased to reaffirm our strong support for this regionally significant project as it embarks on a new phase of permitting and fundraising necessary for implementation.

The return of tidal flow to Herring River would restore approximately 1,000 acres of tidal marsh and numerous ecosystem services these resources provide. Healthy salt marshes and other forms of estuarine wetlands provide critical habitat for a wide variety of birds and wildlife; and serve as nurseries for fish and shellfish. Estuarine habitats are more resilient to coastal flooding; and they help to filter nutrients and other pollutants from run-off and rainfall before they enter the estuary.

Healthy tidal marshes also play a key role in combating climate change. Preliminary estimates based on current science indicate that restoration of salt marsh in the Herring River would result in a substantial reduction in the net volume of greenhouse gases released into the atmosphere.

A collaboration of local state and federal partners has been central to the project's success. This partnership has enabled the project to benefit from vast technical knowledge and experience while ensuring that decisions about project design and implementation remain local and responsive to community needs.

As residents of the Outer Cape, we have a deep appreciation of the link between the health of our coastal environment to the economic opportunities and quality of life in our communities.

R. Dennis O'Connell

R. Dennis O'Connell, President

cc: Senator Edward Markey,
Senator Elizabeth Warren,
Congressman William Keating,
Senator Julian Cyr,
Representative Sarah Peake, and
The Friends of Herring River

APCC
Association to
Preserve Cape Cod
Preserving the Very Nature of Cape Cod

October 1, 2019

Town of Wellfleet Board of Selectmen
Brian Carlstrom, Superintendent, Cape Cod National Seashore

RE: Herring River Restoration Letter of Support

The Association to Preserve Cape Cod (APCC) writes to express our strong support for the Herring River Restoration Project in Wellfleet.

Founded in 1968, APCC is the Cape Cod region's leading nonprofit environmental advocacy and education organization. Representing thousands of members across Cape Cod, APCC's mission is to promote policies and programs that foster the preservation of the Cape's natural resources. APCC focuses its efforts on the protection of groundwater, surface water, and wetland resources, preservation of open space, the promotion of responsible, planned growth and the achievement of an environmental ethic.

One of APCC's major program areas involves promoting and assisting in salt marsh restoration efforts on Cape Cod, and with good reason. Cape Cod has experienced a critical loss of salt marsh habitat. More than 7,000 acres—or 38 percent—of our salt marshes on Cape Cod have been lost or destroyed due to damming, dredging, filling, ditching and other human development activities.

The loss of salt marshes also means the loss of the many valuable ecosystem functions they provide. For example:

- It is estimated that 75 percent of our commercially important fish and shellfish species depend on salt marsh habitat at some point in their life cycles for nurseries and as a source of food.
- Salt marshes attenuate storm flooding and provide a buffer against storm surges.
- Salt marshes filter pollutants from runoff and groundwater before they enter our estuaries.

In addition, we are beginning to understand the significant role salt marshes play in mitigating the effects of climate change. Research shows that salt marshes are able to store more carbon per acre than tropical rain forests.

The Herring River Restoration Project has the potential to restore nearly 1,000 acres of salt marsh, reclaiming a substantial percentage of salt marsh habitat previously lost on

482 Main Street | Dennis, MA 02638
Tel: 508-619-3185 | info@apcc.org | www.apcc.org

Cape Cod. It is a high priority restoration project for the Cape Cod National Seashore, the town of Wellfleet and many partner agencies and organizations. It has also been a priority project for APCC for many decades; APCC was one of the first voices calling for restoration of the Herring River in the 1970s.

The restoration project will significantly improve habitat for a wide variety of wildlife species that thrive in salt and brackish marsh environments. Salt marshes are among the most productive ecosystems on the planet and provide food, shelter, nesting sites and migratory habitat for many species of birds, mammals and reptiles. Restoring tides to the Herring River will enhance the quality and quantity of these resources and improve their resiliency in the face of increased threats by sea level rise and land-based pollution and encroachment.

By restoring twice-daily flushing with clean, high-salinity Cape Cod Bay water, the project will improve water quality, especially near the Herring River mouth, resulting in the likely re-opening and expansion of more than 100 acres of harvestable oyster beds.

The restoration will also restore several miles of river for fish passage as well as access to 160 pond acres for spawning. By providing improved fish passage, improved water quality and expanded habitat, the project will benefit all species of anadromous and catadromous fish, including river herring (alewife and blueback herring), hickory shad, white perch and American eel.

Technical direction for the project has come from a partnership of local, state and federal agencies in consultation with leading estuarine scientists from public, private and university sectors to ensure that the work is founded on a current and peer-reviewed knowledge base. Thanks to an ongoing commitment to public outreach and education on the part of project partners, the project has gained strong local and regional support, and is poised for successful permitting, funding and implementation.

For all the reasons cited above, APCC pledges its continued support of this critically important project to ensure that the full potential of the Herring River restoration is achieved.

Sincerely,

Andrew Gottlieb
Executive Director

cc: Congressman William Keating
Senator Julian Cyr
Representative Sarah Peake
Friends of Herring River

Mass Audubon
Advocacy Department

Six Beacon Street, Suite 1025, Boston, MA 02108
617-523-8448 jclarke@massaudubon.org

October 7, 2019

Brian Carlstrom
Superintendent
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667

Wellfleet Selectboard
300 Main Street
Wellfleet, MA 02667

Re: <u>Herring River Restoration project</u>

Dear Mr. Carlstrom and Wellfleet Selectboard,

On behalf of Mass Audubon, I submit the following letter of support for the Herring River Restoration project. Mass Audubon has a long-held interest in the restoration of the Herring River and has commented numerous times during the project review process. We continue to be strongly supportive of this project because of the important local benefits it will generate, and because it serves as a model for restoring other estuaries along Massachusetts' and America's coast.

The project will return tidal flow to the 1,000-acre Herring River estuary by replacing the Chequessett Neck Road dike with a new bridge with tide gates. This will reverse the loss of hundreds of acres of salt marsh habitat that has occurred over the past 100 years. Salt marshes provide food, shelter, nesting sites, and migratory habitat for many species of birds, including wintering Black Ducks, state-listed Clapper Rail, and Least Bittern. They restore foraging habitat and open new nesting areas for the state-listed diamondback terrapin at the north edge of its range. The project will also restore nursery habitat for the greatly reduced populations of horseshoe crabs in the Wellfleet harbor system and that spawn on nearby Great Island

Restoring tides to the Herring River will enhance the quality and quantity of these resources and improve their resiliency in the face of sea level rise and projected increased storm activity along the coast.

This project will restore natural tidal flow to the Herring River, reversing the damage that has occurred since 1909 when the installation of the dike blocked tides that had carried oxygen-rich ocean waters into the Herring River system.

By restoring twice-daily flushing with clean, high-salinity Cape Cod Bay water, the Project will improve water quality and increase the flow of nutrients into Wellfleet Harbor, fueling shellfish growth and an increase in harvestable oyster beds. The restoration will allow for fish passage and improvements to habitat for species including Osprey and Common and Roseate Terns, and increase forage fish plankton which will improve striped bass and bluefish feeding opportunities. By restoring healthy coastal wetlands, the project will also enhance climate change resiliency against impacts like sea level rise by acting as a natural floodplain.

Restoration of tidal flow will improve water quality and benefit shellfish habitat. A century of tidal restriction has resulted in high concentrations of fecal coliform bacteria in the River, which has led to shellfish closures in Wellfleet Harbor downstream of the Chequessett Neck Road dike. Restoration will reduce bacterial concentrations by flushing cleaner ocean water into Herring River twice daily and by increasing salinity levels in the River that reduce survival time of bacteria. The reduction in fecal coliform concentrations is expected to lead to the reopening of once-productive shellfish beds in Wellfleet Harbor.

Sincerely,

John J. Clarke
Director of Public Policy & Government Relations

cc: Senator Elizabeth Warren
Senator Edward Markey
Congressman William Keating
Senator Julian Cyr
Representative Sarah Peake
Friends of Herring River

Center for Coastal Studies Provincetown

ADMINISTRATIVE OFFICES AND HIEBERT MARINE LABORATORY
5 Holway Avenue, Provincetown, MA 02657
tel (508) 487-3622/3623 fax (508) 487-4695

November 7, 2019

Board of Selectmen, Wellfleet
Superintendent Brian Carlstrom Cape Cod
National Seashore

Dear Mr. Murphy and Mr. Carlstrom:,

The Center for Coastal Studies is dedicated to promoting stewardship of coastal and marine ecosystems in the Gulf of Maine, and to encouraging responsible use and conservation of these ecosystems. We carry out our work through scientific research, education, and collaboration with other institutions and individuals.

The Center's Seafloor Mapping Program worked closely with many partners both public and private (Cape Cod National Seashore, The Town of Wellfleet, Friends of Herring River and SPAT, Inc.), in funded and pro bono efforts, to better understand the current conditions of Herring River and the surrounding Harbor to improve estimates and/or projections of the potential impacts of tidal restoration on the entire system.

The Herring River Restoration Project is a model for restoring other estuaries in Massachusetts and America's coast. Reconnecting the Herring River to the Gulf of Maine will let it once again support the natural coastal food web that numerous fish, birds and other wildlife depend on for their survival. Restoring the estuary is an important step to help increase finfish and shellfish populations, revive the region's commercial and recreational fisheries and increase access for boaters.

The Project will use state-of-the art adaptive management techniques to introduce changes to the natural system carefully, while on-going modeling and monitoring of system responses takes place. This will provide opportunities to adjust the rate of change to achieve maximum restoration benefits while avoiding or minimizing any unintended changes.

We are also encouraged by the Project's potential to expand the benefits of Blue Carbon on Cape Cod. The Center for Coastal Studies is a founding member of the Cape Cod Climate Change Collaborative, an organization formed to unite the varied expertise and experience of Cape Cod organizations to address the impacts of climate change. Tidal restoration of

Herring River will reduce methane emissions from the system as saltwater wetlands are re-established in place of freshwater wetlands.
Avoidance of methane emissions is particularly significant since it is known to be approximately 20 times more potent as a heat trapping gas in the atmosphere than carbon dioxide.

As scientists focused on the health of ocean resources, we often see degradation of marine resource go unaddressed, with devastating long-term consequences. The Herring River Restoration is a rare and important opportunity to reclaim the extensive ecosystem services provided by a healthy 1,000-acre estuary. It will be a living laboratory for future monitoring and research on estuarine restoration. We strongly support the project and offer our assistance to help in facilitating its implementation.

Sincerely

Richard Delaney

Richard F. Delaney, President and CEO
Center for Coastal Studies

CC:

Senator Elizabeth Warren
Senator Edward Markey
Congressman William Keating
Senator Julian Cyr
Representative Sara Peake
Friends of Herring River

The Nature Conservancy
Protecting nature. Preserving life.™

The Nature Conservancy in Massachusetts
99 Bedford Street, Suite 500
Boston, MA 02111

Phone: (617) 532-8360
Cell: (617) 678-6135
abowden@tnc.org
nature.org/massachusetts

Wellfleet Board of Selectmen
Brian Carlstrom, Superintendent, Cape Cod National Seashore

October 11, 2019

Dear Selectmen of Wellfleet, and Superintendent Carlstrom,

I am writing to express The Nature Conservancy's strong support for the Herring River Restoration Project.

The Nature Conservancy is a global non-profit conservation organization whose mission is to "conserve the lands and waters on which all life depends." In Massachusetts, the Conservancy has protected some 23,000 acres of crucial natural resources, and TNC leads many science-based projects to keep nature healthy throughout the state. TNC proudly represents the ideals of 28,000 members in Massachusetts and more than one million members globally. We work using the best available science and in collaboration with individuals, local communities, businesses, public agencies, and other nonprofit groups.

Herring River today is in poor health due to more than a century of tidal restriction caused by the construction of the Chequessett Neck Road dike. Tidal restriction has resulted in poor water quality, loss of salt marsh, degradation of habitat, and contamination of shellfish beds downstream of the dike in Wellfleet Harbor. These conditions will continue as long as the existing Chequessett Neck Road dike remains in place.

Fortunately, the Town of Wellfleet and the Cape Cod National Seashore had the foresight to develop a restoration plan to reverse these degraded conditions.
The Herring River Restoration Project will result in significant improvements in water quality, fisheries and wildlife habitat, and the overwhelming benefits these resources provide to the community and the region. These benefits for nature and people include:

- Roughly 1,000 acres of salt marsh and other estuarine wetlands—and the habitat and food sources they provide—will be restored;
- Expanded habitat for many species of birds, mammals and reptiles—including rare species—that thrive in salt/brackish marsh;
- 11+ river miles for fish passage will be restored, along with access to 160 acres of ponds for spawning;
- Water quality will improve in the Herring River and in Wellfleet Harbor, to the benefit of residents, shellfishermen, and visitors;
- Restored salt marsh will enhance coastal storm resiliency and the ability to adapt to sea level rise;
- Recreational access to 6 miles of waterways will be restored; and,

- Restoration of healthy salt marsh will capture carbon and reduce methane, resulting in a substantial reduction of the net volume of greenhouse gases released to the atmosphere.

The Herring River Restoration Project is the result of scientific study and extensive community discussions. Changes in tide levels will be made incrementally, while careful modeling and monitoring of system responses will allow the project's executors to adjust the rate of change and take other management actions to achieve the benefits of restoration while avoiding or minimizing unintended outcomes.

The Herring River Restoration Project will restore the health of a unique and environmentally significant resource for the benefit of the community today and for years to come.

Sincerely,

Wayne Klockner
State Director
Massachusetts Program
The Nature Conservancy

Cc:
Senator Elizabeth Warren
Senator Edward Markey
Congressman William Keating
Senator Julian Cyr
Representative Sarah Peake
Friends of Herring River

Wellfleet Selectboard
Superintendent, Cape Cod National Seashore

September 9, 2019

As officers of the Great Pastures Property Owners Association we wish to express support for the Herring River Restoration Project.

Our organization is made up of several (50+) homeowners located in what is referred to in Wellfleet as Great Pastures. Some of our member's property abut the restoration estuary and all live in close proximity to it.

The Herring River today is in poor health due to more than a century of tidal restriction caused by the construction of the Chequessett Neck Road dike. Tidal restriction has caused poor water quality, loss of salt marsh, degradation of habitat, and contamination of shellfish beds up and downstream of the dike in Wellfleet Harbor. These conditions will continue and get worse as long as the existing Chequessett Neck Road dike remains in place.

Fortunately, the Town of Wellfleet and the Cape Cod National Seashore had the foresight to develop a restoration plan to reverse these degraded conditions.

The Herring River Restoration Project will result in significant improvements in water quality, fisheries and wildlife habitat, and the overwhelming benefits these resources provide to the community including commercial entities and the region as a whole; some, but not all include:

- Restored salt marsh will enhance coastal storm resiliency and the ability to adapt to sea level rise;
- Expanded habitat for many species of birds, mammals and reptiles including rare species—that thrive in salt/brackish marsh;
- Water quality will improve in Herring River and Wellfleet Harbor, to the benefit of residents, shell fishermen, and visitors;
- 11+ river miles for fish passage will be restored, along with access to 160 pond acres for spawning;
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- Restoration of healthy salt marsh will capture carbon and reduce methane, resulting in a substantial reduction of the net volume of greenhouse gases released to the atmosphere;
- Recreational access to 6 miles of waterways will be restored;
- The existing Chequessett Neck Road dike, which is no longer functioning to control tidal flow, will be replaced with a state-of-the-art tide control structure.

The Herring River Restoration Project is the result of years of scientific study and extensive community discussions. As part of this process changes in tide levels will be made incrementally, while carefully modeling and monitoring of system responses will allow the project to adjust the rate of change. This approach allows management actions to achieve the benefits of restoration while avoiding or minimizing unintended outcomes. The results of this action ensures that no property owners or others will be adversely effected.

The Herring River Restoration Project will restore the health of a unique and environmentally significant resource for the benefit of the community today and for years to come.

Sincerely,

Frank J. Szedlak

Frank Szedlak 85 Highmeadow Road Wellfleet, Ma. 02667
President, Great Pastures Home Owners' Association

S. David Koonce Jr. 30 Highmeadow Road Wellfleet, Ma. 02667
Treasurer, Great Pastures Home Owners' Association

Cc: Senator Elizabeth Warren
Senator Edward Markey
Congressman William Keating
Senator Julian Cyr
Representative Sarah Peake
Friends of Herring River

October 2, 2019

Wellfleet Selectboard; Superintendent, Cape Cod National Seashore

Subject: Letter of Support for the Herring River Restoration Project

Greetings,

I am writing to express my support for the Herring River Restoration Project. I am a resident of Wellfleet who owns real property at 112 West Main Street that is located in the southern most part of the Upper Pole Dike Basin, and within the historic Herring River flood plain.

In late 2012 I received a letter from the Town of Wellfleet notifying me that my property would experience increased water levels and increased regulation as a result of a proposed restoration of the Herring River. From that time until the present time, I have attended most, if not all, of the public hearings and informational meetings that have been held in Wellfleet concerning the restoration and its expected effects.

While I had long been a supporter of salt marsh restoration generally, I nevertheless had concerns about the impact of this particular project on my own property. My concerns, however, faded as I began to gain a sense of the high level of professional attention and expertise upon which the Herring River Project plans rested. As I followed the public hearings I came to understand that a very slow re-introduction of salt water would be carefully monitored throughout the restoration process, thereby enabling a quick response to any deviation from what earlier modeling had predicted. This adaptive approach, together with the mitigation actions that will be taken to protect private structures, eased my initial concerns about unexpected impacts to my own property.

As I am sure you know, it has been a long and complex journey for the proposed restoration. Following the publication of the Herring River Technical Committee’s final report in 2007 (their, “Conceptual Restoration Plan”) the Herring River project has slowly, but steadily, progressed to the point where the restoration is now poised to become a project in fact once the permitting process is finished and funding is in hand. When it is completed the Herring River Restoration project will be the largest restoration of a salt marsh in the Northeast region.

People who had been paying attention to local environmental matters have known for some time that Wellfleet erred when the town decided to restrict tidal flow into the Herring River in the early 1900’s. Eventually the consequences of this tidal restriction became obvious to others, like myself, who live in, or close to, the historic flood plain.

During the approximately 30 years that I have owned my home on West Main Street I have observed a dead and dying landscape along the side of Pole Dike road (a continuation of West Main Street) in an area that was once a beautiful expanse of salt hay and a healthy spawning ground for several species of marine life. Now when I pass by this area I think of the day when oxygen rich tides are re-introduced, and the journey back to a healthy marsh has begun.

(And, as I have learned more about our changing climate I have come to understand that a healthy salt marsh will provide better protection from the higher tides and stronger storms that we now know we should expect.)

I once described the Herring River Restoration Project as our gift to future generations. More recently I have begun to think of it as an act of stepping up to the plate and doing the right thing. When it is completed I believe that it will be a model, as well as an inspiration, for other coastal communities.

Sincerely,

Gail Ferguson

Gail Ferguson
130 West Main Street
Wellfleet, MA 02667
gfergusonwellfleet@comcast.net

CC: Sen. Elizabeth Warren
Sen.Edward Markey
Congressman William Keating
Senator Julian Cyr
Representative Sarah Peake
Friends of Herring River

To: Wellfleet Select Board

From: The Cumblers

Concerning: The Herring River Restoration

As an environmentalist-a professor of environmental studies- and an abutter to the Herring River project, I have carefully looked at the science around the studies of the Herring River as it is now and am greatly concerned. The Herring River is in an advanced state of decline, acidification is increasing, the marsh is sinking, and the drainage from a degraded marsh is compromising shellfish beds. The restoration of the Herring River will dramatically reduce these negative impacts on the eco-system.

The restoration will also increase the herring run and limit the stress on the herring of dealing with highly acidic and polluted water as well as opening up more space for the herring to run thus reducing predation particularly in narrow culverts. The flushing of the Herring River will definitely support greater diversity of marine life, expand the nursery for juvenile fish and perhaps even become a spawning area for stripped bass. Sand eels, a significant food source for striped bass and blue fish, will most likely recolonize the mouth of the river.

With restoration, the Herring River will become a significant destination for fishers from around the region. It will also provide an important destination for canoeists and kayakers. With the increasing concern over sharks at our beaches, a restored Herring River will provide an important alternative tourist attraction to town beaches.

We are full-time residents of Wellfleet who strongly support the restoration of the Herring River. We are also abutters on Mill Creek, which will, soon we hope, eventually be part of the restoration. We strongly urge the town to take whatever steps necessary to move this project forward. We have watched the Herring River degrade over the 30 years we have owned abutting property. As a recreational fisherman I have long advocated the opening up of the Herring River if for no other reason than to dramatically increase fishing potential in town.

This project is long overdue. As conservationists argued at the time (and the courts agreed), the dyke should never have been rebuilt 50 years ago. It is well past time we rectified that mistake. Please continue your support for the restoration project. Future generation of Wellfleetians will thank you.

The Cumblers

380 Old Chequessett Neck Rd

Wellfleet, MA 02667

8.H Design Plans

8.H.1 Project Elements

<u>Chequessett Neck Road Bridge:</u>
Herring River Restoration Project Chequessett Neck Road Bridge and Water Access Facility Construction. Permitting Drawing Set. June 2018; Revised November 12, 2019. Prepared by Fuss & O'Neill, Inc.

<u>Pole Dike Road and other low-lying roads:</u>
Herring River Restoration Project. Engineering Design to Elevate Low-Lying Roadways and Replace Associated Culverts. Permit Plans – Not for Construction. May 2019. Prepared by Louis Berger U.S. Inc.

<u>High Toss Road Removal:</u>
Herring River Restoration Project. High Toss Road Permit-Level Design Plans. June 30, 2017; Revised June 28, 2018. Prepared by ESS Group, Inc.

8.H.2 Mitigation

Herring River Restoration Project. Permit Plans for Low-Lying Property Impact Prevention. Miller-Frederiksen Property (695 Bound Brook Island Road). Permit Plans – Not For Construction. April 2018. Prepared by Louis Berger U.S. Inc.

Herring River Restoration Project. Chequessett Yacht and Country Club Reconfiguration Permit-Level Design Plans. DRAFT. September 13, 2019. Prepared by ESS Group, Inc.
<u>(Note: An updated stamped plan set will be provided shortly to reflect a new haul road location)</u>

8.H.3 Federal Structures on Federal Land

<u>Mill Creek Water Control Structure:</u>
Herring River Restoration Project Mill Creek Water Control Structure. Construction Project Permitting Drawing Set. June 2018. Prepared by Fuss & O'Neill, Inc.

<u>Way 672 Tide Barrier:</u>
Herring River Restoration Project. Way #672 Tidal Barrier Alternatives Assessment. Existing and Proposed Conditions. June 2019. Prepared by Fuss & O'Neill, Inc.
<u>(Note: An updated plan set will be provided shortly for informational purposes)</u>