SEBAGO TECHNICS

CIVIL ENGINEERING ▪ SURVEYING ▪ LANDSCAPE ARCHITECTURE

Stormwater Management Report

To:

City of Portland

For:

Parking Lot Expansion

5 Davis Farm Road

Portland, Maine

Prepared for:

Pizzagalli Properties, LLC

462 Shelburne Road

Burlington, Vermont

Prepared by:

Sebago Technics, Inc.

April 2017

75 John Roberts Road – Suite 1A, South Portland, ME 04106-6963 • 207-200-2100 • Fax: 207-856-2206

Table of Contents

Stormwater Management Narrative
5 Davis Farm Road, Portland, Maine

A. General

This Stormwater Management Plan has been prepared to address the potential impacts associated with the proposed modification in stormwater runoff characteristics for the parking expansion at 5 Davis Farm Road in Portland, Maine. Stormwater management controls outlined in this plan have been designed to best suit the proposed development and to generally comply with applicable State and Local regulatory requirements for evaluation of pre- and post-development conditions.

This project consists of the construction of 8,695 square feet of additional pavement at the existing 5 Davis Farm Road parking lot to make room for additional parking spaces. New landscaped areas will mainly consist of vegetated side slopes, shallow swales for stormwater conveyance and stormwater best management practices (BMPs) for stormwater detention and treatment.

Proposed surfaces will be graded to direct onsite stormwater runoff to three underdrained soil filters. Surface drainage in the post-development condition is designed to maintain natural drainage patterns to the greatest extent practicable. Maine DEP Basic Standards will be generally satisfied with the implementation of erosion control measures depicted in an Erosion and Sedimentation Control Plan, an Inspection and Maintenance Plan, and a housekeeping plan for use by the contractor/owner during and after construction is complete.

Project development requires local Level II Site Plan approval by City staff. The stormwater management plan includes measures to handle stormwater runoff in general conformance with the City of Portland's Land Use Ordinance.

B. Existing Conditions

The subject site is currently developed and is located at 5 Davis Farm Road in Portland, Maine in the Presumpscot River watershed. Existing development is a FairPoint Communications call center building and associated parking. Stormwater runoff across the subject site generally discharges to two separate areas. Runoff from the northerly areas of the parking lot drains to a closed drainage system which then discharges to an existing detention pond at the westerly edge of the parking lot. The detention pond then discharges to an unnamed stream which runs westerly towards Interstate 295.

Runoff from landscaped and wooded parts of the site to the southwest drain to an unnamed stream towards Interstate 295.

C. Proposed Site Improvements

Proposed improvements include the construction of 9,020 square feet of impervious area to accommodate new parking spaces, and 13,465 square feet of landscaped area to accommodate new underdrained soil filters for stormwater treatment, 6,350 square feet of

which is currently landscaped area that will be regraded. Proposed disturbed area will lie greater than 100 feet away from the unnamed streams running through the site.

Overall, approximately 0.52 acres of developed land will be constructed for the parking expansion.

D. Soils

Soil information for the site was obtained via the USDA United States Department of Agriculture and Natural Resources Conservation Service's Web Soil Survey for Cumberland County. The Hydrologic Soil Group (HSG) of the site soils are classified by Technical Release TR-55 of the Soil Conservation Service as follows:

Soil Type	Symbol	Phase	HSG	Drainage Class
Windsor	WmB	Loamy Sand	A	Excessively Drained
Deerfield	DeB	Loamy Sand	A	Moderately Well Drained
Belgrade	BgB	Very Fine Sandy Loam	B	Moderately Well Drained
Suffield	SuE2	Silt Loam	C	Moderately Well Drained

E. Methodology

The stormwater runoff analysis was developed using the "HydroCAD" computer modeling software, which incorporates the TR-55 and TR-20 methodologies as provided by the Soil Conservation Service of the U.S. Department of Agriculture. The peak runoff rates were calculated using a 24-hour duration storm event with a Type III rainfall distribution. The rainfall amounts for southeast Cumberland County for the 2-year, 10-year and 25-year storm events are as follows:

Storm Frequency	24-hr Duration Rainfall (in.)
2-yr	3.1
10-yr	4.6
25-yr	5.8

F. Pre-Development Watershed Model

The pre-development watershed model consists of three (3) subcatchments.

Subcatchment 1 (1S) is the westerly portion of the site. It is a mostly undeveloped, wooded tract of land from which stormwater drains to a ditch and to Study Point-1 (SP-1) at a point on the southwest property line.

Subcatchment 2 (2S) is a northerly portion of the site that includes a small portion of the existing parking lot, mostly undeveloped, wooded land, and the FairPoint Communications industrial site to the north. Stormwater runoff from these areas drain via a natural ditch westerly towards Interstate 295. Study Point-2 (SP-2) is located at a point on the westerly most property line.

Subcatchment 3 (3S) contains the southerly most portion of the site which includes the FairPoint Communications call center building, impervious and landscaped areas surrounding the building, and a pond. The pond discharges to SP-1 via a reach through Subcatchment 1S and a stabilized overflow outlet on the west side of the pond.

G. Post-Development Watershed Model

The post-development watershed model consists of six (6) subcatchments. Modeling reflects on-site ground cover changes to include proposed landscaping and impervious associated with the new parking spaces. Existing drainage patterns will be generally maintained with the proposed stormwater design.

H. Stormwater Quality Management

Three underdrained soil filters will be constructed for stormwater treatment and detention.

Underdrained soil filters are designed in general conformance with Section 7.1 of the BMPs Technical Design Manual, latest revision. Underdrained soil filters provide a high level of contaminant removal prior to discharge of runoff into the underlying sandy soils or toward downstream drainage ways. Treatment is provided through the intermediate sand layer. Depths within the soil filters vary depending on the location and the minimum required water quality volume.

All underdrained soil filters will be constructed with a sediment forebay designed in general conformance with Reference 2, Section 7.1 of the BMP Technical Design Manual. Runoff will filtrate through the non-clayey topsoil and loamy, coarse sand layers for treatment before ultimately discharging to underdrain outlets or infiltrating into the underlying sandy soils. Underdrains will be effective in keeping the soil filters dry during high flow periods that cause the soils to be overly saturated.

I. Stormwater Quantity Management (Flooding Standard)

The following table summarizes the results of stormwater calculations for the design storm events for the project area. Calculations and computer modeling data sheets are provided with this report.

The HydroCAD model predicts slight decreases in peak flow rates during the 2-, 10- and 25-year storm events. Please refer to Attachment B and Attachment C for pre- and post-development stormwater modeling.

Stormwater Peak Discharge Summary Table

Study Point	2-Year Storm			10-Year Storm			25-Year Storm		
	Pre (cfs)	Post (cfs)	Diff. (cfs)	Pre (cfs)	Post (cfs)	Diff. (cfs)	Pre (cfs)	Post (cfs)	Diff. (cfs)
SP-1	0.09	0.08	-0.01	1.22	1.13	-0.09	3.81	3.80	-0.01
SP-2	3.16	2.69	-0.47	12.06	10.98	-1.08	21.34	19.83	-1.51

J. Inspection & Maintenance

Provisions for periodic inspection and maintenance of the underdrained soil filters are included in the Inspection, Maintenance, and Housekeeping Plan included in this section of the application.

K. Summary

An Erosion and Sedimentation Control Plan has been developed for the project site placing emphasis on the installation of sedimentation barriers and revegetation to minimize erosion potential from development activities during and after construction. The Erosion Control Plan is incorporated into the design plans and includes the locations of the erosion control provisions (i.e., silt fence, construction entrance, inlet protection, trench dams) along with a narrative and construction details for reference by the contractor during construction.

The proposed development will include the construction of three underdrained soil filters to which a majority of runoff from impervious and developed areas will be directed. Based on the modeling data, post-development peak flow rates examined at the study points are maintained or reduced from their corresponding current pre-development levels during the 2-year, 10-year, and 25-year storm events.

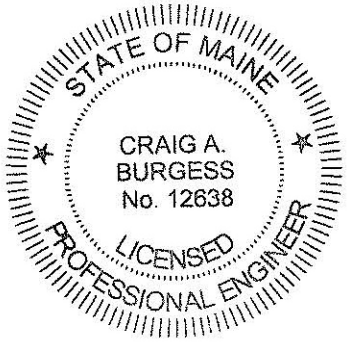
With incorporation of these measures, no significant impacts to off-site drainage are anticipated due to the development of the new parking spaces.

Prepared by

SEBAGO TECHNICS, INC.

Tyler Peabody, E.I.
Civil Engineer

Craig A. Burgess, P.E.
Senior Project Engineer



4/18/17

Attachment A

Water Quality Calculations

Table 1: GENERAL STANDARD CALCULATIONS

5 Davis Farm Road Parking Expansion

Job # 96369

*

AREA ID	WATERSHED SIZE (S.F.)	EXISTING ONSITE IMPERVIOUS AREA TO REMAIN (S.F.)	NEW ONSITE IMPERVIOUS AREA (S.F.)	EXISTING ONSITE LANDSCAPED AREA TO REMAIN (S.F.)	NEW ONSITE LANDSCAPED AREA (S.F.)	NET NEW DEVELOPED AREA (S.F.)	NET EXISTING DEVELOPED AREAS (S.F.)	TREATMENT PROVIDED?	NEW IMPERVIOUS AREA TREATED (S.F.)	NEW LANDSCAPED AREA TREATED* (S.F.)	NEW DEVELOPED AREA TREATED (S.F.)	TREATMENT BMP
1.1S	8,790	3,098	1,488	1,192	3,012	4,500	4,290	YES	1,488	3,012	4,500	UDSF 1
1.2S	5,764	92	1,802	0	3,870	5,672	92	YES	1,802	3,870	5,672	UDSF 2
2.1S	14,861	2,548	5,730	0	4,969	10,699	2,548	YES	5,730	4,969	10,699	UDSF 3
1S	169,449	17,763	0	18,159	0	0	35,922	NO	0	0	0	NONE
2S	731,028	15,896	0	24,102	1,614	1,614	39,998	NO	0	0	0	NONE
3S	169,915	0	0	0	0	0	0	NO	0	0	0	NONE
TOTAL (S.F.)	**1,099,807**	**39,397**	**9,020**	**43,453**	**13,465**	**22,485**	**82,850**		**9,020**	**11,851**	**20,871**	

TOTAL NEW IMPERVIOUS AREA (S.F.)	**9,020**	**TOTAL NEW DEVELOPED AREA (S.F.)**	**22,485**
TOTAL NEW IMPERVIOUS AREA RECEIVING TREATMENT (S.F.)	**9,020**	**TOTAL NEW DEV. AREA RECEIVING TREATMENT (S.F.)**	**20,871**
% OF IMPERVIOUS AREA RECEIVING TREATMENT	**100.00%**	**% OF DEV. AREA RECEIVING TREATMENT**	**92.82%**

SEBAGO TECHNICS, INC.
75 John Roberts Road Suite 1A
South Portland, Maine 04106
Tel. (207) 200-2100

JOB	96369		
SHEET NO.	1	OF	1
CALCULATED BY	TDP	DATE	4/3/2017
FILE NAME		PRNT DATE	4/18/2017

UNDERDRAINED SOIL FILTER #1

Task: Calculate water quality volume per MDEP chapter 500 regulations

References

1. Maine DEP Chapter 500, Section 4.C.(3)(b)
   a. "must detain a runoff volume equal to 1.0 inch times the subcatchment's impervious area plus 0.4 inch times the subcatchment's landscaped area"
2. Maine DEP Best Management Practices Stormwater Manual, Section 7.1
   a. "surface should represent 5% of impervious area and 2% of landscaped area"

Tributary to Underdrained Filter: UDSF 1

Landscaped Area	3,012.00	SF	
Impervious Area	1,488.00	SF	

Minimum Surface Area

Required (2% X Landscaped + 5%" X Impervious)

Total Landscaped Area	3,012.00	SF	Area	60.2	SF
Total Impervious Area	1,488.00	SF	Area	74.4	SF
Required Minimum Surface Area				134.6	SF
Provided Surface Area				392.0	SF

Treatment Volume

Required (0.4" X Landscaped + 1.0" X Impervious)

Landscaped Area	3,012.00	SF	Volume	100.4				
Impervious Area	1,488.00	SF	Volume	124.0				
Treatment Volume Required				224.4	CF	0.005	AF	
Provided Treatment Volume				239.0	CF			

Sediment Pre-Treatment

Per Reference 2, Chapter 7.1 "Pretreatment devices shall be provided to minimize discharge of sediment to the soil filter"

Annual Sediment Load: 55 cubic feet per acre per year of sanded area

Area to be sanded:	1,488.00	SF					
Sediment Volume	2	CF					
Provided	213	CF	18	Inch Deep Forebay	with area of	142	sf

SEBAGO TECHNICS, INC.
75 John Roberts Road Suite 1A
South Portland, Maine 04106
Tel. (207) 200-2100

JOB 11001-02
SHEET NO. 1 OF 1
CALCULATED BY TDP DATE 4/3/2017
FILE NAME PRNT DATE 4/18/2017

UNDERDRAINED SOIL FILTER #2

Task: Calculate water quality volume per MDEP chapter 500 regulations

1. Maine DEP Chapter 500, Section 4.C.(3)(b)

References

a. "must detain a runoff volume equal to 1.0 inch times the subcatchment's impervious area plus 0.4 inch times the subcatchment's landscaped area"

2. Maine DEP Best Management Practices Stormwater Manual, Section 7.1

a. "surface should represent 5% of impervious area and 2% of landscaped area"

Tributary to Underdrained Filter: UDSF 2

Landscaped Area	3,870.00	SF					
Impervious Area	1,802.00	SF					

Minimum Surface Area

Required (2% X Landscaped + 5%" X Impervious)

Total Landscaped Area	3,870.00	SF	Area	77.4	SF		
Total Impervious Area	1,802.00	SF	Area	90.1	SF		
Required Minimum Surface Area				167.5	SF		
Provided Surface Area				414.0	SF		

Treatment Volume

Required (0.4" X Landscaped + 1.0" X Impervious)

Landscaped Area	3,870.00	SF	Volume	129.0			
Impervious Area	1,802.00	SF	Volume	150.2			
Treatment Volume Required				279.2	CF	0.006	AF
Provided Treatment Volume				297.0	CF		

Sediment Pre-Treatment

Per Reference 2, Chapter 7.1 "Pretreatment devices shall be provided to minimize discharge of sediment to the soil filter"

Annual Sediment Load: 55 cubic feet per acre per year of sanded area

Area to be sanded:	1,802.00	SF					
Sediment Volume	2	CF					
Provided	8	CF	3	Inch Deep Forebay	with area of	33	sf

SEBAGO TECHNICS, INC.
75 John Roberts Road Suite 1A
South Portland, Maine 04106
Tel. (207) 200-2100

JOB	11001-02		
SHEET NO.	1	OF	1
CALCULATED BY	TDP	DATE	4/3/2017
FILE NAME		PRNT DATE	4/18/2017

UNDERDRAINED SOIL FILTER #3

Task: Calculate water quality volume per MDEP chapter 500 regulations

1. Maine DEP Chapter 500, Section 4.C.(3)(b)

References

a. "must detain a runoff volume equal to 1.0 inch times the subcatchment's impervious area plus 0.4 inch times the subcatchment's landscaped area"

2. Maine DEP Best Management Practices Stormwater Manual, Section 7.1

a. "surface should represent 5% of impervious area and 2% of landscaped area"

Tributary to Underdrained Filter: UDSF 3

Landscaped Area	4,969.00	SF				
Impervious Area	5,730.00	SF				

Minimum Surface Area

Required (2% X Landscaped + 5%" X Impervious)

Total Landscaped Area	4,969.00	SF	Area	99.4	SF	
Total Impervious Area	5,730.00	SF	Area	286.5	SF	
Required Minimum Surface Area				385.9	SF	
Provided Surface Area				1,124.0	SF	

Treatment Volume

Required (0.4" X Landscaped + 1.0" X Impervious)

Landscaped Area	4,969.00	SF	Volume	165.6				
Impervious Area	5,730.00	SF	Volume	477.5				
Treatment Volume Required				643.1	CF	0.015	AF	
Provided Treatment Volume				1,022.0	CF			

Sediment Pre-Treatment

Per Reference 2, Chapter 7.1 "Pretreatment devices shall be provided to minimize discharge of sediment to the soil filter"

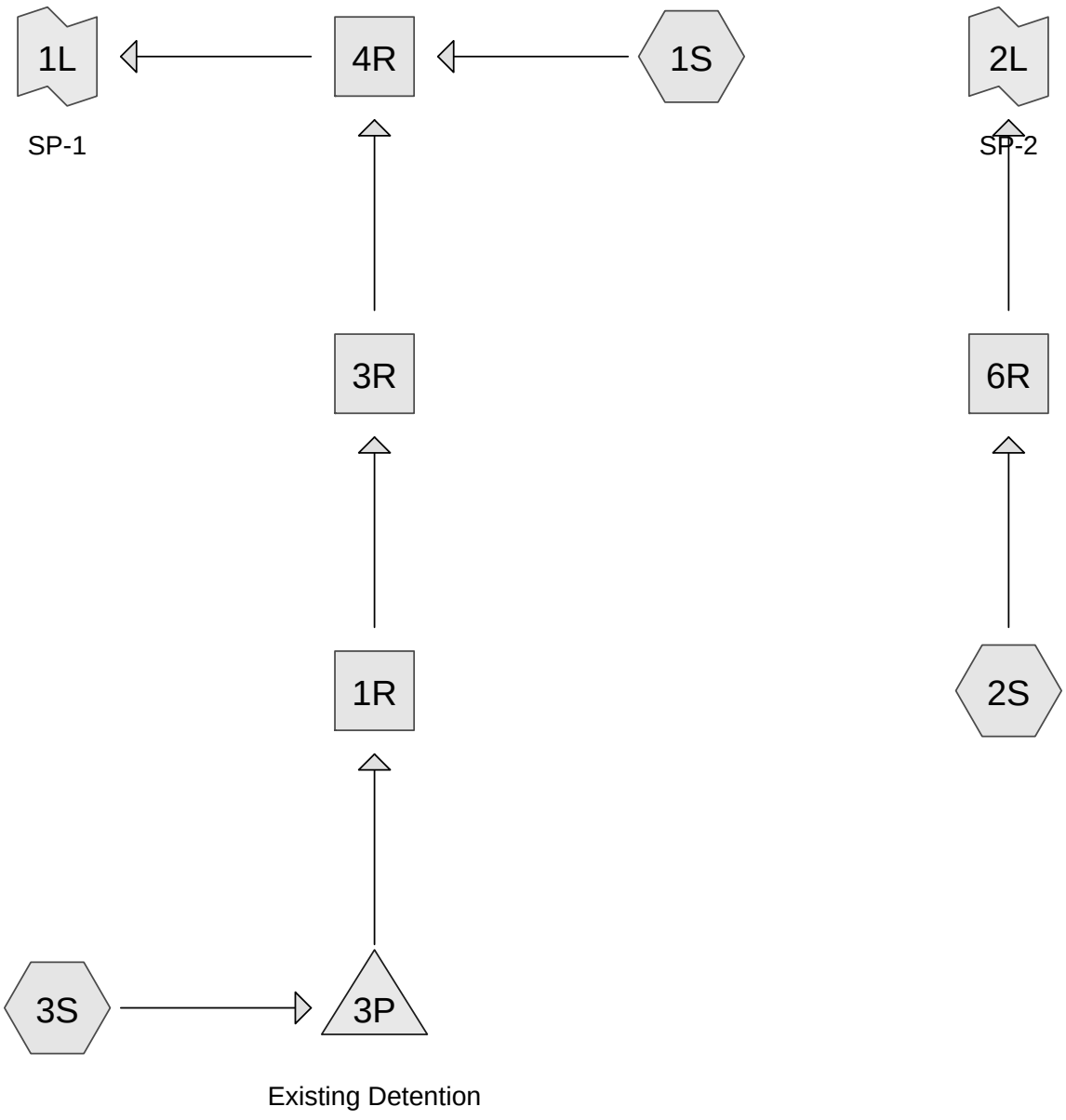
Annual Sediment Load: 55 cubic feet per acre per year of sanded area

Area to be sanded:	5,730.00	SF						
Sediment Volume	7	CF						
Provided	59	CF	8	Inch Deep Forebay	with area of		88	sf

Attachment B

Pre-Development Stormwater Modeling

Pre-Development



Subcat Reach Pond Link

Routing Diagram for 96369 pre
Prepared by Microsoft, Printed 4/17/2017

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=184,003 sf 10.29% Impervious Runoff Depth=1.12"
Flow Length=450' Tc=19.2 min CN=51 Runoff=2.98 cfs 0.393 af

Subcatchment 2S: Runoff Area=745,889 sf 39.93% Impervious Runoff Depth=1.87"
Flow Length=790' Tc=26.0 min CN=61 Runoff=21.38 cfs 2.673 af

Subcatchment 3S: Runoff Area=169,915 sf 72.00% Impervious Runoff Depth=4.76"
Tc=6.0 min CN=91 Runoff=20.64 cfs 1.548 af

Reach 1R: Avg. Flow Depth=0.07' Max Vel=5.47 fps Inflow=1.93 cfs 0.685 af
n=0.022 L=75.0' S=0.2700 '/' Capacity=1,316.81 cfs Outflow=1.93 cfs 0.685 af

Reach 3R: Avg. Flow Depth=0.17' Max Vel=1.92 fps Inflow=1.93 cfs 0.685 af
n=0.030 L=100.0' S=0.0200 '/' Capacity=262.82 cfs Outflow=1.93 cfs 0.685 af

Reach 4R: Avg. Flow Depth=0.26' Max Vel=2.22 fps Inflow=3.81 cfs 1.077 af
n=0.030 L=62.0' S=0.0161 '/' Capacity=236.02 cfs Outflow=3.81 cfs 1.077 af

Reach 6R: Avg. Flow Depth=1.46' Max Vel=2.30 fps Inflow=21.38 cfs 2.673 af
n=0.100 L=130.0' S=0.0308 '/' Capacity=116.36 cfs Outflow=21.34 cfs 2.673 af

Pond 3P: Existing Detention Peak Elev=58.67' Storage=43,205 cf Inflow=20.64 cfs 1.548 af
Outflow=1.93 cfs 0.685 af

Link 1L: SP-1 Inflow=3.81 cfs 1.077 af
Primary=3.81 cfs 1.077 af

Link 2L: SP-2 Inflow=21.34 cfs 2.673 af
Primary=21.34 cfs 2.673 af

Total Runoff Area = 25.248 ac Runoff Volume = 4.613 af Average Runoff Depth = 2.19"
60.08% Pervious = 15.168 ac 39.92% Impervious = 10.080 ac

Summary for Subcatchment 1S:

Runoff = 2.98 cfs @ 12.33 hrs, Volume= 0.393 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.80"

	Area (sf)	CN	Description
	32,369	70	Woods, Good, HSG C
	91,375	30	Woods, Good, HSG A
*	16,383	96	Impervious (gravel)
	22,962	39	>75% Grass cover, Good, HSG A
*	7,725	98	Impervious (pavement)
	13,189	94	Urban commercial, 85% imp, HSG C
	184,003	51	Weighted Average
	165,067		89.71% Pervious Area
	18,936		10.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	80	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.40"
1.8	120	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.6	90	0.2800	2.65		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.0	160	0.0312	0.88		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.2	450	Total			

Summary for Subcatchment 2S:

Runoff = 21.38 cfs @ 12.39 hrs, Volume= 2.673 af, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.80"

	Area (sf)	CN	Description
	30,685	39	>75% Grass cover, Good, HSG A
*	5,032	96	Impervious (gravel)
	340,315	30	Woods, Good, HSG A
	22,873	55	Woods, Good, HSG B
*	19,142	98	Impervious (pavement)
	327,842	92	Urban commercial, 85% imp, HSG B
	745,889	61	Weighted Average
	448,081		60.07% Pervious Area
	297,808		39.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.8	100	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.40"
2.5	240	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.7	450	0.0230	1.60	8.02	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.100 Earth, dense brush, high stage
26.0	790	Total			

Summary for Subcatchment 3S:

Runoff = 20.64 cfs @ 12.08 hrs, Volume= 1.548 af, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
169,915	91	Urban industrial, 72% imp, HSG C
47,576		28.00% Pervious Area
122,339		72.00% Impervious Area

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

Summary for Reach 1R:

Inflow Area = 3.901 ac, 72.00% Impervious, Inflow Depth > 2.11" for 25-YR event
Inflow = 1.93 cfs @ 12.93 hrs, Volume= 0.685 af
Outflow = 1.93 cfs @ 12.93 hrs, Volume= 0.685 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.47 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 0.4 min

Peak Storage= 26 cf @ 12.93 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 1,316.81 cfs

5.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 6.0 '/' Top Width= 29.00'
Length= 75.0' Slope= 0.2700 '/'
Inlet Invert= 58.25', Outlet Invert= 38.00'

‡

Summary for Reach 3R:

Inflow Area = 3.901 ac, 72.00% Impervious, Inflow Depth > 2.11" for 25-YR event
Inflow = 1.93 cfs @ 12.93 hrs, Volume= 0.685 af
Outflow = 1.93 cfs @ 12.94 hrs, Volume= 0.685 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.92 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.76 fps, Avg. Travel Time= 2.2 min

Peak Storage= 100 cf @ 12.94 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 262.82 cfs

5.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 6.0 '/' Top Width= 29.00'
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 38.00', Outlet Invert= 36.00'

‡

Summary for Reach 4R:

Inflow Area = 8.125 ac, 39.92% Impervious, Inflow Depth > 1.59" for 25-YR event
Inflow = 3.81 cfs @ 12.54 hrs, Volume= 1.077 af
Outflow = 3.81 cfs @ 12.54 hrs, Volume= 1.077 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.22 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.77 fps, Avg. Travel Time= 1.3 min

Peak Storage= 106 cf @ 12.54 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 236.02 cfs

5.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 6.0 '/' Top Width= 29.00'
Length= 62.0' Slope= 0.0161 '/'
Inlet Invert= 36.00', Outlet Invert= 35.00'

‡

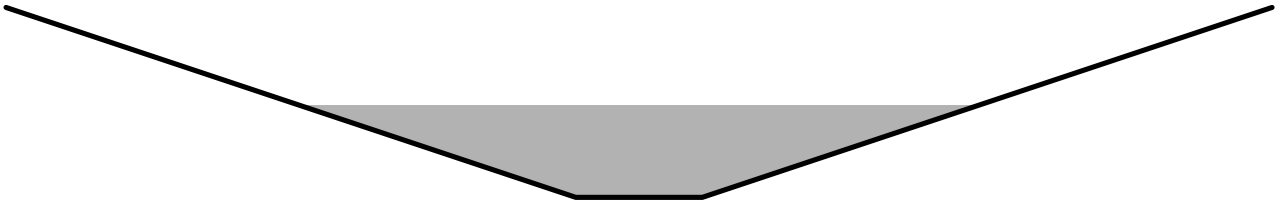
Summary for Reach 6R:

Inflow Area = 17.123 ac, 39.93% Impervious, Inflow Depth = 1.87" for 25-YR event
Inflow = 21.38 cfs @ 12.39 hrs, Volume= 2.673 af
Outflow = 21.34 cfs @ 12.40 hrs, Volume= 2.673 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.30 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.03 fps, Avg. Travel Time= 2.1 min

Peak Storage= 1,207 cf @ 12.40 hrs
Average Depth at Peak Storage= 1.46'
Bank-Full Depth= 3.00' Flow Area= 33.0 sf, Capacity= 116.36 cfs

2.00' x 3.00' deep channel, n= 0.100 Earth, dense brush, high stage
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 130.0' Slope= 0.0308 '/'
Inlet Invert= 36.00', Outlet Invert= 32.00'



Summary for Pond 3P: Existing Detention

Inflow Area = 3.901 ac, 72.00% Impervious, Inflow Depth = 4.76" for 25-YR event
Inflow = 20.64 cfs @ 12.08 hrs, Volume= 1.548 af
Outflow = 1.93 cfs @ 12.93 hrs, Volume= 0.685 af, Atten= 91%, Lag= 50.9 min
Primary = 1.93 cfs @ 12.93 hrs, Volume= 0.685 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 58.67' @ 12.93 hrs Surf.Area= 33,037 sf Storage= 43,205 cf

Plug-Flow detention time= 327.9 min calculated for 0.685 af (44% of inflow)
Center-of-Mass det. time= 204.8 min (986.9 - 782.1)

Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	54,336 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	20,288	0	0
58.00	25,922	23,105	23,105
58.50	32,000	14,481	37,586
59.00	35,000	16,750	54,336

Device	Routing	Invert	Outlet Devices
#1	Primary	58.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.93 cfs @ 12.93 hrs HW=58.67' TW=58.32' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 1.93 cfs @ 1.11 fps)

Summary for Link 1L: SP-1

Inflow Area = 8.125 ac, 39.92% Impervious, Inflow Depth > 1.59" for 25-YR event
Inflow = 3.81 cfs @ 12.54 hrs, Volume= 1.077 af
Primary = 3.81 cfs @ 12.54 hrs, Volume= 1.077 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2L: SP-2

Inflow Area = 17.123 ac, 39.93% Impervious, Inflow Depth = 1.87" for 25-YR event
Inflow = 21.34 cfs @ 12.40 hrs, Volume= 2.673 af
Primary = 21.34 cfs @ 12.40 hrs, Volume= 2.673 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=184,003 sf 10.29% Impervious Runoff Depth=0.13"
Flow Length=450' Tc=19.2 min CN=51 Runoff=0.09 cfs 0.045 af

Subcatchment 2S: Runoff Area=745,889 sf 39.93% Impervious Runoff Depth=0.40"
Flow Length=790' Tc=26.0 min CN=61 Runoff=3.18 cfs 0.576 af

Subcatchment 3S: Runoff Area=169,915 sf 72.00% Impervious Runoff Depth=2.16"
Tc=6.0 min CN=91 Runoff=9.75 cfs 0.704 af

Reach 1R: Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.022 L=75.0' S=0.2700 '/' Capacity=1,316.81 cfs Outflow=0.00 cfs 0.000 af

Reach 3R: Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.030 L=100.0' S=0.0200 '/' Capacity=262.82 cfs Outflow=0.00 cfs 0.000 af

Reach 4R: Avg. Flow Depth=0.03' Max Vel=0.60 fps Inflow=0.09 cfs 0.045 af
n=0.030 L=62.0' S=0.0161 '/' Capacity=236.02 cfs Outflow=0.09 cfs 0.045 af

Reach 6R: Avg. Flow Depth=0.60' Max Vel=1.40 fps Inflow=3.18 cfs 0.576 af
n=0.100 L=130.0' S=0.0308 '/' Capacity=116.36 cfs Outflow=3.16 cfs 0.576 af

Pond 3P: Existing Detention Peak Elev=58.27' Storage=30,649 cf Inflow=9.75 cfs 0.704 af
Outflow=0.00 cfs 0.000 af

Link 1L: SP-1 Inflow=0.09 cfs 0.045 af
Primary=0.09 cfs 0.045 af

Link 2L: SP-2 Inflow=3.16 cfs 0.576 af
Primary=3.16 cfs 0.576 af

Total Runoff Area = 25.248 ac Runoff Volume = 1.325 af Average Runoff Depth = 0.63"
60.08% Pervious = 15.168 ac 39.92% Impervious = 10.080 ac

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Runoff Area=184,003 sf 10.29% Impervious Runoff Depth=0.58"
Flow Length=450' Tc=19.2 min CN=51 Runoff=1.22 cfs 0.206 af

Subcatchment 2S: Runoff Area=745,889 sf 39.93% Impervious Runoff Depth=1.14"
Flow Length=790' Tc=26.0 min CN=61 Runoff=12.08 cfs 1.620 af

Subcatchment 3S: Runoff Area=169,915 sf 72.00% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=91 Runoff=15.82 cfs 1.168 af

Reach 1R: Avg. Flow Depth=0.03' Max Vel=3.58 fps Inflow=0.58 cfs 0.305 af
n=0.022 L=75.0' S=0.2700 '/' Capacity=1,316.81 cfs Outflow=0.58 cfs 0.305 af

Reach 3R: Avg. Flow Depth=0.08' Max Vel=1.26 fps Inflow=0.58 cfs 0.305 af
n=0.030 L=100.0' S=0.0200 '/' Capacity=262.82 cfs Outflow=0.58 cfs 0.305 af

Reach 4R: Avg. Flow Depth=0.14' Max Vel=1.53 fps Inflow=1.22 cfs 0.511 af
n=0.030 L=62.0' S=0.0161 '/' Capacity=236.02 cfs Outflow=1.22 cfs 0.511 af

Reach 6R: Avg. Flow Depth=1.13' Max Vel=1.99 fps Inflow=12.08 cfs 1.620 af
n=0.100 L=130.0' S=0.0308 '/' Capacity=116.36 cfs Outflow=12.06 cfs 1.620 af

Pond 3P: Existing Detention Peak Elev=58.58' Storage=40,089 cf Inflow=15.82 cfs 1.168 af
Outflow=0.58 cfs 0.305 af

Link 1L: SP-1 Inflow=1.22 cfs 0.511 af
Primary=1.22 cfs 0.511 af

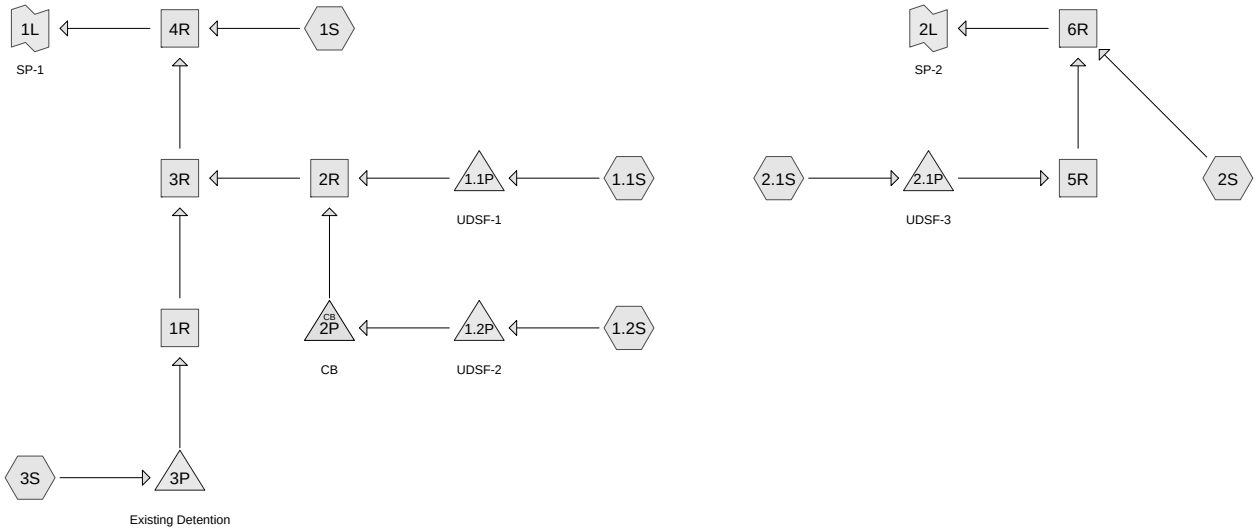
Link 2L: SP-2 Inflow=12.06 cfs 1.620 af
Primary=12.06 cfs 1.620 af

Total Runoff Area = 25.248 ac Runoff Volume = 2.994 af Average Runoff Depth = 1.42"
60.08% Pervious = 15.168 ac 39.92% Impervious = 10.080 ac

Attachment C

Post-Development Stormwater Modeling

Post-Development



Subcat Reach Pond Link

Routing Diagram for 96369 post
Prepared by Microsoft, Printed 4/17/2017

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1.1S: Runoff Area=8,790 sf 52.17% Impervious Runoff Depth=2.65"
Tc=6.0 min CN=70 Runoff=0.62 cfs 0.045 af

Subcatchment1.2S: Runoff Area=5,764 sf 32.86% Impervious Runoff Depth=1.63"
Tc=6.0 min CN=58 Runoff=0.23 cfs 0.018 af

Subcatchment1S: Runoff Area=169,449 sf 7.43% Impervious Runoff Depth=1.12"
Flow Length=450' Tc=19.2 min CN=51 Runoff=2.75 cfs 0.362 af

Subcatchment2.1S: Runoff Area=14,861 sf 55.70% Impervious Runoff Depth=2.83"
Tc=6.0 min CN=72 Runoff=1.13 cfs 0.080 af

Subcatchment2S: Runoff Area=731,028 sf 39.61% Impervious Runoff Depth=1.79"
Flow Length=790' Tc=26.0 min CN=60 Runoff=19.87 cfs 2.506 af

Subcatchment3S: Runoff Area=169,915 sf 72.00% Impervious Runoff Depth=4.76"
Tc=6.0 min CN=91 Runoff=20.64 cfs 1.548 af

Reach 1R: Avg. Flow Depth=0.07' Max Vel=5.47 fps Inflow=1.93 cfs 0.685 af
n=0.022 L=75.0' S=0.2700 '/' Capacity=1,316.81 cfs Outflow=1.93 cfs 0.685 af

Reach 2R: Avg. Flow Depth=0.04' Max Vel=2.02 fps Inflow=0.43 cfs 0.048 af
n=0.030 L=200.0' S=0.1350 '/' Capacity=682.83 cfs Outflow=0.40 cfs 0.048 af

Reach 3R: Avg. Flow Depth=0.17' Max Vel=1.94 fps Inflow=2.01 cfs 0.733 af
n=0.030 L=100.0' S=0.0200 '/' Capacity=262.82 cfs Outflow=2.01 cfs 0.733 af

Reach 4R: Avg. Flow Depth=0.26' Max Vel=2.22 fps Inflow=3.80 cfs 1.094 af
n=0.030 L=62.0' S=0.0161 '/' Capacity=236.02 cfs Outflow=3.80 cfs 1.094 af

Reach 5R: Avg. Flow Depth=0.08' Max Vel=0.66 fps Inflow=0.12 cfs 0.056 af
n=0.100 L=375.0' S=0.0693 '/' Capacity=66.40 cfs Outflow=0.11 cfs 0.056 af

Reach 6R: Avg. Flow Depth=1.41' Max Vel=2.26 fps Inflow=19.87 cfs 2.562 af
n=0.100 L=130.0' S=0.0308 '/' Capacity=116.36 cfs Outflow=19.83 cfs 2.562 af

Pond 1.1P: UDSF-1 Peak Elev=69.58' Storage=587 cf Inflow=0.62 cfs 0.045 af
Discarded=0.00 cfs 0.000 af Primary=0.43 cfs 0.038 af Outflow=0.43 cfs 0.038 af

Pond 1.2P: UDSF-2 Peak Elev=71.31' Storage=475 cf Inflow=0.23 cfs 0.018 af
Discarded=0.00 cfs 0.000 af Primary=0.01 cfs 0.011 af Outflow=0.01 cfs 0.011 af

Pond 2.1P: UDSF-3 Peak Elev=66.84' Storage=1,947 cf Inflow=1.13 cfs 0.080 af
Discarded=0.00 cfs 0.000 af Primary=0.12 cfs 0.056 af Outflow=0.12 cfs 0.056 af

Pond 2P: CB Peak Elev=68.63' Inflow=0.01 cfs 0.011 af
12.0" Round Culvert n=0.013 L=178.0' S=0.0201 '/' Outflow=0.01 cfs 0.011 af

Pond 3P: Existing Detention Peak Elev=58.67' Storage=43,205 cf Inflow=20.64 cfs 1.548 af
Outflow=1.93 cfs 0.685 af

Link 1L: SP-1 Inflow=3.80 cfs 1.094 af
Primary=3.80 cfs 1.094 af

Link 2L: SP-2 Inflow=19.83 cfs 2.562 af
Primary=19.83 cfs 2.562 af

Total Runoff Area = 25.248 ac Runoff Volume = 4.559 af Average Runoff Depth = 2.17"
60.06% Pervious = 15.165 ac 39.94% Impervious = 10.083 ac

Summary for Subcatchment 1.1S:

Runoff = 0.62 cfs @ 12.09 hrs, Volume= 0.045 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.80"

	Area (sf)	CN	Description
	4,204	39	>75% Grass cover, Good, HSG A
*	4,586	98	Impervious (pavement)
	8,790	70	Weighted Average
	4,204		47.83% Pervious Area
	4,586		52.17% Impervious Area

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

Summary for Subcatchment 1.2S:

Runoff = 0.23 cfs @ 12.10 hrs, Volume= 0.018 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.80"

	Area (sf)	CN	Description
	3,870	39	>75% Grass cover, Good, HSG A
*	1,894	98	Impervious (pavement)
	5,764	58	Weighted Average
	3,870		67.14% Pervious Area
	1,894		32.86% Impervious Area

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

Summary for Subcatchment 1S:

Runoff = 2.75 cfs @ 12.33 hrs, Volume= 0.362 af, Depth= 1.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.80"

	Area (sf)	CN	Description
	32,369	70	Woods, Good, HSG C
	87,969	30	Woods, Good, HSG A
*	16,383	96	Impervious (gravel)
	18,159	39	>75% Grass cover, Good, HSG A
*	1,380	98	Impervious (pavement)
	13,189	94	Urban commercial, 85% imp, HSG C
	169,449	51	Weighted Average
	156,858		92.57% Pervious Area
	12,591		7.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	80	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.40"
1.8	120	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.6	90	0.2800	2.65		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.0	160	0.0312	0.88		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
19.2	450	Total			

Summary for Subcatchment 2.1S:

Runoff = 1.13 cfs @ 12.09 hrs, Volume= 0.080 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.80"

	Area (sf)	CN	Description
	6,583	39	>75% Grass cover, Good, HSG A
*	8,278	98	Impervious (pavement)
	14,861	72	Weighted Average
	6,583		44.30% Pervious Area
	8,278		55.70% Impervious Area

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

Summary for Subcatchment 2S:

Runoff = 19.87 cfs @ 12.39 hrs, Volume= 2.506 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.80"

	Area (sf)	CN	Description
	24,102	39	>75% Grass cover, Good, HSG A
*	5,032	96	Impervious (gravel)
	340,315	30	Woods, Good, HSG A
	22,873	55	Woods, Good, HSG B
*	10,864	98	Impervious (pavement)
	327,842	92	Urban commercial, 85% imp, HSG B
	731,028	60	Weighted Average
	441,498		60.39% Pervious Area
	289,530		39.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.8	100	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.40"
2.5	240	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.7	450	0.0230	1.60	8.02	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=1.00' Z= 3.0 '/' Top.W=8.00' n= 0.100 Earth, dense brush, high stage
26.0	790	Total			

Summary for Subcatchment 3S:

Runoff = 20.64 cfs @ 12.08 hrs, Volume= 1.548 af, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.80"

Area (sf)	CN	Description
169,915	91	Urban industrial, 72% imp, HSG C
47,576		28.00% Pervious Area
122,339		72.00% Impervious Area

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

Summary for Reach 1R:

Inflow Area = 3.901 ac, 72.00% Impervious, Inflow Depth > 2.11" for 25-YR event
Inflow = 1.93 cfs @ 12.93 hrs, Volume= 0.685 af
Outflow = 1.93 cfs @ 12.93 hrs, Volume= 0.685 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.47 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 0.4 min

Peak Storage= 26 cf @ 12.93 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 1,316.81 cfs

5.00' x 2.00' deep channel, n= 0.022 Earth, clean & straight
Side Slope Z-value= 6.0 '/' Top Width= 29.00'
Length= 75.0' Slope= 0.2700 '/'
Inlet Invert= 58.25', Outlet Invert= 38.00'

‡

Summary for Reach 2R:

Inflow Area = 0.334 ac, 44.52% Impervious, Inflow Depth > 1.74" for 25-YR event
Inflow = 0.43 cfs @ 12.18 hrs, Volume= 0.048 af
Outflow = 0.40 cfs @ 12.21 hrs, Volume= 0.048 af, Atten= 7%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.02 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 1.32 fps, Avg. Travel Time= 2.5 min

Peak Storage= 40 cf @ 12.21 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 682.83 cfs

5.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 6.0 '/' Top Width= 29.00'
Length= 200.0' Slope= 0.1350 '/'
Inlet Invert= 65.00', Outlet Invert= 38.00'

‡

Summary for Reach 3R:

Inflow Area = 4.235 ac, 69.83% Impervious, Inflow Depth > 2.08" for 25-YR event
Inflow = 2.01 cfs @ 12.92 hrs, Volume= 0.733 af
Outflow = 2.01 cfs @ 12.93 hrs, Volume= 0.733 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.94 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.78 fps, Avg. Travel Time= 2.1 min

Peak Storage= 103 cf @ 12.93 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 262.82 cfs

5.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 6.0 '/' Top Width= 29.00'
Length= 100.0' Slope= 0.0200 '/'
Inlet Invert= 38.00', Outlet Invert= 36.00'

‡

Summary for Reach 4R:

Inflow Area = 8.125 ac, 39.96% Impervious, Inflow Depth > 1.62" for 25-YR event
Inflow = 3.80 cfs @ 12.53 hrs, Volume= 1.094 af
Outflow = 3.80 cfs @ 12.53 hrs, Volume= 1.094 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.22 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 0.77 fps, Avg. Travel Time= 1.3 min

Peak Storage= 106 cf @ 12.53 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 2.00' Flow Area= 34.0 sf, Capacity= 236.02 cfs

5.00' x 2.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 6.0 '/' Top Width= 29.00'
Length= 62.0' Slope= 0.0161 '/'
Inlet Invert= 36.00', Outlet Invert= 35.00'

‡

Summary for Reach 5R:

Inflow Area = 0.341 ac, 55.70% Impervious, Inflow Depth > 1.96" for 25-YR event
Inflow = 0.12 cfs @ 12.99 hrs, Volume= 0.056 af
Outflow = 0.11 cfs @ 13.16 hrs, Volume= 0.056 af, Atten= 6%, Lag= 10.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.66 fps, Min. Travel Time= 9.5 min
Avg. Velocity = 0.34 fps, Avg. Travel Time= 18.6 min

Peak Storage= 64 cf @ 13.16 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 66.40 cfs

2.00' x 2.00' deep channel, n= 0.100 Very weedy reaches w/pools
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 375.0' Slope= 0.0693 '/'
Inlet Invert= 62.00', Outlet Invert= 36.00'

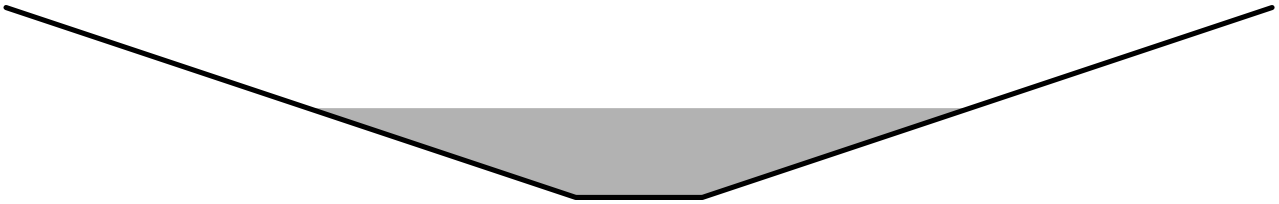
Summary for Reach 6R:

Inflow Area = 17.123 ac, 39.93% Impervious, Inflow Depth > 1.80" for 25-YR event
Inflow = 19.87 cfs @ 12.39 hrs, Volume= 2.562 af
Outflow = 19.83 cfs @ 12.41 hrs, Volume= 2.562 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.26 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 3.8 min

Peak Storage= 1,143 cf @ 12.41 hrs
Average Depth at Peak Storage= 1.41'
Bank-Full Depth= 3.00' Flow Area= 33.0 sf, Capacity= 116.36 cfs

2.00' x 3.00' deep channel, n= 0.100 Earth, dense brush, high stage
Side Slope Z-value= 3.0 '/' Top Width= 20.00'
Length= 130.0' Slope= 0.0308 '/'
Inlet Invert= 36.00', Outlet Invert= 32.00'



Summary for Pond 1.1P: UDSF-1

Inflow Area = 0.202 ac, 52.17% Impervious, Inflow Depth = 2.65" for 25-YR event
Inflow = 0.62 cfs @ 12.09 hrs, Volume= 0.045 af
Outflow = 0.43 cfs @ 12.18 hrs, Volume= 0.038 af, Atten= 31%, Lag= 5.1 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.43 cfs @ 12.18 hrs, Volume= 0.038 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 69.58' @ 12.18 hrs Surf.Area= 603 sf Storage= 587 cf

Plug-Flow detention time= 249.6 min calculated for 0.038 af (84% of inflow)
Center-of-Mass det. time= 182.5 min (1,022.4 - 839.9)

Volume	Invert	Avail.Storage	Storage Description
#1	66.49'	1,975 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.49	392	0.0	0	0
66.50	392	30.0	1	1
68.99	392	30.0	293	294
69.00	392	100.0	4	298
69.50	566	100.0	240	537
70.00	784	100.0	338	875
71.00	1,176	100.0	980	1,855
71.10	1,220	100.0	120	1,975

WQV=537cf-298cf =239cf

Device	Routing	Invert	Outlet Devices
#1	Primary	66.83'	**6.0" Round Stormdrain** L= 66.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 66.83' / 66.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	66.83'	**2.410 in/hr Filtration over Surface area above 66.83'** Excluded Surface area = 392 sf
#3	Primary	69.50'	**6.5' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63
#4	Discarded	66.50'	**2.410 in/hr Exfiltration over Surface area from 66.50' - 66.83'** Excluded Surface area = 392 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=66.49' (Free Discharge)
└**4=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.43 cfs @ 12.18 hrs HW=69.58' TW=65.03' (Dynamic Tailwater)
└**1=Stormdrain** (Passes 0.01 cfs of 0.95 cfs potential flow)
└**2=Filtration** (Exfiltration Controls 0.01 cfs)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.42 cfs @ 0.77 fps)

Summary for Pond 1.2P: UDSF-2

Inflow Area = 0.132 ac, 32.86% Impervious, Inflow Depth = 1.63" for 25-YR event
Inflow = 0.23 cfs @ 12.10 hrs, Volume= 0.018 af
Outflow = 0.01 cfs @ 15.88 hrs, Volume= 0.011 af, Atten= 95%, Lag= 227.1 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.01 cfs @ 15.88 hrs, Volume= 0.011 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 71.31' @ 15.88 hrs Surf.Area= 634 sf Storage= 475 cf

Plug-Flow detention time= 423.8 min calculated for 0.011 af (60% of inflow)
Center-of-Mass det. time= 300.3 min (1,170.9 - 870.6)

Volume	Invert	Avail.Storage	Storage Description
#1	68.49'	1,093 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.49	414	0.0	0	0
68.50	414	30.0	1	1
70.99	414	30.0	309	311
71.00	414	100.0	4	315
71.50	774	100.0	297	612
72.00	1,152	100.0	482	1,093

WQV=612cf-315cf
297cf

Device	Routing	Invert	Outlet Devices
#1	Primary	68.83'	**6.0" Round Stormdrain** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 68.83' / 68.68' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	68.83'	**2.410 in/hr Filtration over Surface area above 68.83'** Excluded Surface area = 414 sf
#3	Primary	71.60'	**2.0" x 2.0" Horiz. Orifice/Grate X 7.00 columns** X 7 rows C= 0.600 in 24.0" x 24.0" Grate (34% open area) Limited to weir flow at low heads
#4	Discarded	68.50'	**2.410 in/hr Exfiltration over Surface area from 68.50' - 68.83'** Excluded Surface area = 414 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=68.49' (Free Discharge)
└**4=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.01 cfs @ 15.88 hrs HW=71.31' TW=68.63' (Dynamic Tailwater)
└**1=Stormdrain** (Passes 0.01 cfs of 1.41 cfs potential flow)
└**2=Filtration** (Exfiltration Controls 0.01 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 2.1P: UDSF-3

Inflow Area = 0.341 ac, 55.70% Impervious, Inflow Depth = 2.83" for 25-YR event
Inflow = 1.13 cfs @ 12.09 hrs, Volume= 0.080 af
Outflow = 0.12 cfs @ 12.99 hrs, Volume= 0.056 af, Atten= 89%, Lag= 54.2 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.12 cfs @ 12.99 hrs, Volume= 0.056 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 66.84' @ 12.99 hrs Surf.Area= 1,583 sf Storage= 1,947 cf

Plug-Flow detention time= 576.3 min calculated for 0.056 af (69% of inflow)
Center-of-Mass det. time= 476.9 min (1,312.1 - 835.2)

Volume	Invert	Avail.Storage	Storage Description
#1	63.48'	2,924 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.48	1,124	0.0	0	0
63.49	1,124	30.0	3	3
65.99	1,124	30.0	843	846
66.00	1,124	100.0	11	858
66.50	1,316	100.0	610	1,468
66.80	1,436	100.0	413	1,880
67.00	2,100	100.0	354	2,234
67.30	2,500	100.0	690	2,924

WQV=1880cf-858cf =1,022cf

Device	Routing	Invert	Outlet Devices
#1	Primary	63.83'	**6.0" Round Stormdrain** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 63.83' / 62.00' S= 0.0915 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf
#2	Device 1	63.83'	**2.410 in/hr Filtration over Surface area above 63.83'** Excluded Surface area = 1,124 sf
#3	Primary	66.80'	**4.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Discarded	63.50'	**2.410 in/hr Exfiltration over Surface area from 63.50' - 63.83'** Excluded Surface area = 1,124 sf

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.48' (Free Discharge)
└**4=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.12 cfs @ 12.99 hrs HW=66.84' TW=62.07' (Dynamic Tailwater)
├**1=Stormdrain** (Passes 0.03 cfs of 1.57 cfs potential flow)
│└**2=Filtration** (Exfiltration Controls 0.03 cfs)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.09 cfs @ 0.52 fps)

Summary for Pond 2P: CB

Inflow Area = 0.132 ac, 32.86% Impervious, Inflow Depth > 0.98" for 25-YR event
Inflow = 0.01 cfs @ 15.88 hrs, Volume= 0.011 af
Outflow = 0.01 cfs @ 15.88 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min
Primary = 0.01 cfs @ 15.88 hrs, Volume= 0.011 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 68.63' @ 15.88 hrs
Flood Elev= 71.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	68.58'	**12.0" Round Stormdrain** L= 178.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 68.58' / 65.00' S= 0.0201 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.01 cfs @ 15.88 hrs HW=68.63' TW=65.01' (Dynamic Tailwater)
└**1=Stormdrain** (Inlet Controls 0.01 cfs @ 0.78 fps)

Summary for Pond 3P: Existing Detention

Inflow Area = 3.901 ac, 72.00% Impervious, Inflow Depth = 4.76" for 25-YR event
Inflow = 20.64 cfs @ 12.08 hrs, Volume= 1.548 af
Outflow = 1.93 cfs @ 12.93 hrs, Volume= 0.685 af, Atten= 91%, Lag= 50.9 min
Primary = 1.93 cfs @ 12.93 hrs, Volume= 0.685 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 58.67' @ 12.93 hrs Surf.Area= 33,037 sf Storage= 43,205 cf

Plug-Flow detention time= 327.9 min calculated for 0.685 af (44% of inflow)
Center-of-Mass det. time= 204.8 min (986.9 - 782.1)

Volume	Invert	Avail.Storage	Storage Description
#1	57.00'	54,336 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.00	20,288	0	0
58.00	25,922	23,105	23,105
58.50	32,000	14,481	37,586
59.00	35,000	16,750	54,336

Device	Routing	Invert	Outlet Devices
#1	Primary	58.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.93 cfs @ 12.93 hrs HW=58.67' TW=58.32' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.93 cfs @ 1.11 fps)

Summary for Link 1L: SP-1

Inflow Area = 8.125 ac, 39.96% Impervious, Inflow Depth > 1.62" for 25-YR event
Inflow = 3.80 cfs @ 12.53 hrs, Volume= 1.094 af
Primary = 3.80 cfs @ 12.53 hrs, Volume= 1.094 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2L: SP-2

Inflow Area = 17.123 ac, 39.93% Impervious, Inflow Depth > 1.80" for 25-YR event
Inflow = 19.83 cfs @ 12.41 hrs, Volume= 2.562 af
Primary = 19.83 cfs @ 12.41 hrs, Volume= 2.562 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1.1S: Runoff Area=8,790 sf 52.17% Impervious Runoff Depth=0.77"
Tc=6.0 min CN=70 Runoff=0.16 cfs 0.013 af

Subcatchment1.2S: Runoff Area=5,764 sf 32.86% Impervious Runoff Depth=0.31"
Tc=6.0 min CN=58 Runoff=0.02 cfs 0.003 af

Subcatchment1S: Runoff Area=169,449 sf 7.43% Impervious Runoff Depth=0.13"
Flow Length=450' Tc=19.2 min CN=51 Runoff=0.08 cfs 0.042 af

Subcatchment2.1S: Runoff Area=14,861 sf 55.70% Impervious Runoff Depth=0.87"
Tc=6.0 min CN=72 Runoff=0.32 cfs 0.025 af

Subcatchment2S: Runoff Area=731,028 sf 39.61% Impervious Runoff Depth=0.37"
Flow Length=790' Tc=26.0 min CN=60 Runoff=2.69 cfs 0.518 af

Subcatchment3S: Runoff Area=169,915 sf 72.00% Impervious Runoff Depth=2.16"
Tc=6.0 min CN=91 Runoff=9.75 cfs 0.704 af

Reach 1R: Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.022 L=75.0' S=0.2700 '/' Capacity=1,316.81 cfs Outflow=0.00 cfs 0.000 af

Reach 2R: Avg. Flow Depth=0.00' Max Vel=1.32 fps Inflow=0.01 cfs 0.006 af
n=0.030 L=200.0' S=0.1350 '/' Capacity=682.83 cfs Outflow=0.01 cfs 0.006 af

Reach 3R: Avg. Flow Depth=0.00' Max Vel=0.51 fps Inflow=0.01 cfs 0.006 af
n=0.030 L=100.0' S=0.0200 '/' Capacity=262.82 cfs Outflow=0.01 cfs 0.006 af

Reach 4R: Avg. Flow Depth=0.03' Max Vel=0.58 fps Inflow=0.08 cfs 0.048 af
n=0.030 L=62.0' S=0.0161 '/' Capacity=236.02 cfs Outflow=0.08 cfs 0.048 af

Reach 5R: Avg. Flow Depth=0.01' Max Vel=0.28 fps Inflow=0.00 cfs 0.004 af
n=0.100 L=375.0' S=0.0693 '/' Capacity=66.40 cfs Outflow=0.00 cfs 0.004 af

Reach 6R: Avg. Flow Depth=0.55' Max Vel=1.34 fps Inflow=2.69 cfs 0.522 af
n=0.100 L=130.0' S=0.0308 '/' Capacity=116.36 cfs Outflow=2.69 cfs 0.522 af

Pond 1.1P: UDSF-1 Peak Elev=69.26' Storage=413 cf Inflow=0.16 cfs 0.013 af
Discarded=0.00 cfs 0.000 af Primary=0.01 cfs 0.006 af Outflow=0.01 cfs 0.006 af

Pond 1.2P: UDSF-2 Peak Elev=69.68' Storage=147 cf Inflow=0.02 cfs 0.003 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Pond 2.1P: UDSF-3 Peak Elev=66.14' Storage=1,024 cf Inflow=0.32 cfs 0.025 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.004 af Outflow=0.00 cfs 0.004 af

Pond 2P: CB Peak Elev=68.58' Inflow=0.00 cfs 0.000 af
12.0" Round Culvert n=0.013 L=178.0' S=0.0201 '/' Outflow=0.00 cfs 0.000 af

Pond 3P: Existing Detention Peak Elev=58.27' Storage=30,649 cf Inflow=9.75 cfs 0.704 af
Outflow=0.00 cfs 0.000 af

Link 1L: SP-1 Inflow=0.08 cfs 0.048 af
Primary=0.08 cfs 0.048 af

Link 2L: SP-2 Inflow=2.69 cfs 0.522 af
Primary=2.69 cfs 0.522 af

Total Runoff Area = 25.248 ac Runoff Volume = 1.304 af Average Runoff Depth = 0.62"
60.06% Pervious = 15.165 ac 39.94% Impervious = 10.083 ac

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1.1S: Runoff Area=8,790 sf 52.17% Impervious Runoff Depth=1.74"
Tc=6.0 min CN=70 Runoff=0.40 cfs 0.029 af

Subcatchment1.2S: Runoff Area=5,764 sf 32.86% Impervious Runoff Depth=0.96"
Tc=6.0 min CN=58 Runoff=0.12 cfs 0.011 af

Subcatchment1S: Runoff Area=169,449 sf 7.43% Impervious Runoff Depth=0.58"
Flow Length=450' Tc=19.2 min CN=51 Runoff=1.12 cfs 0.189 af

Subcatchment2.1S: Runoff Area=14,861 sf 55.70% Impervious Runoff Depth=1.89"
Tc=6.0 min CN=72 Runoff=0.75 cfs 0.054 af

Subcatchment2S: Runoff Area=731,028 sf 39.61% Impervious Runoff Depth=1.07"
Flow Length=790' Tc=26.0 min CN=60 Runoff=11.00 cfs 1.502 af

Subcatchment3S: Runoff Area=169,915 sf 72.00% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=91 Runoff=15.82 cfs 1.168 af

Reach 1R: Avg. Flow Depth=0.03' Max Vel=3.58 fps Inflow=0.58 cfs 0.305 af
n=0.022 L=75.0' S=0.2700 '/' Capacity=1,316.81 cfs Outflow=0.58 cfs 0.305 af

Reach 2R: Avg. Flow Depth=0.01' Max Vel=1.32 fps Inflow=0.11 cfs 0.026 af
n=0.030 L=200.0' S=0.1350 '/' Capacity=682.83 cfs Outflow=0.10 cfs 0.026 af

Reach 3R: Avg. Flow Depth=0.09' Max Vel=1.28 fps Inflow=0.60 cfs 0.331 af
n=0.030 L=100.0' S=0.0200 '/' Capacity=262.82 cfs Outflow=0.60 cfs 0.331 af

Reach 4R: Avg. Flow Depth=0.13' Max Vel=1.49 fps Inflow=1.13 cfs 0.520 af
n=0.030 L=62.0' S=0.0161 '/' Capacity=236.02 cfs Outflow=1.13 cfs 0.520 af

Reach 5R: Avg. Flow Depth=0.02' Max Vel=0.33 fps Inflow=0.02 cfs 0.030 af
n=0.100 L=375.0' S=0.0693 '/' Capacity=66.40 cfs Outflow=0.02 cfs 0.030 af

Reach 6R: Avg. Flow Depth=1.08' Max Vel=1.94 fps Inflow=11.00 cfs 1.532 af
n=0.100 L=130.0' S=0.0308 '/' Capacity=116.36 cfs Outflow=10.98 cfs 1.532 af

Pond 1.1P: UDSF-1 Peak Elev=69.53' Storage=556 cf Inflow=0.40 cfs 0.029 af
Discarded=0.00 cfs 0.000 af Primary=0.11 cfs 0.022 af Outflow=0.11 cfs 0.022 af

Pond 1.2P: UDSF-2 Peak Elev=71.10' Storage=359 cf Inflow=0.12 cfs 0.011 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.003 af Outflow=0.00 cfs 0.003 af

Pond 2.1P: UDSF-3 Peak Elev=66.74' Storage=1,788 cf Inflow=0.75 cfs 0.054 af
Discarded=0.00 cfs 0.000 af Primary=0.02 cfs 0.030 af Outflow=0.02 cfs 0.030 af

Pond 2P: CB Peak Elev=68.61' Inflow=0.00 cfs 0.003 af
12.0" Round Culvert n=0.013 L=178.0' S=0.0201 '/' Outflow=0.00 cfs 0.003 af

Pond 3P: Existing Detention Peak Elev=58.58' Storage=40,089 cf Inflow=15.82 cfs 1.168 af
Outflow=0.58 cfs 0.305 af

Link 1L: SP-1 Inflow=1.13 cfs 0.520 af
Primary=1.13 cfs 0.520 af

Link 2L: SP-2 Inflow=10.98 cfs 1.532 af
Primary=10.98 cfs 1.532 af

Total Runoff Area = 25.248 ac Runoff Volume = 2.954 af Average Runoff Depth = 1.40"
60.06% Pervious = 15.165 ac 39.94% Impervious = 10.083 ac

Attachment D

Inspection, Maintenance, and Housekeeping Plan

Inspection, Maintenance, and Housekeeping Plan
5 Davis Farm Road Parking Expansion
5 Davis Farm Road
Portland, Maine

Introduction

Upon completion of the proposed office development, Pizzagalli Properties, LLC will be the responsible party for maintaining the stormwater management system. Pizzagalli Properties, LLC, or other another responsible party shall schedule maintenance of all stormwater management structures, the establishment of any contract services required to implement the program, and the keeping of records and maintenance logbook.

Records of all inspections and maintenance work accomplished must be kept on file and retained for a minimum 5-year time span. The maintenance logbook will be made available to the City of Portland upon request. At a minimum, the appropriate and relevant activities for each of the stormwater management systems will be performed on the prescribed schedule.

The following plan outlines the anticipated inspection, maintenance, and housekeeping procedures for the erosion and sedimentation controls as well as stormwater management devices for the project site. Also, this plan outlines several housekeeping requirements that shall be followed during and after construction. These procedures should be followed in order to ensure the intended function of the designed measures and to prevent unreasonable adverse impacts to the surrounding environment.

The procedures outlined in the Inspection, Maintenance, and Housekeeping Plan are provided as an overview of the anticipated practices to be used on this site. In some instances, additional measures may be required due to unexpected conditions. For additional details on any of the erosion and sedimentation control measures or stormwater management devices to be utilized on this project, refer to the most recently revised edition of the "Maine Erosion and Sedimentation Control BMP" manual and/or the "Stormwater Management for Maine: Best Management Practices" manual as published by the MDEP.

During Construction

1. **Inspection:** During the construction process, it is the Contractor's responsibility to comply with the inspection and maintenance procedures outlined in this section. These responsibilities include inspecting disturbed and impervious areas, erosion control measures, materials storage areas that are exposed to precipitation, and locations where vehicles enter or exit the site. These areas shall be inspected at least once a week as well as before and after a storm event, and prior to completing permanent stabilization measures. A person with knowledge of erosion and stormwater control, including the standards and conditions in any applicable permits, shall conduct the inspections.

2. **Maintenance:** All measures shall be maintained in an effective operating condition until areas are permanently stabilized. If Best Management Practices (BMPs) need to be maintained or modified, additional BMPs are necessary, or other corrective action is needed, implementation must be completed within seven (7) calendar days and prior to any storm event (rainfall).

3. **Documentation:** A log summarizing the inspections and any corrective action taken must be maintained on-site. The log must include the name(s) and qualifications of the person making the inspections, the date(s) of the inspections, and major observations about the operation and maintenance of erosion and sedimentation controls, material storage areas, and vehicle access points to the site. Major observations must include BMPs that need maintenance, BMPs that failed to operate as designed or proved inadequate for a particular location, and locations where additional BMPs are needed. For each BMP requiring maintenance, BMP needing replacement, and location needing additional BMPs, note in the log the corrective action taken and when it was taken.

   The log must be made accessible to the appropriate regulatory agency upon request. The permittee shall retain a copy of the log for a period of at least three (3) years from the completion of permanent stabilization.

4. **Specific Inspection and Maintenance Tasks:** The following is a list of erosion control and stormwater management measures and the specific inspection and maintenance tasks to be performed during construction.

   A. Sediment Barriers:

   - Hay bale barriers, silt fences, and filter berms shall be inspected immediately after each rainfall and at least daily during prolonged rainfall.
   - If the fabric on silt fence or filter barrier should decompose or become ineffective prior to the end of the expected usable life and the barrier is still necessary, it shall be replaced.
   - Sediment deposits should be removed after each storm event. They must be removed before deposits reach approximately one-half the height of the barrier.
   - Filter berms shall be reshaped as needed.
   - Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required should be dressed to conform to the existing grade, prepared, and seeded.

   B. Riprap Materials:

   - Once a riprap installation has been completed, it should require very little maintenance. It shall, however, be inspected periodically to determine if high flows have caused scour beneath the riprap or dislodged any of the stone.

   C. Erosion Control Blankets:

   - Inspect these reinforced areas semi-annually and after significant rainfall events for slumping, sliding, seepage, and scour. Pay close attention to unreinforced areas adjacent to the erosion control blankets, which may experience accelerated erosion.
   - Review all applicable inspection and maintenance procedures recommended by the specific blanket manufacturer. These tasks shall be included in addition to this plan.

D. Temporary Storm Drain Inlet Protection:

- The inlet protection structure shall be inspected before each rain event and repaired as necessary.
- Sediment shall be removed and the storm drain sediment barrier restored to its original dimensions when the sediment has accumulated to half of the design depth of the trap.
- Structures shall be removed upon permanent stabilization of the tributary area.
- Upon removal of the structure, all accumulated sediments downstream of the structure shall be cleaned from the storm drain system.

E. Stabilized Construction Entrances/Exits:

- The exit shall be maintained in a condition that will prevent tracking of sediment onto public rights-of-way.
- When the control pad becomes ineffective, the stone shall be removed along with the collected soil material. The entrance should then be reconstructed.
- Areas that have received mud-tracking or sediment deposits shall be swept or washed. Washing shall be done on an area stabilized with aggregate, which drains into an approved sediment-trapping device (not into storm drains, ditches, or waterways).

F. Temporary Seed and Mulch:

- Mulched areas should be inspected after rain events to check for rill erosion.
- If less than 90% of the soil surface is covered by mulch, additional mulch shall be applied in bare areas.
- In applications where seeding and mulch have been applied in conjunction with erosion control blankets, the blankets must be inspected after rain events for dislocation or undercutting.
- Mulch shall continue to be reapplied until 95% of the soil surface has established temporary vegetative cover.

G. Stabilized Drainage Swales:

- Sediment accumulation in the swale shall be removed once the cross section of the swale is reduced by 25%.
- The swales shall be inspected after rainfall events. Any evidence of sloughing of the side slopes or channel erosion shall be repaired and corrective action should be taken to prevent reoccurrence of the problem.
- In addition to the stabilized lining of the channel (i.e. erosion control blankets), stone check dams may be needed to further reduce channel velocity.

5. **Housekeeping:** The following general performance standards apply to the proposed project.

A. Spill Prevention: Controls must be used to prevent pollutants from being discharged from materials on-site, including storage practices to minimize exposure of the materials to stormwater, and appropriate spill prevention, containment, and response planning and implementation.

B. Groundwater Protection: During construction, liquid petroleum products and other hazardous materials with the potential to contaminate groundwater may not be stored or handled in areas of the site draining to an infiltration area. An "infiltration area" is any area of the site that by design or as a result of soils, topography and other relevant factors, accumulates runoff that infiltrates into the soil. Dikes, berms, sumps, and other forms of secondary containment that prevent discharge to groundwater may be used to isolate portions of the site for the purposes of storage and handling of these materials.

C. Fugitive Sediment and Dust: Actions must be taken to insure that activities do not result in noticeable erosion of soils or fugitive dust emissions during or after construction. Oil may not be used for dust control.

D. Debris and Other Materials: Litter, construction debris, and chemicals exposed to stormwater must be prevented from becoming a pollutant source.

E. Trench or Foundation Dewatering: Trench dewatering is the removal of water from trenches, foundations, cofferdams, ponds, and other areas within the construction area that retain water after excavation. In most cases, the collected water is heavily silted and hinders correct and safe construction practices. The collected water must be removed from the ponded area, either through gravity or pumping, and must be spread through natural wooded buffers or removed to areas that are specifically designed to collect the maximum amount of sediment possible, like a cofferdam sedimentation basin. Avoid allowing the water to flow over disturbed areas of the site. Equivalent measures may be taken if approved.

After Construction

1. **Inspection:** After construction, the owner or operator shall hire a qualified post-construction stormwater inspector to at least annually, inspect the BMPs, in accordance with all municipal and state inspection, cleaning and maintenance requirements of the approved post-construction stormwater management plan.

2. **Maintenance, and repair:** If a BMP requires maintenance, repair or replacement to function as intended by the approved post-construction stormwater management plan, the owner or operator shall take corrective actions to address the deficiency or deficiencies as soon as possible after the deficiency is discovered and shall provide a record of the deficiency and corrective actions to the City upon request. The following is a list of permanent erosion control and stormwater management measures and the inspection, maintenance, and housekeeping tasks to be performed after construction.

   A. Vegetated Areas:
      - Inspect vegetated areas, particularly slopes and embankments, early in the growing season or after heavy rains to identify active or potential erosion problems.
      - Replant bare areas or areas with sparse growth. Where rill erosion is evident, armor the area with an appropriate lining or divert the erosive flows to on-site areas able to withstand the concentrated flows.

   B. Ditches, Swales and Other Open Channels:
      - Inspect ditches, swales, and other open stormwater channels in the spring, in the late fall, and after heavy rains to remove any obstructions to the flow. Remove accumulated sediments and debris,

remove woody vegetative growth that could obstruct flow and repair any erosion of the ditch lining.

- Vegetated ditches must be mowed at least annually or otherwise maintained to control the growth of woody vegetation and maintain flow capacity.
- Any woody vegetation growing through riprap linings must also be removed. Repair any slumping side slopes as soon as practicable.
- Replace riprap in areas where any underlying filter fabric or underlying gravel is showing through the stone or where stones have dislodged.

C. Winter Sanding:

- Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring.
- Accumulations on pavement may be removed by pavement sweeping.
- Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader or other acceptable method.

D. Underdrained Soil Filter:

- During the first year, the basin shall be inspected semi-annually and following major storm events.
- Debris and sediment buildup shall be removed from the forebay and basin as needed. Mowing of a grassed basin can occur semiannually to a height no less than 6 inches. Any bare area or erosion rills shall be repaired with new filter media or sandy loam then seeded and mulched. Maintaining good grass cover will minimize clogging with fine sediments and if ponding exceeds 48 hours, the top of the filter bed must be rototilled to reestablish the soil's filtration capacity.
- The soil filter should be inspected after every major storm in the first year to be sure it is functioning properly. Thereafter, the filter should be inspected at least once every six months to ensure that it is draining within 48 hours following a one inch storm or greater. Following storms that fill the system and overflow is observed, the soil filter should drain in no less than 36 to 60 hours. If the system drains too fast, an orifice may need to be added on the underdrain outlet or, if already present, may need to be modified.
- Soil Filter Replacement: The top several inches of the filter shall be replaced with fresh material when water ponds on the surface of the bed for more than 72 hours. Removed sediments should be disposed of in an acceptable manner.
- Sediment Removal: Sediment and plant debris should be removed from the pretreatment structure at least annually.
- Mowing: If mowing is desired, only handheld string trimmers or push-mowers are allowed on the filter (no tractor) and the grass bed should be mowed no more than 2 times per growing season to maintain grass heights of no less than 6 inches.
- Fertilization: Fertilization of the underdrained filter area should be avoided unless absolutely necessary to establish vegetation.
- Harvesting and Weeding: Harvesting and pruning of excessive growth will need to be done occasionally. Weeding to control unwanted or invasive plants may also be necessary.

E. Catch Basins:

- Inspect and, if required, clean-out catch basins at least once a year, preferably in early spring.

- Clean out must include the removal and legal disposal of accumulated sediments and debris at the bottom of the basin, at any inlet grates, at any inflow channels to the basin, and at any pipes between basins.

F. Culverts and Stormdrains:
- Inspect culverts and stormdrains in the spring, in the late fall, and after heavy rains to remove any obstructions to flow.
- Remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit.
- Inspect and repair any erosion damage at the culvert's inlet and outlet.
- Inspect embankment for erosion, settling, and structural failure.

3. **Documentation:**

A. The owner or operator of a BMP or a qualified post-construction stormwater inspector hired by that person, shall, on or by June 30 of each year, provide a completed and signed certification to DPS in a form provided by DPS, certifying that the person has inspected the BMP(s) and that they are adequately maintained and functioning as intended by the approved post-construction stormwater management plan, or that they required maintenance or repair, including the record of the deficiency and corrective action(s) taken.

B. A log summarizing the inspections and any corrective action taken must be maintained. The log must include the name(s) and qualifications of the person making the inspections, the date(s) of the inspections, and major observations about the operation and maintenance of controls. Major observations must include BMPs that need maintenance, BMPs that failed to operate as designed or proved inadequate for a particular location, and locations where additional BMPs are needed. For each BMP requiring maintenance, BMP needing replacement, and location needing additional BMPs, note in the log the corrective action taken and when it was taken. The log must be made accessible to the appropriate regulatory agency upon request. A sample "Stormwater Inspection and Maintenance Form" has been included as Attachment 1 of this Inspection, Maintenance, and Housekeeping Plan.

4. **Duration of Maintenance:** Perform maintenance as described and required for any associated permits unless and until the system is formally accepted by a municipality or quasi-municipal district, or is placed under the jurisdiction of a legally created association that will be responsible for the maintenance of the system.

Attachments

Attachment 1 – Sample Stormwater Inspection and Maintenance Form

Sample Stormwater Inspection and Maintenance Form

5 Davis Farm Road Parking Expansion
5 Davis Farm Road
Portland, Maine

Attachment 1

This log is intended to accompany the stormwater Inspection, Maintenance and Housekeeping Plan for the office development at 473/ 483 Riverside Street. The following items shall be checked, cleaned and maintained on a regular basis as specified in the Maintenance Plan and as described in the table below. This log shall be kept on file for a minimum of five (5) years and shall be available for review. Qualified personnel familiar with drainage systems and soils shall perform all inspections. Attached is a copy of the construction and post-construction maintenance logs.

	INSPECTOR NAME	DATE PERFORMED	SUGGESTED INTERVAL
Vegetated Areas			
Inspect all slopes and embankments			Annually
Replant bare areas or areas with sparse growth			Annually
Paved Surfaces			
Clear accumulated winter sand			Annually
Remove sediment along edges and in pockets			Annually
Ditches & Swales			
Remove any obstructions and accumulated sediments and debris			Monthly
Repair any erosion of ditch lining			Annually
Mow vegetated ditches			Annually
Remove woody vegetation growing through riprap			Annually
Repair any slumping side slopes			Annually
Replace riprap where stones have dislodged			Annually
Catch Basins			
Remove accumulated sediments and debris in the sump and at grate			Annually
Culverts			
Remove accumulated sediments and debris at the inlet, outlet, within conduit			Annually
Repair any erosion at inlet and outlet			Annually
Sump Depth			Annually

Underdrained Soil Filter				
	Remove sediment & debris			Monthly
	Remove weeds			Monthly (during growing season)
	Erosion (side slopes, embankment)			Monthly
	Inspection after major storm to verify proper function			Bi-Annually