DRAINAGE REPORT

For

YEARLY GRIND II REALTY, LLC

PROPOSED

WITH DRIVE-THRU

970 Ashley Boulevard
New Bedford, Massachusetts
Bristol County

Prepared by:

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BE #W181069

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I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the development of a proposed fast-food restaurant with drive-thru located on the corner of Ashley Boulevard and York Street in the City of New Bedford, Massachusetts. The site, which contains approximately 0.45 acres of land, contains an existing monument sign retail store and a single-story building with an associated compacted gravel outdoor sales area and driveway/parking area. The north and east sides of the site have grassed areas.

The proposed project includes the construction of a new freestanding "Dunkin"' fast-food restaurant with drive-thru, along with new paved parking areas, landscaping, a new storm water management system and associated utilities. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler Engineering. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

II. EXISTING SITE CONDITIONS

The majority of the soils at the site are mapped as "urban land" with adjacent soils mapped by the Natural Resource Conservation Service (NRCS) as Hydrologic Soil Group (HSG) "C". Slopes on the site generally range from 1%-5% with on-site elevations ranging from 71 in the northeastern corner of the site to 68 in the southern portion of the site.

For the purposes of this analysis, in order to provide a comparison of pre- and post-development drainage conditions, three (3) "Design Points" (DP-1, DP-2, and DP-3) have been designated for the site, as follows:

Design Point #1 (DP-1) is the Ashley Boulevard municipal drainage system at a culmination point to the south of the site. Under existing conditions, this design point receives stormwater flows from approximately 0.22 acres of land, designated as watershed "E-1". This watershed includes areas of compacted gravel, grass, and a building roof flowing overland into the existing municipal drainage system in Ashley Boulevard.

Design Point #2 (DP-2) is the abutting residential property on the southeast side of the site. Under existing conditions, this design point receives stormwater flows from approximately 0.14 acres of land, designated as watershed "E-2". This watershed includes areas of compacted gravel, landscaping, and a building roof flowing overland to the abutting property.

Design Point #3 (DP-3) is the York Street municipal drainage system. Under existing conditions, this design point receives stormwater flows from approximately 0.14 acres of land, designated as watershed "E-3". This watershed includes areas of compacted gravel and landscaping flowing overland into York Street, culminating within the municipal drainage system to the east of the site.

The pre-development peak rates of runoff associated with this property have been presented in Table 2.1 below (for additional information, refer to the Appendices of this report):

Table 2.1 – Pre-Development Runoff Rates to Design Points (cubic feet per second)

Design Point	2-Year Storm Event	10-Year Storm Event	25-Year Storm Event	100-Year Storm Event
Design Point #1	0.57	0.88	1.06	1.37
Design Point #2	0.27	0.47	0.58	0.78
Design Point #3	0.21	0.38	0.47	0.65

III. PROPOSED SITE CONDITIONS

The proposed project consists of the construction of a new 2,002 SF freestanding "Dunkin" fast food restaurant with drive-thru, associated paved parking areas, landscaping, utilities, and a new stormwater management system. The site, including the proposed parking areas, has been designed to drain to deep sump hooded catch basins. The catch basins will capture and convey stormwater runoff, via an underground pipe system, to a proposed underground infiltration system. Pretreatment of stormwater runoff will be provided by deep sump hooded catch basins providing adequate pre-treatment prior to discharge into the proposed infiltration basins. "Clean" rooftop runoff has been designed to flow to the underground infiltration system as well.

The proposed drainage system has been designed to provide at least 80% removal of Total Suspended Solids (TSS) in accordance with the Massachusetts DEP Stormwater Handbook. Per the New Bedford Stormwater Bylaw, 1" of runoff over all impervious area on the site is proposed to infiltrate from the proposed stormwater management system. In addition, the project has been designed to maintain existing drainage watersheds to the greatest extent possible, with the same Design Points described in Section II above. The post-development peak rates of runoff associated with this property have been presented in Table 3.1 below (refer to Appendices at the end of this report for additional information):

Table 3.1 – Post-Development Runoff Rates to Design Points (cubic feet per second)

Design Point	2-Year Storm Event	10-Year Storm Event	25-Year Storm Event	100-Year Storm Event
Design Point #1	0.33	0.66	0.78	1.00
Design Point #2	0.08	0.15	0.19	0.26
Design Point #3	0.06	0.10	0.12	0.17

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet the total suspended solid (TSS) removal requirements as set forth in the Massachusetts Department of Environmental Protection Stormwater Handbook standards. In addition, a Stormwater Operation and Maintenance (O&M) Plan has been developed which includes scheduled pavement sweepings, and periodic inspections of stormwater management structures (i.e. catch basins and infiltration basin).

IV. METHODOLOGY

Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the guidelines set forth in the latest edition of Massachusetts DEP Stormwater Handbook. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the Appendices of this Report. The following rainfall data was utilized in the calculations:

Frequency	2 year	10 year	25 year	100 year
Rainfall (inches)	3.40	4.80	5.60	7.00

The project's compliance with the MADEP Stormwater Management standards is described further below:

Standard #1: No New Untreated Discharges:

The project has been designed so that proposed impervious areas, including the building roof and paved parking/driveway areas, shall be collected and passed through the proposed drainage system for treatment. Therefore no new untreated discharges are proposed.

Standard 2: Peak Rate Attenuation

As outlined in Tables 2.1 and 3.1 above, the development of the site and the proposed stormwater management system, have been designed so that post-development peak rates of runoff are below pre-development conditions for the 2-, 10-, 25- and 100-year storm events at Design Point DP-1. Calculations are provided in the appendices of this report.

Standard 3: Recharge

The stormwater runoff from the project will be collected and diverted to a proposed underground infiltration system. The project as proposed will involve the creation of 0.19 acres of new impervious area and is required to infiltrate 177 cubic feet of stormwater as defined in Stormwater Standard 3. The proposed underground infiltration system will provide 1,369 cubic feet of volume below the lowest outlet for groundwater recharge. Additional calculations are included in the Appendices of this Report (Per the City of New Bedford Stormwater Management Rules and Regulations, the site has been designed to retain and infiltrate the first one (1) inch of runoff from all impervious cover on site, or 1,136 CF).

The DEP Stormwater Standards require that the infiltration BMP drains completely within 72 hours of the end of the storm event. Calculations showing that the proposed infiltration basin will drain within 60.5 hours are included in the Appendices of this report.

Standard #4 Water Quality:

Water quality treatment is provided via deep sump catch basins and an underground infiltration system. TSS removal Calculations are included in the Appendices of this report. The project as proposed will involve the creation of 0.19 acres of new impervious area and is required to treat 1,136 cubic feet of water quality volume as defined in Stormwater Standard 4 and the New Bedford Stormwater Management Rules & Regulations. The proposed underground infiltration system will provide 1,369 cubic feet of water quality volume below the lowest outlet for water quality treatment. Additional calculations are included in the Appendices of this Report. Per the City of New Bedford Stormwater Management Rules and Regulations, the site has been designed to retain and infiltrate the first one (1) inch of runoff from all impervious cover on site.

Standard #5 Land Uses with Higher Potential Pollutant Loads

Not Applicable for this project.

Standard 6: Critical Areas

Not Applicable for this project.

Standard 7: Redevelopment

This project consists of a portion of redevelopment as defined under Standard 7, however it has been designed in accordance with all Massachusetts Stormwater Management Standards for new development.

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

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction entrance, protection for stormwater inlets, protection around temporary material stock piles and various other techniques as outlined on the erosion and sediment control sheets. As this project proposes to disturb less than one acre of land, the project is not required to file a Notice of Intent with the US EPA and implement a Stormwater Pollution Prevention Plan (SWPPP) during the construction period.

Standard 9: Operation and Maintenance (O&M) Plan

An Operation and Maintenance (O&M) Plan for this site has been prepared and is included within this report. The O&M Plan outlines procedures and time tables for the long term operation and maintenance of

the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan includes a list of responsible parties and an estimated budget for inspections and maintenance.

Standard 10: Prohibition of Illicit Discharges

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and will not contain any illicit discharges from prohibited sources. An Illicit Discharge Statement is included in the Appendices of this report.

V. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler Engineering results in a reduction in peak rates of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies. In addition, the proposed best management practices will result in an effective removal of total suspended solids from the post-development runoff. The pre-development versus post-development peak discharge rates comparisons are contained within Tables 5.1 below:

Table 5.1 – Runoff Rates to Design Point #1 (cubic feet per second)

Frequency (yrs)	Existing Flow	Proposed Flow	Change in Flow
2	0.57	0.33	-0.28 (-49.1%)
10	0.88	0.66	-0.16 (-18.2%)
25	1.06	0.78	-0.20 (-18.9%)
100	1.37	1.00	-0.33 (-24.1%)

Table 5.2 – Runoff Rates to Design Point #2 (cubic feet per second)

Frequency (yrs)	Existing Flow	Proposed Flow	Change in Flow
2	0.27	0.08	-0.19 (-70.3%)
10	0.47	0.15	-0.32 (-68.1%)
25	0.58	0.19	-0.39 (-67.2%)
100	0.78	0.26	-0.52 (-66.7%)

Table 5.3 – Runoff Rates to Design Point #3 (cubic feet per second)

Frequency (yrs)	Existing Flow	Proposed Flow	Change in Flow
2	0.21	0.06	-0.15 (-71.4%)
10	0.38	0.10	-0.28 (-73.7%)
25	0.47	0.12	-0.35 (-74.5%)
100	0.65	0.17	-0.48 (-73.8%)

APPENDIX A – PROJECT MAPS AND SOIL DATA

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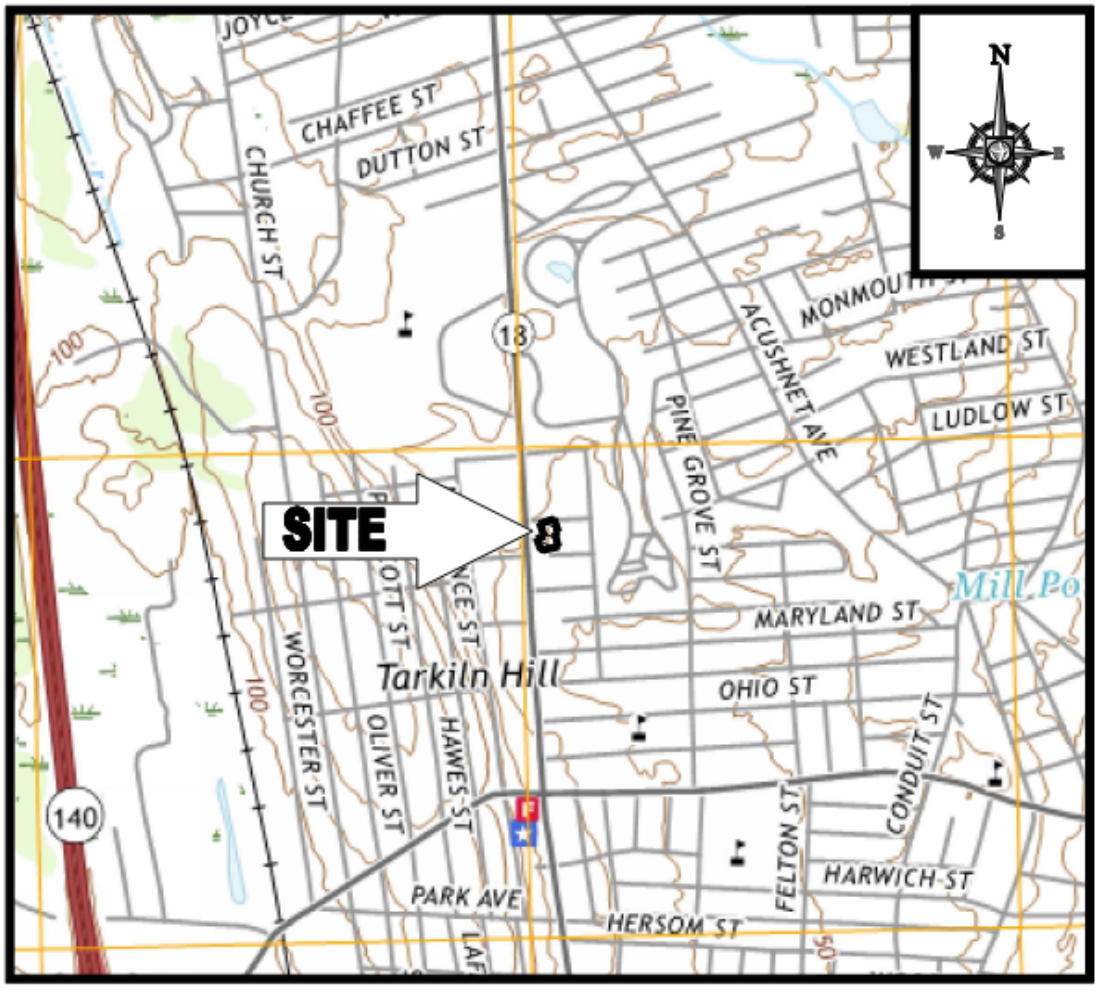


LOCATION MAP

SCALE: 1"=1000'
PLAN REFERENCE: NEW BEDFORD USGS QUADRANGLE

Map Scale: 1:3,530 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Bristol County, Massachusetts, Southern Part
Survey Area Data: Version 12, Sep 7, 2018

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

Date(s) aerial images were photographed: Dec 31, 2009—Jul 3, 2017

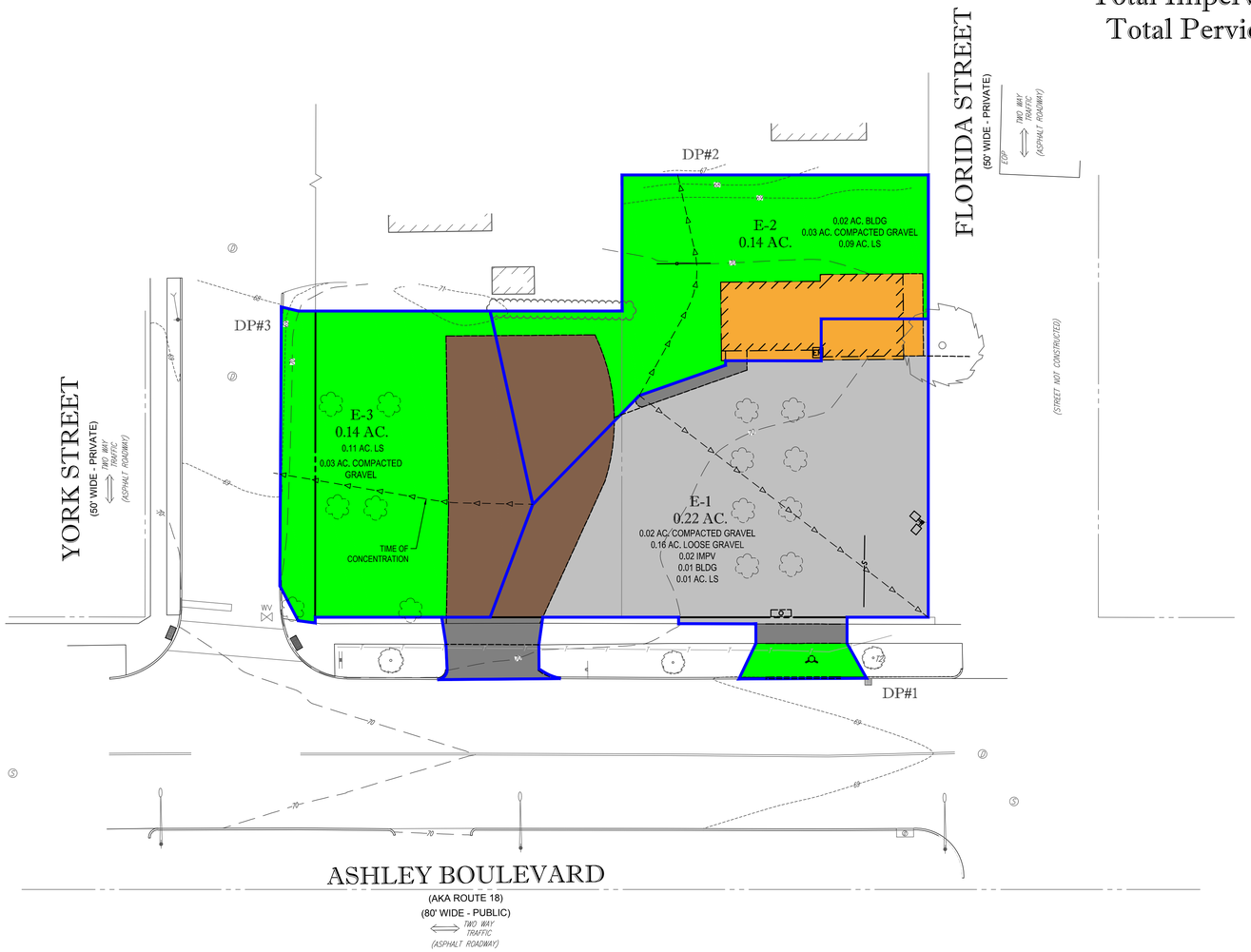
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	49.8	100.0%
Totals for Area of Interest		**49.8**	**100.0%**

APPENDIX B – PRE DEVELOPMENT WATERSHEDS MAP

TOTAL SITE AREA: 0.50 Acres
Total Impervious Coverage: 0.13 Acres
Total Pervious Coverage: 0.37 Acres



EXISTING DRAINAGE TRIBUTARY MAP

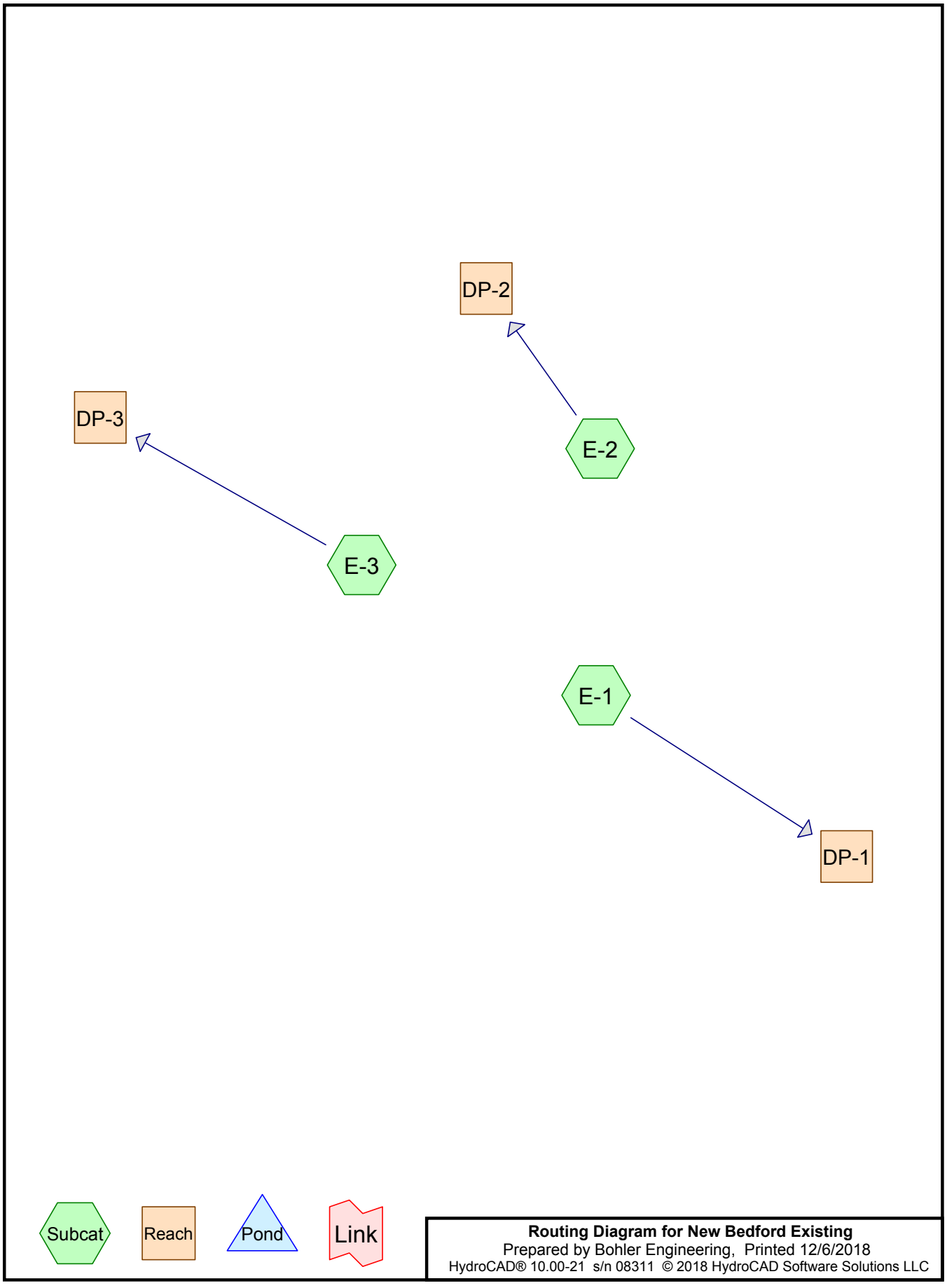
970 ASHLEY BOULEVARD
CITY OF NEW BEDFORD
BRISTOL COUNTY
MASSACHUSETTS

PREPARED BY

BOHLER ENGINEERING

NOT TO SCALE

APPENDIX C – PRE DEVELOPMENT STORMWATER ATTENUATION CALCULATIONS



Routing Diagram for New Bedford Existing
Prepared by Bohler Engineering, Printed 12/6/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.210	74	>75% Grass cover, Good, HSG C (E-1, E-2, E-3)
0.180	89	Gravel roads, HSG C (E-1)
0.090	96	Gravel surface, HSG C (E-1, E-2, E-3)
0.020	98	Impervious (E-2)
0.500	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.480	HSG C	E-1, E-2, E-3
0.000	HSG D	
0.020	Other	E-2
0.500		**TOTAL AREA**

Summary for Subcatchment E-1:

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 0.042 af, Depth= 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

Area (ac)	CN	Description
0.010	74	>75% Grass cover, Good, HSG C
0.180	89	Gravel roads, HSG C
0.030	96	Gravel surface, HSG C
0.220	89	Weighted Average
0.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0170	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
0.9	55	0.0040	1.02		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.6	105	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E-2:

Runoff = 0.27 cfs @ 12.09 hrs, Volume= 0.020 af, Depth= 1.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

	Area (ac)	CN	Description
	0.090	74	>75% Grass cover, Good, HSG C
*	0.020	98	Impervious
	0.030	96	Gravel surface, HSG C
	0.140	82	Weighted Average
	0.120		85.71% Pervious Area
	0.020		14.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0170	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.2	23	0.1050	2.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	73	Total			

Summary for Subcatchment E-3:

Runoff = 0.21 cfs @ 12.14 hrs, Volume= 0.017 af, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

Area (ac)	CN	Description
0.110	74	>75% Grass cover, Good, HSG C
0.030	96	Gravel surface, HSG C
0.140	79	Weighted Average
0.140		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.2	30	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	80	Total			

Summary for Reach DP-1:

Inflow Area = 0.220 ac, 0.00% Impervious, Inflow Depth = 2.26" for 2-yr storm event
Inflow = 0.57 cfs @ 12.09 hrs, Volume= 0.042 af
Outflow = 0.57 cfs @ 12.09 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.140 ac, 14.29% Impervious, Inflow Depth = 1.70" for 2-yr storm event
Inflow = 0.27 cfs @ 12.09 hrs, Volume= 0.020 af
Outflow = 0.27 cfs @ 12.09 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3:

Inflow Area = 0.140 ac, 0.00% Impervious, Inflow Depth = 1.49" for 2-yr storm event
Inflow = 0.21 cfs @ 12.14 hrs, Volume= 0.017 af
Outflow = 0.21 cfs @ 12.14 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Subcatchment E-1:

Runoff = 0.88 cfs @ 12.09 hrs, Volume= 0.066 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

Area (ac)	CN	Description
0.010	74	>75% Grass cover, Good, HSG C
0.180	89	Gravel roads, HSG C
0.030	96	Gravel surface, HSG C
0.220	89	Weighted Average
0.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0170	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
0.9	55	0.0040	1.02		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.6	105	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E-2:

Runoff = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

	Area (ac)	CN	Description
	0.090	74	>75% Grass cover, Good, HSG C
*	0.020	98	Impervious
	0.030	96	Gravel surface, HSG C
	0.140	82	Weighted Average
	0.120		85.71% Pervious Area
	0.020		14.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0170	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.2	23	0.1050	2.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	73	Total			

Summary for Subcatchment E-3:

Runoff = 0.38 cfs @ 12.14 hrs, Volume= 0.031 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

Area (ac)	CN	Description
0.110	74	>75% Grass cover, Good, HSG C
0.030	96	Gravel surface, HSG C
0.140	79	Weighted Average
0.140		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.2	30	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	80	Total			

Summary for Reach DP-1:

Inflow Area = 0.220 ac, 0.00% Impervious, Inflow Depth = 3.58" for 10-yr storm event
Inflow = 0.88 cfs @ 12.09 hrs, Volume= 0.066 af
Outflow = 0.88 cfs @ 12.09 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.140 ac, 14.29% Impervious, Inflow Depth = 2.90" for 10-yr storm event
Inflow = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af
Outflow = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3:

Inflow Area = 0.140 ac, 0.00% Impervious, Inflow Depth = 2.63" for 10-yr storm event
Inflow = 0.38 cfs @ 12.14 hrs, Volume= 0.031 af
Outflow = 0.38 cfs @ 12.14 hrs, Volume= 0.031 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Subcatchment E-1:

Runoff = 1.06 cfs @ 12.09 hrs, Volume= 0.080 af, Depth= 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

Area (ac)	CN	Description
0.010	74	>75% Grass cover, Good, HSG C
0.180	89	Gravel roads, HSG C
0.030	96	Gravel surface, HSG C
0.220	89	Weighted Average
0.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0170	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
0.9	55	0.0040	1.02		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.6	105	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E-2:

Runoff = 0.58 cfs @ 12.09 hrs, Volume= 0.042 af, Depth= 3.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

	Area (ac)	CN	Description
	0.090	74	>75% Grass cover, Good, HSG C
*	0.020	98	Impervious
	0.030	96	Gravel surface, HSG C
	0.140	82	Weighted Average
	0.120		85.71% Pervious Area
	0.020		14.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0170	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.2	23	0.1050	2.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	73	Total			

Summary for Subcatchment E-3:

Runoff = 0.47 cfs @ 12.14 hrs, Volume= 0.039 af, Depth= 3.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

Area (ac)	CN	Description
0.110	74	>75% Grass cover, Good, HSG C
0.030	96	Gravel surface, HSG C
0.140	79	Weighted Average
0.140		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.2	30	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	80	Total			

Summary for Reach DP-1:

Inflow Area = 0.220 ac, 0.00% Impervious, Inflow Depth = 4.35" for 25-yr storm event
Inflow = 1.06 cfs @ 12.09 hrs, Volume= 0.080 af
Outflow = 1.06 cfs @ 12.09 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.140 ac, 14.29% Impervious, Inflow Depth = 3.62" for 25-yr storm event
Inflow = 0.58 cfs @ 12.09 hrs, Volume= 0.042 af
Outflow = 0.58 cfs @ 12.09 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3:

Inflow Area = 0.140 ac, 0.00% Impervious, Inflow Depth = 3.32" for 25-yr storm event
Inflow = 0.47 cfs @ 12.14 hrs, Volume= 0.039 af
Outflow = 0.47 cfs @ 12.14 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Subcatchment E-1:

Runoff = 1.37 cfs @ 12.09 hrs, Volume= 0.105 af, Depth= 5.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

Area (ac)	CN	Description
0.010	74	>75% Grass cover, Good, HSG C
0.180	89	Gravel roads, HSG C
0.030	96	Gravel surface, HSG C
0.220	89	Weighted Average
0.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0170	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.40"
0.9	55	0.0040	1.02		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.6	105	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment E-2:

Runoff = 0.78 cfs @ 12.09 hrs, Volume= 0.057 af, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

	Area (ac)	CN	Description
	0.090	74	>75% Grass cover, Good, HSG C
*	0.020	98	Impervious
	0.030	96	Gravel surface, HSG C
	0.140	82	Weighted Average
	0.120		85.71% Pervious Area
	0.020		14.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0170	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.2	23	0.1050	2.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.0	73	Total			

Summary for Subcatchment E-3:

Runoff = 0.65 cfs @ 12.14 hrs, Volume= 0.053 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

Area (ac)	CN	Description
0.110	74	>75% Grass cover, Good, HSG C
0.030	96	Gravel surface, HSG C
0.140	79	Weighted Average
0.140		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
0.2	30	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
9.7	80	Total			

Summary for Reach DP-1:

Inflow Area = 0.220 ac, 0.00% Impervious, Inflow Depth = 5.71" for 100-yr storm event
Inflow = 1.37 cfs @ 12.09 hrs, Volume= 0.105 af
Outflow = 1.37 cfs @ 12.09 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.140 ac, 14.29% Impervious, Inflow Depth = 4.92" for 100-yr storm event
Inflow = 0.78 cfs @ 12.09 hrs, Volume= 0.057 af
Outflow = 0.78 cfs @ 12.09 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

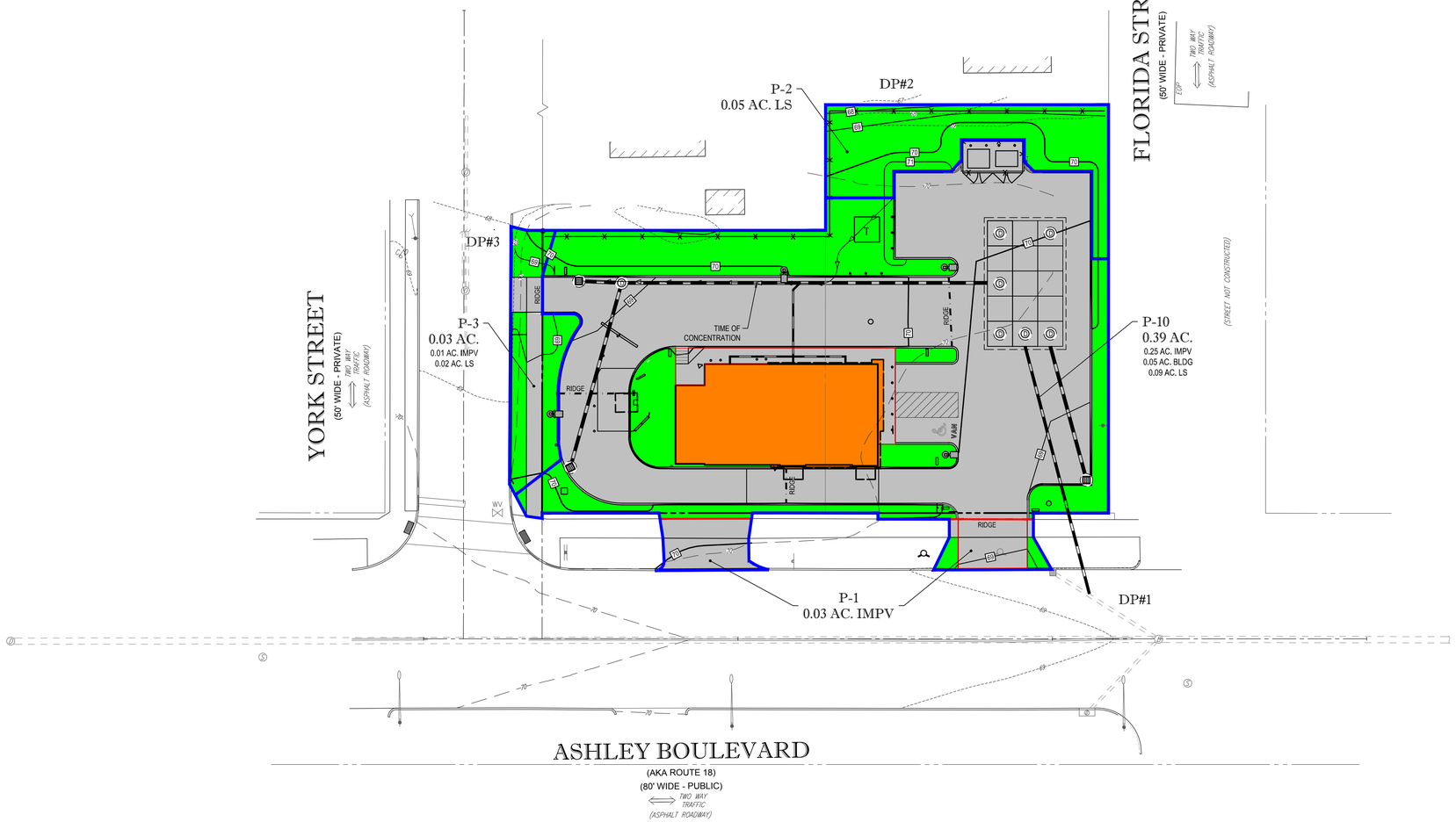
Summary for Reach DP-3:

Inflow Area = 0.140 ac, 0.00% Impervious, Inflow Depth = 4.58" for 100-yr storm event
Inflow = 0.65 cfs @ 12.14 hrs, Volume= 0.053 af
Outflow = 0.65 cfs @ 12.14 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

APPENDIX D – POST DEVELOPMENT WATERSHEDS MAP

TOTAL SITE AREA: 0.50 Acres
Total Impervious Coverage: 0.34 Acres
Total Pervious Coverage: 0.16 Acres



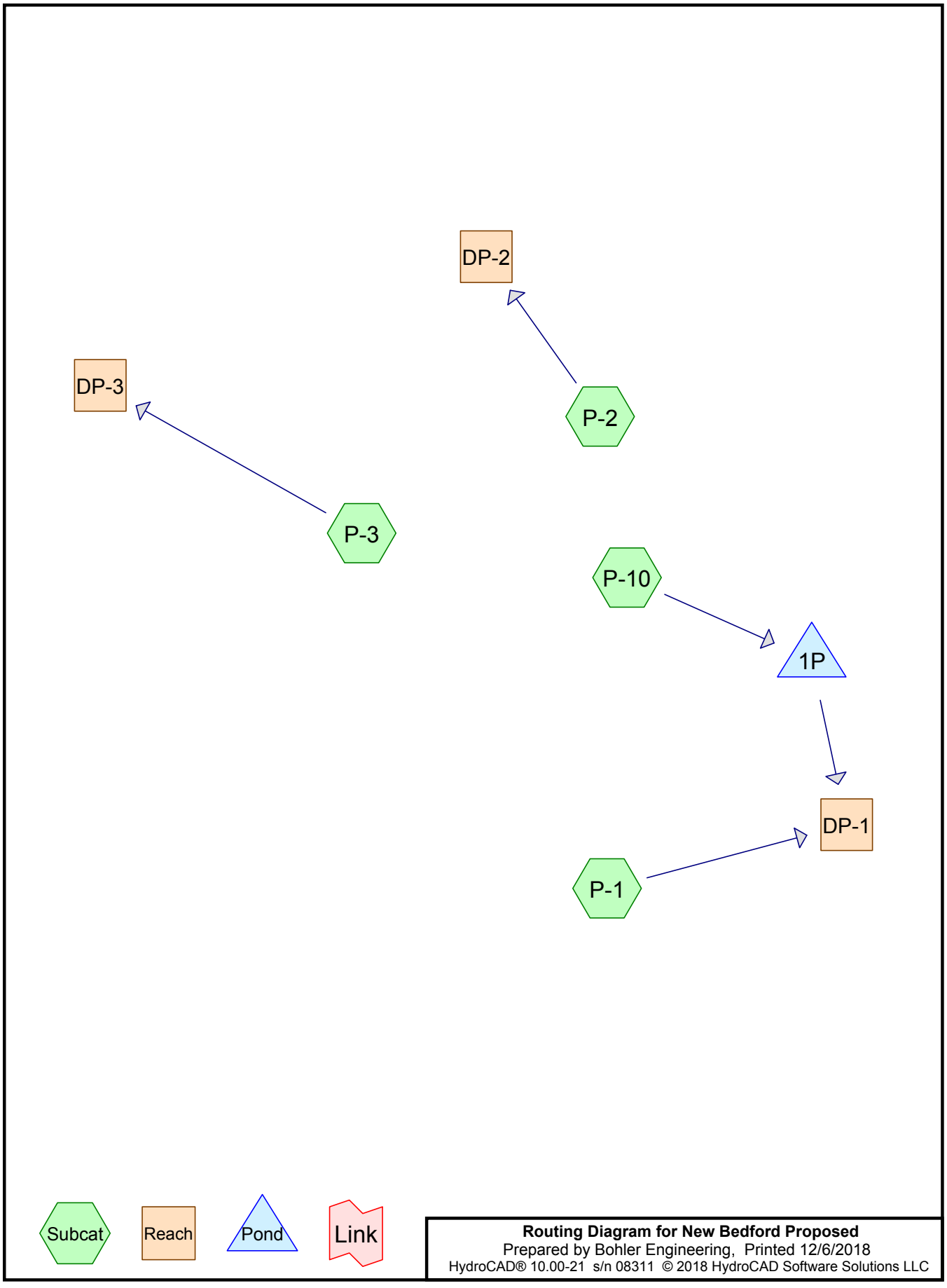
PROPOSED DRAINAGE TRIBUTARY MAP

970 ASHLEY BOULEVARD
CITY OF NEW BEDFORD
BRISTOL COUNTY
MASSACHUSETTS

PREPARED BY
BOHLER ENGINEERING

NOT TO SCALE

APPENDIX E – POST DEVELOPMENT STORMWATER ATTENUATION CALCULATIONS



Routing Diagram for New Bedford Proposed
Prepared by Bohler Engineering, Printed 12/6/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.050	79	50-75% Grass cover, Fair, HSG C (P-2)
0.110	74	>75% Grass cover, Good, HSG C (P-10, P-3)
0.010	98	Impervious (P-3)
0.330	98	Paved parking, HSG C (P-1, P-10)
0.500	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.490	HSG C	P-1, P-10, P-2, P-3
0.000	HSG D	
0.010	Other	P-3
0.500		**TOTAL AREA**

Summary for Subcatchment P-1:

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.008 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG C
0.030		100.00% Impervious Area

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

Summary for Subcatchment P-10:

Runoff = 1.11 cfs @ 12.09 hrs, Volume= 0.083 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

Area (ac)	CN	Description
0.090	74	>75% Grass cover, Good, HSG C
0.300	98	Paved parking, HSG C
0.390	92	Weighted Average
0.090		23.08% Pervious Area
0.300		76.92% Impervious Area

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

Summary for Subcatchment P-2:

Runoff = 0.08 cfs @ 12.10 hrs, Volume= 0.006 af, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

Area (ac)	CN	Description
0.050	79	50-75% Grass cover, Fair, HSG C
0.050		100.00% Pervious Area

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

Summary for Subcatchment P-3:

Runoff = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af, Depth= 1.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr storm Rainfall=3.40"

	Area (ac)	CN	Description
	0.020	74	>75% Grass cover, Good, HSG C
*	0.010	98	Impervious
	0.030	82	Weighted Average
	0.020		66.67% Pervious Area
	0.010		33.33% Impervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.420 ac, 78.57% Impervious, Inflow Depth = 1.37" for 2-yr storm event
Inflow = 0.33 cfs @ 12.42 hrs, Volume= 0.048 af
Outflow = 0.33 cfs @ 12.42 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.050 ac, 0.00% Impervious, Inflow Depth = 1.49" for 2-yr storm event
Inflow = 0.08 cfs @ 12.10 hrs, Volume= 0.006 af
Outflow = 0.08 cfs @ 12.10 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3:

Inflow Area = 0.030 ac, 33.33% Impervious, Inflow Depth = 1.70" for 2-yr storm event
Inflow = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af
Outflow = 0.06 cfs @ 12.09 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 1P:

Inflow Area = 0.390 ac, 76.92% Impervious, Inflow Depth = 2.54" for 2-yr storm event
Inflow = 1.11 cfs @ 12.09 hrs, Volume= 0.083 af
Outflow = 0.31 cfs @ 12.44 hrs, Volume= 0.054 af, Atten= 72%, Lag= 21.2 min
Discarded = 0.01 cfs @ 8.60 hrs, Volume= 0.014 af
Primary = 0.30 cfs @ 12.44 hrs, Volume= 0.040 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 65.72' @ 12.44 hrs Surf.Area= 1,092 sf Storage= 1,743 cf

Plug-Flow detention time= 235.5 min calculated for 0.054 af (65% of inflow)
Center-of-Mass det. time= 137.0 min (932.6 - 795.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	63.50'	730 cf	**26.00'W x 42.00'L x 5.33'H Field A** 5,824 cf Overall - 4,000 cf Embedded = 1,824 cf x 40.0% Voids
#2A	64.00'	2,913 cf	**retain_it retain_it 3.5'** x 15 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 3 Rows adjusted for 98.2 cf perimeter wall
		3,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	65.30'	**6.0" Round Culvert** L= 81.0' Ke= 0.500 Inlet / Outlet Invert= 65.30' / 64.90' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Discarded	63.50'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 8.60 hrs HW=63.56' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.30 cfs @ 12.44 hrs HW=65.72' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.30 cfs @ 2.31 fps)

Summary for Subcatchment P-1:

Runoff = 0.14 cfs @ 12.09 hrs, Volume= 0.011 af, Depth= 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG C
0.030		100.00% Impervious Area

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

Summary for Subcatchment P-10:

Runoff = 1.66 cfs @ 12.09 hrs, Volume= 0.127 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

Area (ac)	CN	Description
0.090	74	>75% Grass cover, Good, HSG C
0.300	98	Paved parking, HSG C
0.390	92	Weighted Average
0.090		23.08% Pervious Area
0.300		76.92% Impervious Area

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

Summary for Subcatchment P-2:

Runoff = 0.15 cfs @ 12.09 hrs, Volume= 0.011 af, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

Area (ac)	CN	Description
0.050	79	50-75% Grass cover, Fair, HSG C
0.050		100.00% Pervious Area

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

Summary for Subcatchment P-3:

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 0.007 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr storm Rainfall=4.80"

	Area (ac)	CN	Description
	0.020	74	>75% Grass cover, Good, HSG C
*	0.010	98	Impervious
	0.030	82	Weighted Average
	0.020		66.67% Pervious Area
	0.010		33.33% Impervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.420 ac, 78.57% Impervious, Inflow Depth = 2.70" for 10-yr storm event
Inflow = 0.66 cfs @ 12.27 hrs, Volume= 0.094 af
Outflow = 0.66 cfs @ 12.27 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.050 ac, 0.00% Impervious, Inflow Depth = 2.63" for 10-yr storm event
Inflow = 0.15 cfs @ 12.09 hrs, Volume= 0.011 af
Outflow = 0.15 cfs @ 12.09 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3:

Inflow Area = 0.030 ac, 33.33% Impervious, Inflow Depth = 2.90" for 10-yr storm event
Inflow = 0.10 cfs @ 12.09 hrs, Volume= 0.007 af
Outflow = 0.10 cfs @ 12.09 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 1P:

Inflow Area = 0.390 ac, 76.92% Impervious, Inflow Depth = 3.89" for 10-yr storm event
Inflow = 1.66 cfs @ 12.09 hrs, Volume= 0.127 af
Outflow = 0.61 cfs @ 12.34 hrs, Volume= 0.097 af, Atten= 63%, Lag= 15.4 min
Discarded = 0.01 cfs @ 7.15 hrs, Volume= 0.014 af
Primary = 0.60 cfs @ 12.34 hrs, Volume= 0.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 66.42' @ 12.34 hrs Surf.Area= 1,092 sf Storage= 2,357 cf

Plug-Flow detention time= 175.8 min calculated for 0.097 af (77% of inflow)
Center-of-Mass det. time= 95.9 min (879.9 - 784.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	63.50'	730 cf	**26.00'W x 42.00'L x 5.33'H Field A** 5,824 cf Overall - 4,000 cf Embedded = 1,824 cf x 40.0% Voids
#2A	64.00'	2,913 cf	**retain_it retain_it 3.5'** x 15 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 3 Rows adjusted for 98.2 cf perimeter wall
		3,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	65.30'	**6.0" Round Culvert** L= 81.0' Ke= 0.500 Inlet / Outlet Invert= 65.30' / 64.90' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Discarded	63.50'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 7.15 hrs HW=63.56' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.60 cfs @ 12.34 hrs HW=66.42' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.60 cfs @ 3.07 fps)

Summary for Subcatchment P-1:

Runoff = 0.16 cfs @ 12.09 hrs, Volume= 0.013 af, Depth= 5.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG C
0.030		100.00% Impervious Area

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

Summary for Subcatchment P-10:

Runoff = 1.97 cfs @ 12.09 hrs, Volume= 0.152 af, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

Area (ac)	CN	Description
0.090	74	>75% Grass cover, Good, HSG C
0.300	98	Paved parking, HSG C
0.390	92	Weighted Average
0.090		23.08% Pervious Area
0.300		76.92% Impervious Area

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

Summary for Subcatchment P-2:

Runoff = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af, Depth= 3.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

Area (ac)	CN	Description
0.050	79	50-75% Grass cover, Fair, HSG C
0.050		100.00% Pervious Area

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

Summary for Subcatchment P-3:

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 0.009 af, Depth= 3.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr storm Rainfall=5.60"

	Area (ac)	CN	Description
	0.020	74	>75% Grass cover, Good, HSG C
*	0.010	98	Impervious
	0.030	82	Weighted Average
	0.020		66.67% Pervious Area
	0.010		33.33% Impervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.420 ac, 78.57% Impervious, Inflow Depth = 3.47" for 25-yr storm event
Inflow = 0.78 cfs @ 12.23 hrs, Volume= 0.121 af
Outflow = 0.78 cfs @ 12.23 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.050 ac, 0.00% Impervious, Inflow Depth = 3.32" for 25-yr storm event
Inflow = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af
Outflow = 0.19 cfs @ 12.09 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3:

Inflow Area = 0.030 ac, 33.33% Impervious, Inflow Depth = 3.62" for 25-yr storm event
Inflow = 0.12 cfs @ 12.09 hrs, Volume= 0.009 af
Outflow = 0.12 cfs @ 12.09 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 1P:

Inflow Area = 0.390 ac, 76.92% Impervious, Inflow Depth = 4.68" for 25-yr storm event
Inflow = 1.97 cfs @ 12.09 hrs, Volume= 0.152 af
Outflow = 0.72 cfs @ 12.34 hrs, Volume= 0.123 af, Atten= 63%, Lag= 15.3 min
Discarded = 0.01 cfs @ 6.40 hrs, Volume= 0.015 af
Primary = 0.72 cfs @ 12.34 hrs, Volume= 0.108 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 66.84' @ 12.34 hrs Surf.Area= 1,092 sf Storage= 2,731 cf

Plug-Flow detention time= 161.6 min calculated for 0.123 af (81% of inflow)
Center-of-Mass det. time= 87.9 min (867.1 - 779.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	63.50'	730 cf	**26.00'W x 42.00'L x 5.33'H Field A** 5,824 cf Overall - 4,000 cf Embedded = 1,824 cf x 40.0% Voids
#2A	64.00'	2,913 cf	**retain_it retain_it 3.5'** x 15 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 3 Rows adjusted for 98.2 cf perimeter wall
		3,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	65.30'	**6.0" Round Culvert** L= 81.0' Ke= 0.500 Inlet / Outlet Invert= 65.30' / 64.90' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Discarded	63.50'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 6.40 hrs HW=63.55' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.72 cfs @ 12.34 hrs HW=66.84' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.72 cfs @ 3.65 fps)

Summary for Subcatchment P-1:

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 0.017 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

Area (ac)	CN	Description
0.030	98	Paved parking, HSG C
0.030		100.00% Impervious Area

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

Summary for Subcatchment P-10:

Runoff = 2.51 cfs @ 12.09 hrs, Volume= 0.197 af, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

Area (ac)	CN	Description
0.090	74	>75% Grass cover, Good, HSG C
0.300	98	Paved parking, HSG C
0.390	92	Weighted Average
0.090		23.08% Pervious Area
0.300		76.92% Impervious Area

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

Summary for Subcatchment P-2:

Runoff = 0.26 cfs @ 12.09 hrs, Volume= 0.019 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

Area (ac)	CN	Description
0.050	79	50-75% Grass cover, Fair, HSG C
0.050		100.00% Pervious Area

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

Summary for Subcatchment P-3:

Runoff = 0.17 cfs @ 12.09 hrs, Volume= 0.012 af, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr storm Rainfall=7.00"

	Area (ac)	CN	Description
	0.020	74	>75% Grass cover, Good, HSG C
*	0.010	98	Impervious
	0.030	82	Weighted Average
	0.020		66.67% Pervious Area
	0.010		33.33% Impervious Area

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

Summary for Reach DP-1:

Inflow Area = 0.420 ac, 78.57% Impervious, Inflow Depth = 4.84" for 100-yr storm event
Inflow = 1.00 cfs @ 12.33 hrs, Volume= 0.169 af
Outflow = 1.00 cfs @ 12.33 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2:

Inflow Area = 0.050 ac, 0.00% Impervious, Inflow Depth = 4.58" for 100-yr storm event
Inflow = 0.26 cfs @ 12.09 hrs, Volume= 0.019 af
Outflow = 0.26 cfs @ 12.09 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3:

Inflow Area = 0.030 ac, 33.33% Impervious, Inflow Depth = 4.92" for 100-yr storm event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 0.012 af
Outflow = 0.17 cfs @ 12.09 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 1P:

Inflow Area = 0.390 ac, 76.92% Impervious, Inflow Depth = 6.05" for 100-yr storm event
Inflow = 2.51 cfs @ 12.09 hrs, Volume= 0.197 af
Outflow = 0.94 cfs @ 12.34 hrs, Volume= 0.167 af, Atten= 63%, Lag= 15.3 min
Discarded = 0.01 cfs @ 5.30 hrs, Volume= 0.015 af
Primary = 0.93 cfs @ 12.34 hrs, Volume= 0.152 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 67.82' @ 12.34 hrs Surf.Area= 1,092 sf Storage= 3,333 cf

Plug-Flow detention time= 144.6 min calculated for 0.167 af (85% of inflow)
Center-of-Mass det. time= 81.0 min (853.7 - 772.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	63.50'	730 cf	**26.00'W x 42.00'L x 5.33'H Field A** 5,824 cf Overall - 4,000 cf Embedded = 1,824 cf x 40.0% Voids
#2A	64.00'	2,913 cf	**retain_it retain_it 3.5'** x 15 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 3 Rows adjusted for 98.2 cf perimeter wall
		3,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	65.30'	**6.0" Round Culvert** L= 81.0' Ke= 0.500 Inlet / Outlet Invert= 65.30' / 64.90' S= 0.0049 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Discarded	63.50'	**0.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 5.30 hrs HW=63.56' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.92 cfs @ 12.34 hrs HW=67.79' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 0.92 cfs @ 4.70 fps)

APPENDIX F – STORMWATER MANAGEMENT CALCULATIONS

Proposed Dunkin' Donuts
970 Ashley Boulevard
New Bedford, MA
Bohler Job Number: W181193
December 6, 2018

MA DEP Standard 3: Recharge Volume Calculations

Required Recharge Volume - A Soils (0.60 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

*Water Quality volume runoff is equal 1.0 inches of runoff times the total impervious area of the post developr

Required Recharge Volume - B Soils (0.35 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Required Recharge Volume - C Soils (0.25 in.)	
Existing Site Impervious Area (ac)	0.129
Proposed Site Impervious Area (ac)	0.315
Proposed Increase in Site Impervious Area (ac)	0.186
Recharge Volume Required (cf)	**169**

Required Recharge Volume - D Soils (0.10 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Total Recharge Volume Required (cf)	**169**

Recharge Volume Adjustment Factor	
Impervious Area Directed to Infiltration BMP (ac)	**0.300**
%Impervious Directed to Infiltration BMP	95%
Adjustment Factor	1.05
Adjusted Total Recharge Volume Required (cf)	**177**

Provided Recharge Volume*	
BMP Pond #1	1,369
Total Recharge Volume Provided (cf)	**1,369**

Provided greater than or Equal to Required

*Volume provided below lowest outlet in cubic feet (cf)

Prepared By:
Bohler Engineering
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Proposed Dunkin' Donuts
970 Ashley Boulevard
New Bedford, MA
Bohler Job Number: W181193
December 6, 2018

MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - BMP Pond #1	
Volume below outlet pipe (Rv) (cf)	1,546
Soil Type	Silt Loam - C
Infiltration rate (K)*	0.27
*Water Quality volume runoff is equal 1.0 inches of runoff times the total impervious area of the post development project site.	1,136
Drawdown time (Hours)*	60.5

*Infiltration Rates taken from Rawls Table
**Drawdown time = Rv / (K) x (bottom area)

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Proposed Dunkin' Donuts
970 Ashley Boulevard
New Bedford, MA
Bohler Job Number: W181193
December 6, 2018

MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	1.0
Total Post Development Impervious Area (sf)	13,626
Required Water Quality Volume (cf)	1,136

*Water Quality volume runoff is equal 1.0 inches of runoff times the total impervious area of the post development project site.

Water Quality Volume Provided*	
BMP Pond #1	1,369
0	0
0	0
0	0
0	0
Total Provided Water Quality Volume (cf)	1,369

Provided greater than or Equal to Required

*Volume provided below lowest outlet pipe in cubic feet (cf)

Prepared By:
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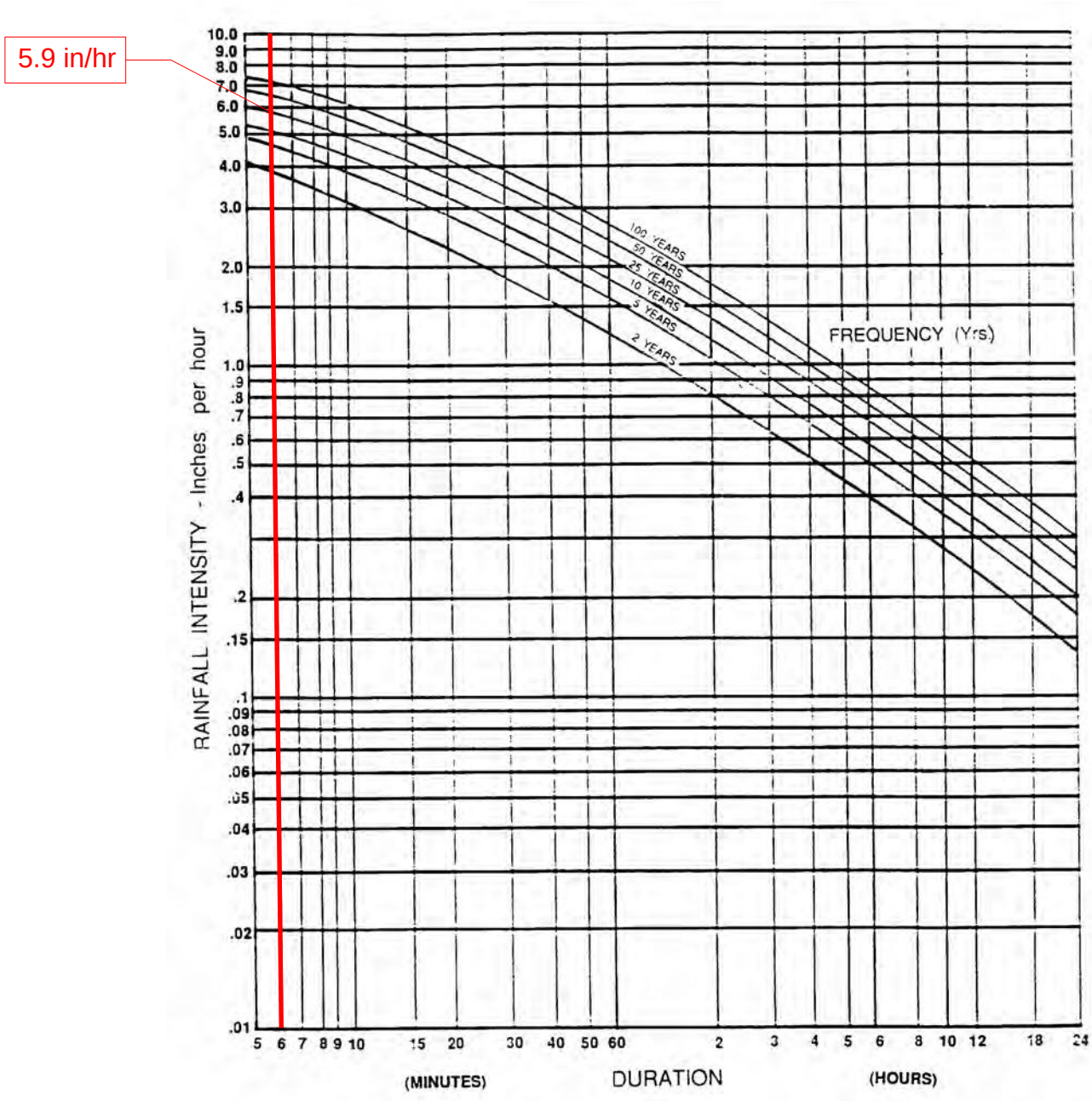
Stage-Area-Storage for Pond 1P:

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
63.50	**1,092**	0	64.54	1,092	696
63.52	1,092	9	64.56	1,092	714
63.54	1,092	17	64.58	1,092	732
63.56	1,092	26	64.60	1,092	750
63.58	1,092	35	64.62	1,092	767
63.60	1,092	44	64.64	1,092	785
63.62	1,092	52	64.66	1,092	803
63.64	1,092	61	64.68	1,092	820
63.66	1,092	70	64.70	1,092	838
63.68	1,092	79	64.72	1,092	856
63.70	1,092	87	64.74	1,092	873
63.72	1,092	96	64.76	1,092	891
63.74	1,092	105	64.78	1,092	909
63.76	1,092	114	64.80	1,092	927
63.78	1,092	122	64.82	1,092	944
63.80	1,092	131	64.84	1,092	962
63.82	1,092	140	64.86	1,092	980
63.84	1,092	149	64.88	1,092	997
63.86	1,092	157	64.90	1,092	1,015
63.88	1,092	166	64.92	1,092	1,033
63.90	1,092	175	64.94	1,092	1,051
63.92	1,092	183	64.96	1,092	1,068
63.94	1,092	192	64.98	1,092	1,086
63.96	1,092	201	65.00	1,092	1,104
63.98	1,092	210	65.02	1,092	1,121
64.00	1,092	218	65.04	1,092	1,139
64.02	1,092	236	65.06	1,092	1,157
64.04	1,092	254	65.08	1,092	1,174
64.06	1,092	272	65.10	1,092	1,192
64.08	1,092	289	65.12	1,092	1,210
64.10	1,092	307	65.14	1,092	1,228
64.12	1,092	325	65.16	1,092	1,245
64.14	1,092	342	65.18	1,092	1,263
64.16	1,092	360	65.20	1,092	1,281
64.18	1,092	378	65.22	1,092	1,298
64.20	1,092	395	65.24	1,092	1,316
64.22	1,092	413	65.26	1,092	1,334
64.24	1,092	431	65.28	1,092	1,351
64.26	1,092	449	65.30	1,092	1,369
64.28	1,092	466	65.32	1,092	1,387
64.30	1,092	484	65.34	1,092	1,405
64.32	1,092	502	65.36	1,092	1,422
64.34	1,092	519	65.38	1,092	1,440
64.36	1,092	537	65.40	1,092	1,458
64.38	1,092	555	65.42	1,092	1,475
64.40	1,092	572	65.44	1,092	1,493
64.42	1,092	590	65.46	1,092	1,511
64.44	1,092	608	65.48	1,092	1,529
64.46	1,092	626	65.50	1,092	1,546
64.48	1,092	643	65.52	1,092	1,564
64.50	1,092	661	65.54	1,092	1,582
64.52	1,092	679	65.56	1,092	1,599

elevation of lowest outlet invert

Exhibit 8-13
Intensity - Duration - Frequency Curve for Barnstable, MA



Source: TR55 - Urban Hydrology for Small Wetlands, NRCS

F-1. Rainfall Data for Massachusetts from *Rainfall Frequency Atlas of the United States* (TP-40)

- Users of this Handbook should note that current MA DEP written guidance (see DEP Waterlines newsletter -- Fall 2000) requires the use of TP-40 Rainfall Data for calculations under the Wetlands Protection Regulations and the Stormwater Management Policy. More stringent design storms may be used under a local bylaw or ordinance. However, DEP will continue to require the use of TP-40 in any case it reviews under the Wetlands Protection Act and Stormwater Management Policy.

Adjusted Technical Paper 40 Design Storms for 24-hour Event by County

County Name	1-yr 24-hr	2-yr 24-hr	5-yr 24-hr	10-yr 24-hr	25-yr 24-hr	50-yr 24-hr	100-yr 24-hr
Barnstable	2.5	3.6	4.5	4.8	5.7	6.4	7.1
Berkshire	2.5	2.9	3.8	4.4	5.1	5.9	6.4
Bristol	2.5	3.4	4.3	4.8	5.6	6.3	7.0
Dukes	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Essex	2.5	3.1	3.9	4.5	5.4	5.9	6.5
Franklin	2.5	2.9	3.8	4.3	5.1	5.8	6.2
Hampden	2.5	3.0	4.0	4.6	5.3	6.0	6.5
Hampshire	2.5	3.0	3.9	4.5	5.2	5.9	6.4
Middlesex	2.5	3.1	4.0	4.5	5.3	5.9	6.5
Nantucket	2.5	3.6	4.6	4.9	5.8	6.5	7.2
Norfolk	2.5	3.2	4.1	4.7	5.5	6.1	6.7
Plymouth	2.5	3.4	4.3	4.7	5.6	6.2	7.0
Suffolk	2.5	3.2	4.0	4.6	5.5	6.0	6.6
Worcester	2.5	3.0	4.0	4.5	5.3	5.9	6.5

Note: Not used - for reference only.

Proposed Dunkin' Donuts
970 Ashley Boulevard
New Bedford, MA
Bohler Job Number: W181193
December 6, 2018

Rational Pipe Sizing Calculations

Design Period Storm:		**25**	**Year**	**Design Period Intensity***			**5.9**	**in/hr**									
LOCATION		IMPERVIOUS			OTHER			SUM CA	Tc (min)	I (in/hr)	Q (cfs)	D (in)	S (ft/ft)	Material	n	Q Full (cfs)	V Full (fps)
FROM	TO	A	C	CA	A	C	CA										
CB-2	DMH-1	0.03	0.95	0.03	0.02	0.30	0.01	0.03	6	5.9	0.20	8	0.008	HDPE	0.012	1.17	3.35
CB-3	DMH-1	0.06	0.95	0.06	0.04	0.30	0.01	0.07	6	5.9	0.41	8	0.005	HDPE	0.012	0.93	2.65
DMH-1	WYE-1								6	5.9	0.61	8	0.005	HDPE	0.012	0.93	2.65
BLDG	WYE-1	0.05	0.95	0.05	0.00	0.30	0.00	0.05	6	5.9	0.28	6	0.010	PVC	0.010	0.73	3.71
WYE-1	UGS-1								6	5.9	0.89	8	0.005	HDPE	0.012	0.93	2.65
CB-1	UGS-1	0.16	0.95	0.15	0.03	0.30	0.01	0.16	6	5.9	0.95	10	0.005	HDPE	0.012	1.68	3.08

*Rainfall intesity provided by TR55 Exhibit 8-13 for Barnstable, MA

Prepared By:
Bohler Engineering
352 Turnpike Road
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TSS Removal Calculation Worksheet

Location: 970 Ashley Boulevard, New Bedford, MA

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15

Total TSS Removal = 85%

Project: New Bedford, Dunkin'
Prepared By: Bohler Engineering
Date: 12/6/2018

*Equals remaining load from previous BMP (E) which enters the BMP

Prepared By:
Bohler Engineering
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Southborough, MA 01772
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APPENDIX G – OPERATIONS AND MAINTENANCE PLAN

STORMWATER OPERATION & MAINTENANCE PLAN

Yearly Grind II Realty, LLC.
970 Ashley Boulevard
New Bedford, MA

RESPONSIBLE PARTY:

Yearly Grind II Realty, LLC
P.O Box 51147
New Bedford, MA 02745

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the Erosion and Sedimentation Control Plan. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Upon proper notice to the property owner, the City of New Bedford or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots and on-site driveways shall be swept at least twice per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of off site in accordance with MADEP and other applicable requirements. BUDGET: $1,000/yr

2. Catch basins, manholes and piping: Inspect two (2) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned two (2) 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 catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed and properly disposed of off site in accordance with MADEP and other applicable requirements. BUDGET $500/yr per structure.

3. Underground Infiltration System: The underground infiltration system shall be inspected after every major storm event during the first three months of operation at minimum and once per year thereafter to ensure that it is operating as intended and that all components are stable and in working order. Inspect structures to ensure proper functioning after every major storm event (generally equal to or greater than 3.0 inches in 24 hours) for the first three months. The chambers shall be inspected and if the depth of sediment is 3 inches deep or greater the sediment shall be removed, but no less than once annually. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

LONG-TERM POLLUTION PREVENTION PLAN

Yearly Grind II Realty, LLC
970 Ashley Boulevard
New Bedford, MA

RESPONSIBLE PARTY:

Yearly Grind II Realty, LLC
P.O Box 51147
New Bedford, MA 02745

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

1. No outdoor maintenance or washing of vehicles allowed.
2. The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
3. Proper storage and removal of solid waste (dumpsters).
4. Regular sweeping of the parking lot pavement areas, as indicated in the "O&M Plan".
5. Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
6. Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges listed below are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Type of Allowable Non-Stormwater Discharge	**Likely to be Present at Your Site?**
Discharges from emergency fire-fighting activities	☐ YES ☒ NO
Fire hydrant flushings	☐ YES ☒ NO
Landscape irrigation	☒ YES ☐ NO
Waters used to wash vehicles and equipment	☐ YES ☒ NO
Water used to control dust	☒ YES ☐ NO
Potable water including uncontaminated water line flushings	☒ YES ☐ NO
Routine external building wash down	☐ YES ☒ NO
Pavement wash waters	☐ YES ☒ NO
Uncontaminated air conditioning or compressor condensate	☐ YES ☒ NO
Uncontaminated, non-turbid discharges of ground water or spring water	☐ YES ☒ NO
Foundation or footing drains	☐ YES ☒ NO
Construction dewatering water	☐ YES ☒ NO

SPILL PREVENTION AND RESPONSE PROCEDURES (POST-CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill , the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

STORMWATER MANAGEMENT SYSTEM
POST-CONSTRUCTION INSPECTION REPORT

LOCATION:
Dunkin' Fast Food Restaurant
970 Ashley Boulevard
New Bedford, Massachusetts

RESPONSIBLE PARTY:
Yearly Grind II Realty, LLC
P.O Box 51147
New Bedford, MA 02745

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins:	
Drain Manholes:	
Underground Infiltration System(s):	
Other:	
Note Actions taken on the Following (sediment and/or debris removal, repairs, etc.):	
Catch Basins:	

STORMWATER MANAGEMENT SYSTEM
POST-CONSTRUCTION INSPECTION REPORT

Drainage Manholes:
Underground Infiltration System(s):
Other:
Comments:

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:

Name & Title:

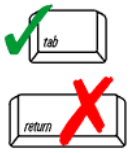
APPENDIX H – STORMWATER MANAGEMENT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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