Tighe&Bond
Engineers | Environmental Specialists

L-0700-013
August 21, 2018

Ms. Juliet Walker, Planning Director
City of Portsmouth Planning Department
1 Junkins Avenue
Portsmouth, New Hampshire 03801

Re: **Lonza Biologics – Proposed Industrial Development**
Site Plan Review & Subdivision Applications

Dear Juliet:

On behalf of Lonza Biologics, we are pleased to submit the following supplemental information to support a request to the Planning Board for a recommendation for approval to the Pease Development Authority (PDA) for Site Plan Review and Subdivision Applications for a proposed industrial development located at 70 and 80 Corporate Drive and 101 International Drive on Pease International Tradeport:

- Four (4) full size and six (6) half size copies of Site Plans last revised August 21, 2018;
- Ten (10) copies of a Buildings Renderings prepared by Lonza dated August 20, 2018;
- Ten (10) copies of the Site Review Comment Response dated August 21, 2018;
- Ten (10) copies of the Peer Review Comment Response dated August 21, 2018;
- Ten (10) copies of the Revised Trip Distribution Analysis dated August 9, 2018;
- Ten (10) copies of Section 6, 7, 8 & 11 of the Alteration of Terrain Report last revised August 21, 2018;
- Ten (10) copies of the Fire Truck Turning Exhibits dated August 21, 2018;
- One (1) CD containing digital (PDF) copies of the above listed information

On June 6, 2018, we attended the Technical Advisory Committee (TAC) and received comments from City staff regarding the site and building. In addition, we attended meetings at the Fire Department on July 5, 2018 and August 6, 2018. The enclosed supplemental materials have been provided to address these comments. Also enclosed is a Site Review Comment Response that includes responses to City staff comments.

On August 6, 2018, Altus Engineering provided a Third Party Peer Review Letter for the stormwater design. The enclosed Site Plans and pertinent sections of the Alteration of Terrain Application have been revised to address comments in the Peer Review Letter. Also enclosed is a Peer Review Comment Response that includes repsonses to these comments. One item to note in the stormwater management design is that one of the gravel wetlands (previously Gravel Wetland #2) located along Corporate Drive has been eliminated from the design. Eliminating this gravel wetland improves construction phasing for the stormwater management, improves site access and allows for a longer stream restoration design which provides additional wetland impact mitigation. The two (2) remaining gravel wetlands and rain garden have been revised manage the site's stormwater as shown in the enclosed drainage calculations. This includes the addition of fire lanes which have been added to site desing at the request of the Fire Deparment.

We respectfully request to be placed on the September 4, 2018 TAC Public Hearing agenda. If you have any questions or need any additional information, please contact me at (603) 433-8818 or pmcrimmins@tighebond.com.

Sincerely,
TIGHE & BOND, INC.

Patrick M. Crimmins, P.E.
Senior Project Manager

Enclosures

Cc: Lonza Biologics (via email)
DTC Lawyers (via email)
Pease Development Authority (via email)

Revised Trip Distribution Analysis
Lonza Biologics Proposed Industrial Development
Portsmouth, New Hampshire

TO: George Combes, PE, CPIP
Principal Design Lead - Global Engineering
Lonza Biologics
230 Corporate Drive
Portsmouth, NH 03801

FROM: Patrick Crimmins, P.E.
Vinod Kalikiri, P.E., PTOE

DATE: August 9, 2018

Tighe & Bond, Inc. (Tighe & Bond) has prepared this memorandum to summarize the revised trip distribution analysis for the above referenced project, prepared in response to a request for such analysis by the City's Technical Advisory Committee (TAC).

The original trip distribution analysis included in the April 2018 traffic study was based on calculations using the existing peak hour counts at intersections near the Site. This methodology, while reliable for use in intersection impact analysis presented in the study, does not extrapolate the trip percentages to the regional highway system and roadways outside of the study area.

To address the TAC's request for trip distribution percentages on the regional roadway network, Tighe & Bond requested and analyzed zip code data for Lonza employees' place of residence. The analysis results from the zip code data is presented both on a map as well as in a tabular form in the attachment to this memorandum. The new analysis is generally consistent with the corresponding analysis presented in the original study. Both analyses indicate that a majority of the Site traffic (as much as three quarters of the Site generate traffic) would be oriented to/from Pease Boulevard (i.e., north of the Site) and the remaining Site traffic oriented to/from Grafton Road (i.e., south of the Site).

Attachments

Trip Distribution Map

Calculation worksheet

\\nas-wfo\data\Projects\L\L0700 Lonza Biologics Expansion was 1576F\013 Iron Parcel Redevelopment\Traffic\Tech\Zip Code Trip Distribution Data\2018-08-09 Trip Dist Memo.docx

KEY

Regional Distribution

Local Assignment

1%

3%

10%

3%

3%

72%

72%

40%

28%

28%

30%

10%

SITE

Lonza Biologics
Major Roads

Legend

USA Major Roads

Road Classification

- Freeway or Other Major Road
- Major Road Less Important than a Freeway
- Other Major Road
- Secondary Road
- Local Connecting Road
- Important Local Road

N

0 0.2 0.4 0.6 0.8 Miles

SUMMARY OF TRIP DISTRIBUTION ANALYSIS
BASED ON EMPLOYEE ZIP CODE DATA

Tighe&Bond
Engineers | Environmental Specialists

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LONZA BIOLOGICS
EMPLOYEE RESIDENTIAL ZIP CODE BASED TRIP DISTRIBUTION ANALYSIS

OBJECTID	ZIP_CODE	PO_NAME	STATE	employeeCount	Shape_Area	Direction	I-95 South	I-95 North	Route 33 South	Route 33 East	Route 1 East	Route 1 North	Route 4 West	Gosling Road North	check	I-95 South	I-95 North	Route 33 South	Route 33 East	Route 1 East	Route 1 North	Route 4 West	Gosling Road North
1	1010.00	Brimfield	MA	1	0.010514			100.00%							OK	1	0	0	0	0	0	0	0
2	1451.00	Harvard	MA	1	0.006399			100.00%							OK	1	0	0	0	0	0	0	0
3	1507.00	Charlton	MA	1	0.012443			100.00%							OK	1	0	0	0	0	0	0	0
4	1522.00	Jefferson	MA	1	0.00476			100.00%							OK	1	0	0	0	0	0	0	0
5	1581.00	Westborough	MA	1	0.005997			100.00%							OK	1	0	0	0	0	0	0	0
6	1730.00	Bedford	MA	2	0.003859			100.00%							OK	2	0	0	0	0	0	0	0
7	1772.00	Southborough	MA	1	0.004393			100.00%							OK	1	0	0	0	0	0	0	0
8	1801.00	Woburn	MA	1	0.00367			100.00%							OK	1	0	0	0	0	0	0	0
9	1810.00	Andover	MA	2	0.009116			100.00%							OK	2	0	0	0	0	0	0	0
10	1826.00	Dracut	MA	2	0.006115			100.00%							OK	2	0	0	0	0	0	0	0
11	1830.00	Haverhill	MA	6	0.004248			100.00%							OK	6	0	0	0	0	0	0	0
12	1832.00	Haverhill	MA	2	0.003408			100.00%							OK	2	0	0	0	0	0	0	0
13	1833.00	Georgetown	MA	1	0.003762			100.00%							OK	1	0	0	0	0	0	0	0
14	1835.00	Haverhill	MA	1	0.002461			100.00%							OK	1	0	0	0	0	0	0	0
15	1844.00	Methuen	MA	10	0.006546			100.00%							OK	10	0	0	0	0	0	0	0
16	1845.00	North Andover	MA	2	0.007855			100.00%							OK	2	0	0	0	0	0	0	0
17	1852.00	Lowell	MA	1	0.001495			100.00%							OK	1	0	0	0	0	0	0	0
18	1854.00	Lowell	MA	2	0.001247			100.00%							OK	2	0	0	0	0	0	0	0
19	1860.00	Merrimac	MA	2	0.002536			100.00%							OK	2	0	0	0	0	0	0	0
20	1876.00	Tewksbury	MA	2	0.006037			100.00%							OK	2	0	0	0	0	0	0	0
21	1880.00	Wakefield	MA	1	0.00226			100.00%							OK	1	0	0	0	0	0	0	0
22	1886.00	Westford	MA	1	0.008731			100.00%							OK	1	0	0	0	0	0	0	0
23	1907.00	Swampscott	MA	1	0.00085			100.00%							OK	1	0	0	0	0	0	0	0
24	1913.00	Amesbury	MA	5	0.003893			100.00%							OK	5	0	0	0	0	0	0	0
25	1915.00	Beverly	MA	1	0.00446			100.00%							OK	1	0	0	0	0	0	0	0
26	1921.00	Boxford	MA	2	0.006996			100.00%							OK	2	0	0	0	0	0	0	0
27	1938.00	Ipswich	MA	1	0.009451			100.00%							OK	1	0	0	0	0	0	0	0
28	1950.00	Newburyport	MA	7	0.003159			100.00%							OK	7	0	0	0	0	0	0	0
29	1951.00	Newbury	MA	2	0.005088			100.00%							OK	2	0	0	0	0	0	0	0
30	1952.00	Salisbury	MA	3	0.004937			100.00%							OK	3	0	0	0	0	0	0	0
31	1960.00	Peabody	MA	1	0.004791			100.00%							OK	1	0	0	0	0	0	0	0
32	1970.00	Salem	MA	1	0.002453			100.00%							OK	1	0	0	0	0	0	0	0
33	1985.00	West Newbury	MA	1	0.004183			100.00%							OK	1	0	0	0	0	0	0	0
34	2127.00	Boston	MA	1	0.000853			100.00%							OK	1	0	0	0	0	0	0	0
35	2145.00	Somerville	MA	1	0.000407			100.00%							OK	1	0	0	0	0	0	0	0
36	2176.00	Melrose	MA	1	0.001348			100.00%							OK	1	0	0	0	0	0	0	0
37	2180.00	Stoneham	MA	1	0.001849			100.00%							OK	1	0	0	0	0	0	0	0
38	2461.00	Newton Highlands	MA	1	0.000427			100.00%							OK	1	0	0	0	0	0	0	0
39	2472.00	Watertown	MA	3	0.001181			100.00%							OK	3	0	0	0	0	0	0	0
40	2492.00	Needham	MA	1	0.00267			100.00%							OK	1	0	0	0	0	0	0	0
41	3031.00	Amherst	NH	5	0.010143			100.00%							OK	5	0	0	0	0	0	0	0
42	3032.00	Auburn	NH	1	0.008167			100.00%							OK	1	0	0	0	0	0	0	0
43	3034.00	Candia	NH	3	0.01063			100.00%							OK	3	0	0	0	0	0	0	0
44	3037.00	Deerfield	NH	4	0.014317			100.00%							OK	4	0	0	0	0	0	0	0
45	3038.00	Derry	NH	8	0.010857			100.00%							OK	8	0	0	0	0	0	0	0
46	3042.00	Epping	NH	11	0.007973			50.00%						50.00%	OK	5.5	0	0	0	0	0	5.5	0
47	3044.00	Fremont	NH	4	0.004945			50.00%	50.00%						OK	2	0	2	0	0	0	0	0
48	3045.00	Goffstown	NH	2	0.010311			100.00%							OK	2	0	0	0	0	0	0	0
49	3047.00	Greenfield	NH	1	0.008001			100.00%							OK	1	0	0	0	0	0	0	0
50	3051.00	Hudson	NH	1	0.008357			100.00%							OK	1	0	0	0	0	0	0	0
51	3052.00	Litchfield	NH	1	0.004289			100.00%							OK	1	0	0	0	0	0	0	0
52	3053.00	Londonderry	NH	10	0.011616			100.00%							OK	10	0	0	0	0	0	0	0
53	3054.00	Merrimack	NH	1	0.009547			100.00%							OK	1	0	0	0	0	0	0	0
54	3055.00	Milford	NH	1	0.007092			75.00%	25.00%						OK	0.75	0	0.25	0	0	0	0	0
55	3062.00	Nashua	NH	1	0.003368			100.00%							OK	1	0	0	0	0	0	0	0
56	3070.00	New Boston	NH	2	0.012502			75.00%	25.00%						OK	1.5	0	0.5	0	0	0	0	0
57	3076.00	Pelham	NH	3	0.007647			100.00%							OK	3	0	0	0	0	0	0	0
58	3077.00	Raymond	NH	8	0.008318			100.00%							OK	8	0	0	0	0	0	0	0
59	3079.00	Salem	NH	6	0.007438			100.00%							OK	6	0	0	0	0	0	0	0
60	3101.00	Manchester	NH	1	0.000226			90.00%						10.00%	OK	0.9	0	0	0	0	0	0.1	0
61	3102.00	Manchester	NH	9	0.002627			90.00%						10.00%	OK	8.1	0	0	0	0	0	0.9	0
62	3103.00	Manchester	NH	6	0.002887			90.00%						10.00%	OK	5.4	0	0	0	0	0	0.6	0
63	3104.00	Manchester	NH	9	0.002441			90.00%						10.00%	OK	8.1	0	0	0	0	0	0.9	0
64	3106.00	Hooksett	NH	3	0.010556			100.00%							OK	3	0	0	0	0	0	0	0
65	3109.00	Manchester	NH	1	0.002277			90.00%						10.00%	OK	0.9	0	0	0	0	0	0.1	0
66	3110.00	Bedford	NH	4	0.009428			100.00%							OK	4	0	0	0	0	0	0	0
67	3225.00	Center Barnstead	NH	1	0.008176									100.00%	OK	0	0	0	0	0	0	1	0
68	3234.00	Epsom	NH	1	0.009624									100.00%	OK	0	0	0	0	0	0	1	0
69	3235.00	Franklin	NH	1	0.009122				50.00%					50.00%	OK	0	0.5	0	0	0	0	0.5	0
70	3244.00	Hillsborough	NH	1	0.024593			100.00%							OK	1	0	0	0	0	0	0	0
71	3245.00	Holderness	NH	1	0.010031									100.00%	OK	0	0	0	0	0	0	1	0
72	3253.00	Meredith	NH	1	0.014683									100.00%	OK	0	0	0	0	0	0	1	0
73	3255.00	Newbury	NH	1	0.010912			50.00%						50.00%	OK	0.5	0	0	0	0	0	0.5	0
74	3258.00	Chichester	NH	3	0.005796									100.00%	OK	0	0	0	0	0	0	3	0
75	3261.00	Northwood	NH	9	0.008624									100.00%	OK	0	0	0	0	0	0	9	0
76	3263.00	Pittsfield	NH	1	0.007336									100.00%	OK	0	0	0	0	0	0	1	0
77	3275.00	Suncook	NH	1	0.011764			50.00%						50.00%	OK	0.5	0	0	0	0	0	0.5	0

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EMPLOYEE RESIDENTIAL ZIP CODE BASED TRIP DISTRIBUTION ANALYSIS

OBJECTID	ZIP_CODE	PO_NAME	STATE	employeeCount	Shape_Area	Direction	I-95 South	I-95 North	Route 33 South	Route 33 East	Route 1 East	Route 1 North	Route 4 West	Gosling Road North	check	I-95 South	I-95 North	Route 33 South	Route 33 East	Route 1 East	Route 1 North	Route 4 West	Gosling Road North	
78	3280.00	Washington	NH	1	0.013125			100.00%							OK	1	0	0	0	0	0	0	0	
79	3281.00	Weare	NH	1	0.017189			50.00%						50.00%	OK	0.5	0	0	0	0	0	0.5	0	
80	3290.00	Nottingham	NH	18	0.013032			50.00%						50.00%	OK	9	0	0	0	0	0	9	0	
81	3301.00	Concord	NH	2	0.014821			50.00%						50.00%	OK	1	0	0	0	0	0	1	0	
82	3303.00	Concord	NH	1	0.020526			50.00%						50.00%	OK	0.5	0	0	0	0	0	0.5	0	
83	3570.00	Berlin	NH	1	0.023446									100.00%	OK	0	0	0	0	0	0	1	0	
84	3576.00	Colebrook	NH	1	0.057233				34.00%	33.00%				33.00%	OK	0	0.34	0.33	0	0	0	0.33	0	
85	3801.00	Portsmouth	NH	116	0.008103					20.00%	20.00%	20.00%		20.00%	20.00% OK	0	0	23.2	23.2	23.2	0	23.2	23.2	
86	3809.00	Alton	NH	1	0.014804									100.00%	OK	0	0	0	0	0	0	1	0	
87	3810.00	Alton Bay	NH	3	0.008575									100.00%	OK	0	0	0	0	0	0	3	0	
88	3811.00	Atkinson	NH	2	0.003295			100.00%							OK	2	0	0	0	0	0	0	0	
89	3812.00	Bartlett	NH	1	0.02191									100.00%	OK	0	0	0	0	0	0	1	0	
90	3819.00	Danville	NH	3	0.003186			50.00%						50.00%	OK	1.5	0	0	0	0	0	1.5	0	
91	3820.00	Dover	NH	116	0.00875									100.00%	OK	0	0	0	0	0	0	116	0	
92	3823.00	Madbury	NH	5	0.003217									100.00%	OK	0	0	0	0	0	0	5	0	
93	3824.00	Durham	NH	7	0.007376									100.00%	OK	0	0	0	0	0	0	7	0	
94	3825.00	Barrington	NH	20	0.014117									100.00%	OK	0	0	0	0	0	0	20	0	
95	3826.00	East Hampstead	NH	2	0.001192			100.00%							OK	2	0	0	0	0	0	0	0	
96	3827.00	East Kingston	NH	3	0.00496			100.00%							OK	3	0	0	0	0	0	0	0	
97	3830.00	East Wakefield	NH	2	0.003238									100.00%	OK	0	0	0	0	0	0	2	0	
98	3833.00	Exeter	NH	39	0.013793			50.00%		50.00%					OK	19.5	0	19.5	0	0	0	0	0	
99	3835.00	Farmington	NH	15	0.010892									100.00%	OK	0	0	0	0	0	0	15	0	
100	3839.00	Rochester	NH	9	0.002018									100.00%	OK	0	0	0	0	0	0	9	0	
101	3840.00	Greenland	NH	24	0.003048					100.00%					OK	0	0	24	0	0	0	0	0	
102	3841.00	Hampstead	NH	7	0.003098			100.00%							OK	7	0	0	0	0	0	0	0	
103	3842.00	Hampton	NH	27	0.003921			100.00%							OK	27	0	0	0	0	0	0	0	
104	3844.00	Hampton Falls	NH	4	0.003506			100.00%							OK	4	0	0	0	0	0	0	0	
105	3848.00	Kingston	NH	3	0.005907			100.00%							OK	3	0	0	0	0	0	0	0	
106	3851.00	Milton	NH	10	0.008272									100.00%	OK	0	0	0	0	0	0	10	0	
107	3852.00	Milton Mills	NH	1	0.001669									100.00%	OK	0	0	0	0	0	0	1	0	
108	3855.00	New Durham	NH	9	0.012785									100.00%	OK	0	0	0	0	0	0	9	0	
109	3856.00	Newfields	NH	5	0.00225					100.00%					OK	0	0	5	0	0	0	0	0	
110	3857.00	Newmarket	NH	25	0.004782			50.00%						50.00%	OK	12.5	0	0	0	0	0	12.5	0	
111	3858.00	Newton	NH	1	0.002836			100.00%							OK	1	0	0	0	0	0	0	0	
112	3861.00	Lee	NH	7	0.005561									100.00%	OK	0	0	0	0	0	0	7	0	
113	3862.00	North Hampton	NH	9	0.003932					100.00%					OK	0	0	9	0	0	0	0	0	
114	3864.00	Ossipee	NH	2	0.01136									100.00%	OK	0	0	0	0	0	0	2	0	
115	3865.00	Plaistow	NH	4	0.002967			100.00%							OK	4	0	0	0	0	0	0	0	
116	3867.00	Rochester	NH	58	0.009024									100.00%	OK	0	0	0	0	0	0	58	0	
117	3868.00	Rochester	NH	15	0.002244									100.00%	OK	0	0	0	0	0	0	15	0	
118	3869.00	Rollinsford	NH	5	0.001979				50.00%				50.00%		OK	0	2.5	0	0	0	2.5	0	0	
119	3870.00	Rye	NH	10	0.003512			50.00%		50.00%					OK	5	0	5	0	0	0	0	0	
120	3872.00	Sanbornville	NH	3	0.012299									100.00%	OK	0	0	0	0	0	0	3	0	
121	3873.00	Sandown	NH	4	0.004147			50.00%		50.00%					OK	2	0	2	0	0	0	0	0	
122	3874.00	Seabrook	NH	5	0.002676			100.00%							OK	5	0	0	0	0	0	0	0	
123	3878.00	Somersworth	NH	50	0.002836									100.00%	OK	0	0	0	0	0	0	50	0	
124	3882.00	Effingham	NH	2	0.011411									100.00%	OK	0	0	0	0	0	0	2	0	
125	3884.00	Strafford	NH	5	0.014538									100.00%	OK	0	0	0	0	0	0	5	0	
126	3885.00	Stratham	NH	24	0.004492					100.00%					OK	0	0	24	0	0	0	0	0	
127	3887.00	Union	NH	7	0.006041									100.00%	OK	0	0	0	0	0	0	7	0	
128	3894.00	Wolfeboro	NH	1	0.020419									100.00%	OK	0	0	0	0	0	0	1	0	
129	3901.00	Berwick	ME	10	0.0107		100.00%								OK	0	10	0	0	0	0	0	0	
130	3902.00	Cape Neddick	ME	9	0.005456		100.00%								OK	0	9	0	0	0	0	0	0	
131	3903.00	Eliot	ME	13	0.006136		100.00%								OK	0	13	0	0	0	0	0	0	
132	3904.00	Kittery	ME	10	0.003178		100.00%								OK	0	10	0	0	0	0	0	0	
133	3905.00	Kittery Point	ME	3	0.002057		100.00%								OK	0	3	0	0	0	0	0	0	
134	3906.00	North Berwick	ME	7	0.011124		100.00%								OK	0	7	0	0	0	0	0	0	
135	3907.00	Ogunquit	ME	1	0.0011		100.00%								OK	0	1	0	0	0	0	0	0	
136	3908.00	South Berwick	ME	13	0.009329		100.00%								OK	0	13	0	0	0	0	0	0	
137	3909.00	York	ME	9	0.010628		100.00%								OK	0	9	0	0	0	0	0	0	
138	4005.00	Biddeford	ME	2	0.014128		100.00%								OK	0	2	0	0	0	0	0	0	
139	4009.00	Bridgton	ME	1	0.018959		100.00%								OK	0	1	0	0	0	0	0	0	
140	4021.00	Cumberland Center	ME	1	0.005747		100.00%								OK	0	1	0	0	0	0	0	0	
141	4027.00	Lebanon	ME	5	0.016093		100.00%								OK	0	5	0	0	0	0	0	0	
142	4038.00	Gorham	ME	1	0.014925		100.00%								OK	0	1	0	0	0	0	0	0	
143	4042.00	Hollis Center	ME	2	0.009715		100.00%								OK	0	2	0	0	0	0	0	0	
144	4043.00	Kennebunk	ME	9	0.009994		100.00%								OK	0	9	0	0	0	0	0	0	
145	4046.00	Kennebunkport	ME	2	0.013092		100.00%								OK	0	2	0	0	0	0	0	0	
146	4061.00	North Waterboro	ME	1	0.005735		100.00%								OK	0	1	0	0	0	0	0	0	
147	4062.00	Windham	ME	3	0.014431		100.00%								OK	0	3	0	0	0	0	0	0	
148	4072.00	Saco	ME	2	0.011271		100.00%								OK	0	2	0	0	0	0	0	0	
149	4073.00	Sanford	ME	4	0.010941		100.00%								OK	0	4	0	0	0	0	0	0	
150	4076.00	Shapleigh	ME	3	0.011892		100.00%								OK	0	3	0	0	0	0	0	0	
151	4083.00	Springvale	ME	2	0.002897		100.00%								OK	0	2	0	0	0	0	0	0	
152	4087.00	Waterboro	ME	1	0.005467		100.00%								OK	0	1	0	0	0	0	0	0	
153	4090.00	Wells	ME	2	0.016786		100.00%								OK	0	2	0	0	0	0	0	0	
154	4105.00	Falmouth	ME	1	0.008846		100.00%								OK	0	1	0	0	0	0	0	0	
155	4281.00	South Paris	ME	1	0.012843		100.00%								OK	0	1	0	0	0	0	0	0	
156	4938.00	Farmington	ME	1	0.036329		100.00%								OK	0	1	0	0	0	0	0	0	
			SUM	1020												285.65	122.34	114.78	23.2	23.2	2.5	425.13	23.2	1020
				0												28%	12%	11%	2%	2%	0%	42%	2%	
																	30%	10%	10%	3%	3%	1%	40%	3%

Tighe&Bond

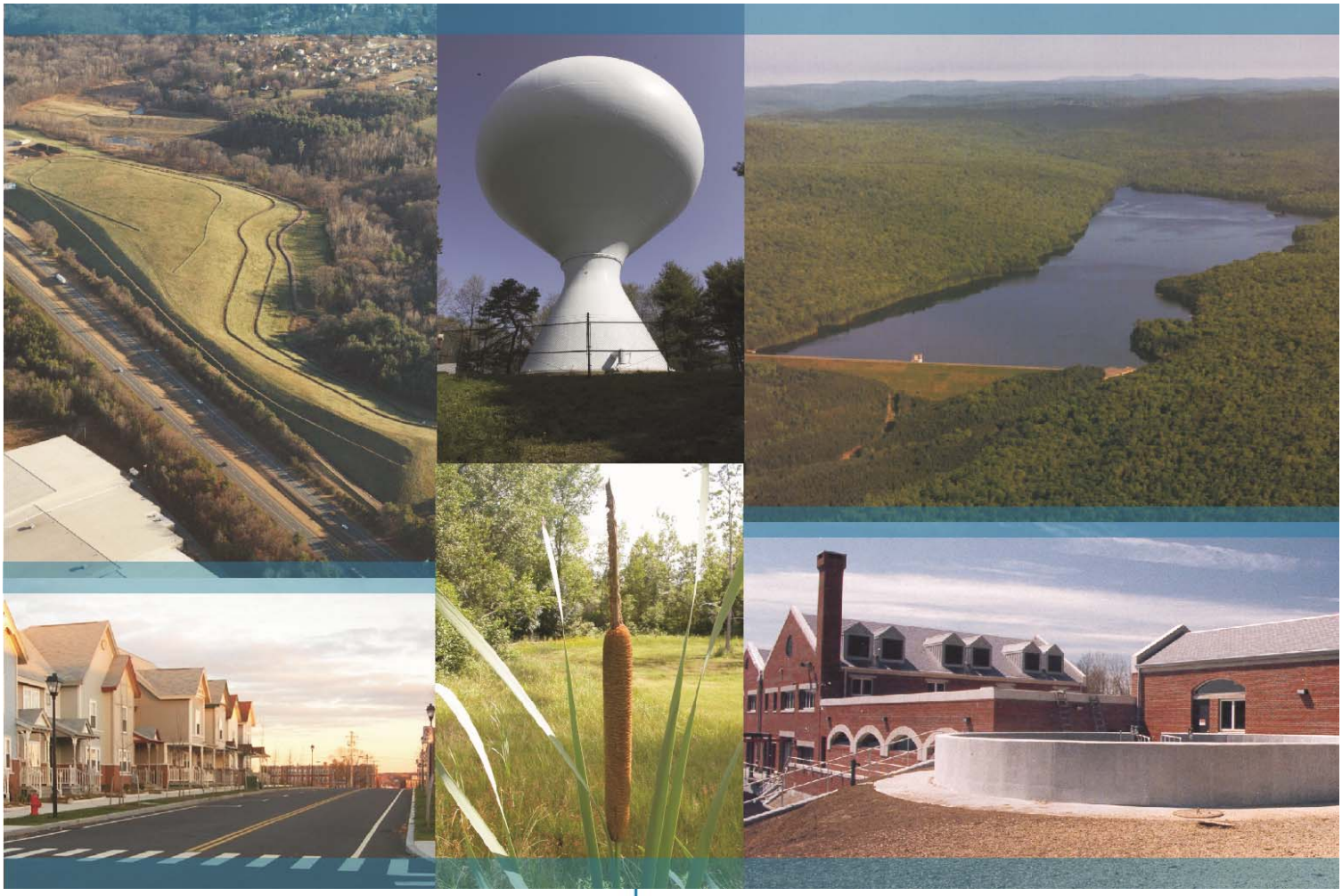
PROPOSED IRON PARCEL REDEVELOPMENT PROJECT - PEER REVIEW COMMENT RESPONSE **Date: August 21, 2018**

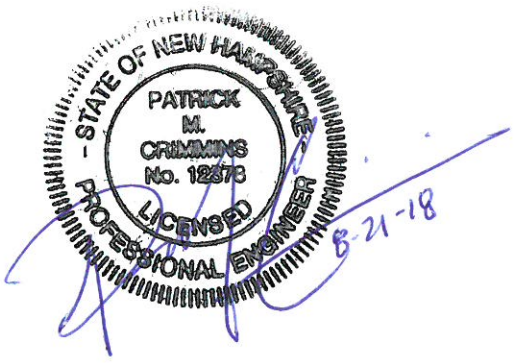
City of Portsmouth Third Party Review, Altus Engineering, August 6, 2018:			
	Altus Engineering Comment	**Applicant Response**	**Sheet**
General Comments:			
1	In general , Altus supports the premise to eliminate the closed drainage system across this property to create an open and vegetated channel. With this modification to the watershed, Altus is concerned that there could be unintended consequences that could impact down gradient properties. The Hodgson Brook watershed is highly developed . The flow through the Lonza site is through a series of pipes which allows the runs to pass through the area rapidly. Opening the channel up slows the flow through the system which will delay and impact the overall watershed time of concentration and the peak rate of runoff during storm events. This could create conflicts with the peak rate of flow elsewhere. Streamworks should document as to how this change will impact the rest of the system.	The following response is from the stream designer Streamworks, PLLC, "In early August, Tighe and Bond received comments regarding concern about downstream effects to the watershed resulting from the proposed plan to daylight Hodgson Brook at the Iron Rail Parcel, in the Pease Tradeport. The concern voiced by the city's third-party reviewer, Altus, described the current condition of Hodgson Brook - how flows currently pass through the site quickly - and the impervious nature of the watershed upstream from the site. The comment then raised points about how the watershed time of concentration would be altered, how this could create conflicts with peak flows elsewhere down the watershed, and perhaps cause unintended consequences. The points made by Altus are all correct; the project will reduce the time of concentration for this section of the stream, it will reduce peak flows, and slightly affect those downstream from here. However, these are among the factors the project aims to address with the goal of benefiting the watershed by alleviating those factors and returning the system to a slightly more natural condition. Peak flows have only been increasing since the alteration of this site was performed, resulting from increased precipitation intensities and impervious cover in the watershed. The effects of the project felt downstream in the watershed should only provide benefits, specifically with regards to peak flows, volumes, and runoff time. So while the points made by Altus are correct, they should not be concerns, rather benefits to the system as a whole."	N/A
2	The development project is very large and complex and according to the drainage computations over 13.2 acres of new impervious will be created. It is presumed that it will not be constructed in a single phase. As such, it would be prudent for the designer to provide detailed phasing and sequencing plans for both the building and site improvements aspects as well as the stormwater management.	Stormwater management has been designed to take into consideration phasing that will be associated with the construction of each of the three (3) buildings. Detailed plans will be prepared prior to construction of each phase. Under separate correspondence, DTC Lawyers will submit supplemental correspondence that further addresses this comment.	N/A
3	The Streamworks report discusses the stream work sequencing. These requirements should also be incorporated into the site plans.	The stream construction sequence from the Streamworks report has been added to the plans.	C-701
4	It is understood that the stream bed will be constructed in advance of the culvert removal. Special construction considerations need to be discussed on the plans as to how the lower concrete vault (oversized drain manhole) will be removed and the flow maintained.	The method of removal of the downstream concrete vault and construction of concrete headwall is a construction means and methods item and is the responsibility of the contractor to determine the best way to construct. However, a note was added to sheet C-701 stating that the contractor shall submit a detailed construction sequence plan to be reviewed and approved by the design engineer prior to construction	C-701
5	The plans are deficient detailed construction sequencing details and notes that are referenced in the Streamworks report.	The stream construction sequence from the Streamworks report has been added to the plans.	C-701
Site Plans:			
6	There is a discrepancy between the survey plans (Doucet sheet 4 of 4) and the grading and drainage plans (Tighe & Bond sheet C-110) for size and shape of the outlet pipes crossing Goose Bay Drive. Please verify which is correct and correct the plans.	The Doucet plan was revised to correctly identify the size and shape of the Hodgson Brook outlet pipes.	Doucet Sheet 4 of 4
7	The grading plans should include spot grades to confirm the subcatchment boundaries.	There were already spot grades at high and low spots of the roads and loading areas. Additional spot grades were added in various places of the site to further clarify subcatchment areas.	C-108 - C-110

8	The plans should include locations for temporary sediment basins and other temporary erosion control measures typically seen on major site development projects.	The grading plan shows proposed silt sock and silt sack locations. Locations of temporary sediment basins and other forms of temporary erosion control measures are the responsibility of the contractor. Details for temporary erosions control measures are shown on sheet C-501.	N/A
9	The plans should provide documents as to how dewatering will occur on site and any special precautions necessary that are site specific.	Tighe & Bond has been retained by Lonza to perform a detailed Environmental Assessment for the site. The assessment is being performed in 3 stages. Currently 2 stages have been completed and reviewed with NHDES and PDA. The third stage of assessment will be performed closer to construction when building designs have been further developed and site design is finalized. Upon the completion of the third stage assessment, Tighe & Bond will provide recommendation to Lonza, PDA & NHDES for soil and groundwater management for the site. Based on the first 2 phases of assessment, dewatering recommendation will be to re-infiltrate on-site.	N/A
10	The project will impact a significant amount of on-site wetlands. There may be an opportunity to reuse the excavated wetland soils for reuse in the gravel wetlands or in the stream channel. Altus has found that one challenge in creating wetlands is establishing the vegetation. The landscape architect and wetlands scientist may want to comment on this opportunity.	Per Gove Environmental, the project wetland scientist, in theory there is no issue with reusing excavated wetland soils to construct the gravel wetlands. However, the contractor will be required to perform soil testing to confirm that the existing soil meets the requirements of gravel wetland soil. A note stating this option has been added to the gravel wetland details.	C-507 & C-508
11	It appears that the culverts discharging into the gravel wetland forebays will be under tail water conditions. The designer should review this design approach to see if there are any alternative solutions.	Due to the existing and proposed grades of the site the invert elevations of the culverts discharging into the gravel wetlands can not be raised.	C-108 - C-110
Detail Sheets:			
12	In order to ensure that the gravel wetland water level remains at the desired level a clay or other impervious membrane liner should be provided.	Note 3 on the gravel wetland details states that infiltration testing of the native soils shall be performed prior to construction. The soils shall be amended or a low permeability liner installed if the soils exceed the 0.03ft/day infiltration rate require by NHDES.	C-507 & C-508
13	The gravel wetland and rain garden planting plans should be stamped by a licensed landscape architect. In addition to the New England Erosion Control/Restoration mix, there are only 2 varieties of plantings in the gravel wetlands. A more diverse variety of plantings is recommended.	Additional plants were added to the planting list for the gravel wetlands as requested. Plantings specified for the gravel wetland and rain garden designs are typical plantings that have been included in prior designs approved by the City of Portsmouth and NHDES Alteration of Terrain Bureau. Same as these prior approved designs, the gravel wetland and rain garden plans have been stamped by professional engineers.	C-507 & C-508
14	The Hodgson Brook Wetland Planting Plan should be stamped by a licensed landscape architect. In addition to the Riverbank stabilization mix, only three species of plantings are proposed along the entire corridor.	The Hodgson Brook Wetland Planting Plan has been revised to match the planting requirements recommended in the Hodgson Brook Restoration Report prepared by Streamworks, PLLC.	C-702
Alteration of Terrain (AoT) Package/Drainage Calculations:			
15	The drainage study (AOT package) has not been stamped by the responsible Professional Engineer.	The drainage study (AOT package) has been stamped by the responsible Professional Engineer.	N/A
16	The Streamworks Report has not been stamped by the responsible Professional Engineer.	A stamped copy of the Hodgson Brook Restoration Report prepared by Streamworks, PLLC will be provided under a supplemental submission package in advance of the next TAC meeting.	N/A
	Section 6, BMP Worksheets:		
17	The name and stamp of the qualified professional who designed the planting plan for the gravel wetlands needs to be provided for all three gravel wetlands.	Plantings specified for the gravel wetland are typical plantings that have been included in prior designs approved by the City of Portsmouth and NHDES Alteration of Terrain Bureau. The gravel wetland plans are stamped by the professional engineers responsible for the design.	N/A

18	The flow lengths shown for the gravel wetlands do not seem to match the scaled flow lengths shown on the plans. Please review and correct as necessary.	The flow lengths for the gravel wetlands have been reviewed. The BMP asks for the flow length of each cell. As the two cells in both gravel wetlands are different lengths the average of the two cells was used. The NHDES requirement is that each cell is to be greater than 15 feet long which all cells meet.	N/A
	Section 7.2, Pre-Development Conditions:		
19	The color-coded soil map shows the 500 series soil to be HSG D, however the soil type legend and the soils report indicate that it is HSG C. This should be corrected and the calculations revised to reflect the correct soil type.	The soil map was revised to match the HSG listed in the Site Specific Soils Report. The drainage calculations have also been revised to reflect this change.	N/A
20	For the calculation of sheet flow time of concentration, the 2-year rainfall depth should be 3.68 inches to match the depth assumed for the analysis.	The 2-year rainfall depth was revised in the calculation of sheet flow time of concentration.	N/A
21	The analysis is deficient computations for the off-site drainage that flows onto and through the site. It appears that there may be a significant flow coming onto the site from the existing facility. These computations should be included in the analysis in both the pre-and post-development scenarios.	The stormwater runoff from the existing facility flows to either International Drive to the south or to an onsite detention pond. There is an existing swale along the south side of Goose Bay Drive that captures the runoff from the existing facility that discharges to the existing detention pond located in the northeast corner of the existing lot. There is no offsite runoff that flows onto the site from adjacent properties.	N/A
22	The existing triple arch culverts are partially submerged with sediment and are under tail water conditions. It does not appear that the designer took the current field conditions into consideration with their computations.	The point of analysis for the drainage calculations is located at the inlet of the existing triple arch culverts. The stormwater management system has been designed to reduce peak flows that ultimately discharge to the inlet of these culverts. Thus, the downstream tailwater conditions at the outlet of these culverts were not modeled.	N/A
	Section 7.3, Post-Development Conditions:		
23	As with the pre-development model, the soil types should be corrected to reflect the 500 series soils as HSG C.	The soil map was revised to match the HSG listed in the Site Specific Soils Report. The drainage calculations have also been revised to reflect this change.	N/A
24	The Soil Listing for the post-development model should be revised to reflect that much of the site will be developed and the existing soil types will not necessarily remain as they are. Please review and revise as necessary.	The drainage calculations were performed in such a way that the soil areas remained the same between the pre and post development conditions. The changes occurred where the ground cover changed to an impervious cover in the post development condition, either roof or paved impervious. This results in the Curve Number for the site increasing from 74 in the pre development condition to 87 in the post development condition. The underlying soils would not change between pre and post development conditions. The change in impervious cover is reflected in the color soil plans that are included as part of the Alteration of Terrain drainage report.	N/A
25	For the calculation of sheet flow time of concentration, the 2-year rainfall depth should be 3.68 inches to match the depth assumed for the analysis.	The 2-year rainfall depth was revised in the calculation of sheet flow time of concentration.	N/A
26	In general, the time of concentration longest flow path does not match the pipe sizes and slopes depicted on the plans.	The time of concentration calculations have been reviewed and revised as necessary.	N/A
27	The site has been modeled as five large subcatchments feeding into either constructed gravel wetlands, a rain garden or the re-constructed Hodgson Brook. Modeling the site in this manner may result in some inaccuracies as the calculated times of concentration are much longer than what would be seen if each structure were modeled as a subcatchment and pond. Additionally , this method does not provide a way to determine if catch basin grate capacity or pipe sizing is adequate. It is recommended that the site be modeled in a more conventional way so as to provide a more detailed analysis of the stormwater management system.	Modeling each treatment practice with a single watershed area is an engineering practice that Tighe & Bond has routinely submitted and had approved by the City of Portsmouth and NHDES Alteration of Terrain. Using a single watershed area for each treatment practice will generate slightly larger peak flow rates making the design of the treatment practices more conservative. In addition to modeling each treatment practice with a single watershed, separate calculations were performed on each individual structure to determine pipe sizing and grate capacities. Those calculations and subcatchment watershed plans have been included in the revised drainage analysis.	N/A
28	Subcatchment Post 1.3 is shown as entering Reach 1.3 (Hodgson Brook) directly, however it will need to pass through the pipe network modeled as Reach 1.2 before it reaches the brook. Please revise.	Subcatchment Post 1.2 (formerly Post 1.3) has been rerouted into Reach 1.2.	N/A

29	Reach 1.2 is modeled as a 54-inch diameter pipe, however the engineer has not provided calculations to show that this is adequate to convey the existing upstream flows into the system.	The existing Hodgson Brook culvert was measured at 49-inch. A 54-inch culvert was chosen as this was the closest conventional pipe size that was not smaller. Additionally, the design flows for Hodgson Brook were added to the drainage calculations per comment 30 in this review letter. The calculations show there is sufficient capacity in a 54-inch pipe.	N/A
30	Reaches 1.2 and 1.3 replace the existing underground culvert that carries Hodgson Brook . The model should reflect the existing brook flow and the anticipated flows from the modeled storms through these reaches.	The design flows used in the Streamworks Stream Restoration Report were added to Reach 1.2 to reflect the existing brook flow and the anticipated flows from the modeled storms through these reaches.	N/A
31	The analysis should include calculations to show that the existing pipes crossing Goose Bay Drive have sufficient capacity to carry the anticipated flows from the site as well as the flows from the Hodgson Brook watershed. The culverts are flowing under tail water conditions.	As noted above in Comment 30 response, design flows used in the Streamworks Report were added to model. As noted above in the Comment 22 response, the point of analysis for the drainage calculations is located at the inlet of the existing triple arch culverts. The stormwater management system has been designed to reduce peak flows that ultimately discharge to the inlet of these culverts. Thus, the downstream tailwater conditions at the outlet of these culverts were not modeled.	N/A
	Section 8, Rip Rap Apron Calculations:		
32	Please provide rip rap calculations for the outlet at HW 300 (Hodgson Brook). The design should include the flows from the upstream watershed.	The outlet of HW200 (formerly HW300) was designed as a plunge pool. The calculations for the plunge pool have been included with the revised drainage analysis.	N/A
	Section 11, Long Term Operation and Maintenance Plan		
33	The O & M plan should incorporate the recommended maintenance schedule for gravel wetlands contained in the publication "Design and Maintenance of Subsurface Gravel Wetlands " by the UNH Stormwater Center, dated February 4, 2015 or as amended . This document should recorded at the registry of deeds to ensure that the owner and/or subsequence owners are aware of the maintenance requirements.	The O & M plan was revised to add additional maintenance requirements for the gravel wetlands based on the recommendations by the UNH Stormwater center.	N/A
34	The O&M Plan should include the recommendations for the maintenance of the reconstructed Hodgson Brook.	Detailed maintenance recommendations for the Hodgson Brook restoration are provided in the Streamworks Report. The O&M plan has been revised to reference this report for the stream maintenance requirements.	N/A
	Appendix B, Soil Report and Boring Logs		
35	Provide boring logs for the test pits in the vicinity of the proposed gravel wetlands so as to verify the assumed seasonal high water shown in the BMP worksheets (TP-1, 2, 17 and 18).	Boring logs for the test pits in the vicinity of the proposed gravel wetlands and raingardens (TP-1, 2, 17 and 18) have been provided.	N/A





Tighe&Bond

Iron Parcel Redevelopment
70 & 80 Corporate Drive
Portsmouth, New Hampshire

Revised Drainage Analysis

Prepared For:

Lonza Biologics
101 International Drive
Portsmouth, New Hampshire

August 21, 2018

Section 6
BMP Worksheets

GRAVEL WETLAND DESIGN CRITERIA
(Env-Wq 1508.05)

Type/Node Name: **Gravel Wetland 1 (POND 1.0)**

Enter the node name in the drainage analysis if applicable

9.92	ac	A = Area draining to the practice	
6.98	ac	A_I = Impervious area draining to the practice	
0.70	decimal	I = percent impervious area draining to the practice, in decimal form	
0.68	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
6.78	ac-in	WQV= 1" x Rv x A	
24,594	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
2,459	cf	10% x WQV (check calc for sediment forebay and micropool volume)	
11,067	cf	45% x WQV (check calc for gravel wetland treatment bay volume)	
3,205	cf	V_{SED} = sediment forebay volume	← **≥ 10%WQV**
14,269	cf	V_{TB1} = volume of treatment bay 1	← **≥ 45%WQV**
20,912	cf	V_{TB2} = volume of treatment bay 2	← **≥ 45%WQV**
44.05	ft	E_{WQV} = elevation of WQV (attach stage-storage table)	
0.55	cfs	Q_{WQV} = discharge at the E_{WQV} (attach stage-discharge table)	← **<2Q_{avg}**
24.84	hours	T_{ED} = drawdown time of extended detention = 2WQV/Q_{WQV}	← **≥ 24-hrs**
3.00	:1	Pond side slopes	← **≥3:1**
39.50	ft	Elevation of SHWT	
41.35	ft	Epp = Elevation of the permanent pool (elevation of lowest orifice)[2]	← **≥ E_{SHWT} - 2 ft**
85.00	ft	Length of the flow path between the inlet and outlet in each cell	← **≥ 15 ft**
Trash rack		What mechanism is proposed to prevent the outlet structure from clogging (applicable for orifices/weirs with a dimension of ≤6")?	
47.28	ft	Peak elevation of the 50-year storm event (E_{50})	
48.00	ft	Berm elevation of the pond	
YES		E_{50} ≤ the berm elevation?	← **yes**

Qualified professional that developed the planting plan:
Name, Profession:

1. Volume stored above the wetland soil and below the high flow by-pass.
2. 4" to 8" below the wetland soil. If lowest orifice is less than 2 feet below SHWT, and saturated hydraulic conductivity (Ksat) is greater than 0.005 in/hr, the system must be lined.

Designer's Notes:

Stage-Discharge for Pond POND 1.0: GRAVEL WETLAND 1

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)
39.05	0.00	0.00	0.00
39.15	0.00	0.00	0.00
39.25	0.00	0.00	0.00
39.35	0.00	0.00	0.00
39.45	0.00	0.00	0.00
39.55	0.00	0.00	0.00
39.65	0.00	0.00	0.00
39.75	0.00	0.00	0.00
39.85	0.00	0.00	0.00
39.95	0.00	0.00	0.00
40.05	0.00	0.00	0.00
40.15	0.00	0.00	0.00
40.25	0.00	0.00	0.00
40.35	0.00	0.00	0.00
40.45	0.00	0.00	0.00
40.55	0.00	0.00	0.00
40.65	0.00	0.00	0.00
40.75	0.00	0.00	0.00
40.85	0.00	0.00	0.00
40.95	0.00	0.00	0.00
41.05	0.00	0.00	0.00
41.15	0.00	0.00	0.00
41.25	0.00	0.00	0.00
41.35	0.00	0.00	0.00
41.45	0.02	0.02	0.00
41.55	0.06	0.06	0.00
41.65	0.10	0.10	0.00
41.75	0.12	0.12	0.00
41.85	0.14	0.14	0.00
41.95	0.16	0.16	0.00
42.05	0.18	0.18	0.00
42.15	0.19	0.19	0.00
42.25	0.21	0.21	0.00
42.35	0.22	0.22	0.00
42.45	0.23	0.23	0.00
42.55	0.25	0.25	0.00
42.65	0.26	0.26	0.00
42.75	0.27	0.27	0.00
42.85	0.28	0.28	0.00
42.95	0.29	0.29	0.00
43.05	0.30	0.30	0.00
43.15	0.31	0.31	0.00
43.25	0.31	0.31	0.00
43.35	0.32	0.32	0.00
43.45	0.33	0.33	0.00
43.55	0.34	0.34	0.00
43.65	0.35	0.35	0.00
43.75	0.36	0.36	0.00
43.85	0.37	0.37	0.00
43.95	0.45	0.45	0.00
44.05	0.55	0.55	0.00
44.15	0.61	0.61	0.00
44.25	0.66	0.66	0.00
44.35	0.71	0.71	0.00
44.45	0.75	0.75	0.00
44.55	0.79	0.79	0.00
44.65	0.82	0.82	0.00
44.75	0.86	0.86	0.00
44.85	0.89	0.89	0.00
44.95	0.92	0.92	0.00
45.05	1.06	1.06	0.00
45.15	1.54	1.54	0.00
45.25	2.21	2.21	0.00
45.35	3.01	3.01	0.00
45.45	3.93	3.93	0.00
45.55	4.84	4.84	0.00
45.65	5.52	5.52	0.00
45.75	6.10	6.10	0.00
45.85	6.62	6.62	0.00
45.95	7.09	7.09	0.00
46.05	7.53	7.53	0.00
46.15	7.94	7.94	0.00
46.25	8.33	8.33	0.00
46.35	17.54	17.54	0.00
46.45	17.75	17.75	0.00
46.55	18.40	17.95	0.45
46.65	20.49	18.15	2.34
46.75	23.38	18.35	5.03
46.85	26.91	18.54	8.37
46.95	30.96	18.74	12.23
47.05	35.45	18.93	16.52
47.15	40.23	19.12	21.11
47.25	45.18	19.31	25.87
47.35	50.50	19.50	31.00
47.45	56.24	19.68	36.56
47.55	62.35	19.86	42.49
47.65	68.84	20.05	48.79
47.75	75.57	20.23	55.34
47.85	82.52	20.40	62.11
47.95	**89.66**	**20.58**	**69.08**

Stage-Area-Storage for Pond POND 1.0: GRAVEL WETLAND 1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
39.05	9,855	0
39.15	9,855	296
39.25	9,855	591
39.35	9,855	887
39.45	9,855	1,183
39.55	9,855	1,478
39.65	9,855	1,774
39.75	9,855	2,070
39.85	9,855	2,365
39.95	9,855	2,661
40.05	9,855	2,957
40.15	9,855	3,252
40.25	9,855	3,548
40.35	9,855	3,843
40.45	9,855	4,139
40.55	9,855	4,435
40.65	9,855	4,730
40.75	9,855	5,026
40.85	9,855	5,322
40.95	9,855	5,617
41.05	9,855	5,913
41.15	9,855	6,209
41.25	9,855	6,504
41.35	9,855	6,800
41.45	9,855	7,243
41.55	9,855	7,687
41.65	9,855	8,130
41.75	9,855	8,574
41.85	9,855	9,017
41.95	9,855	9,461
42.05	9,959	10,178
42.15	10,168	11,184
42.25	10,377	12,212
42.35	10,586	13,260
42.45	10,795	14,329
42.55	11,003	15,419
42.65	11,212	16,529
42.75	11,421	17,661
42.85	11,630	18,814
42.95	11,839	19,987
43.05	12,056	21,182
43.15	12,282	22,398
43.25	12,508	23,638
43.35	12,734	24,900
43.45	12,960	26,185
43.55	13,185	27,492
43.65	13,411	28,822
43.75	13,637	30,174
43.85	13,863	31,549
43.95	14,089	32,947
44.05	14,336	34,367
44.15	14,605	35,815
44.25	14,874	37,289
44.35	15,143	38,789
44.45	15,412	40,317
44.55	15,681	41,872
44.65	15,950	43,453
44.75	16,219	45,062
44.85	16,488	46,697
44.95	16,757	48,359
45.05	17,034	50,049
45.15	17,320	51,766
45.25	17,606	53,513
45.35	17,892	55,288
45.45	18,178	57,091
45.55	18,465	58,923
45.65	18,751	60,784
45.75	19,037	62,673
45.85	19,323	64,591
45.95	19,609	66,538
46.05	19,848	68,512
46.15	20,039	70,506
46.25	20,231	72,520
46.35	20,423	74,553
46.45	20,614	76,604
46.55	20,806	78,675
46.65	20,997	80,766
46.75	21,189	82,875
46.85	21,381	85,003
46.95	21,572	87,151
47.05	21,762	89,318
47.15	21,951	91,503
47.25	22,140	93,708
47.35	22,329	95,932
47.45	22,518	98,174
47.55	22,707	100,435
47.65	22,896	102,715
47.75	23,085	105,014
47.85	23,274	107,332
47.95	**23,463**	**109,669**

GRAVEL WETLAND DESIGN CRITERIA
(Env-Wq 1508.05)

Type/Node Name: **Gravel Wetland 2 (POND 1.1)**

Enter the node name in the drainage analysis if applicable

5.89	ac	A = Area draining to the practice	
3.17	ac	A_I = Impervious area draining to the practice	
0.54	decimal	I = percent impervious area draining to the practice, in decimal form	
0.53	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
3.15	ac-in	WQV= 1" x Rv x A	
11,428	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1,143	cf	10% x WQV (check calc for sediment forebay and micropool volume)	
5,143	cf	45% x WQV (check calc for gravel wetland treatment bay volume)	
3,510	cf	V_{SED} = sediment forebay volume	← **≥ 10%WQV**
11,448	cf	V_{TB1} = volume of treatment bay 1	← **≥ 45%WQV**
17,112	cf	V_{TB2} = volume of treatment bay 2	← **≥ 45%WQV**
51.98	ft	E_{WQV} = elevation of WQV (attach stage-storage table)	
0.15	cfs	Q_{WQV} = discharge at the E_{WQV} (attach stage-discharge table)	← **<2Q_{avg}**
42.33	hours	T_{ED} = drawdown time of extended detention = 2WQV/Q_{WQV}	← **≥ 24-hrs**
3.00	:1	Pond side slopes	← **≥3:1**
46.00	ft	Elevation of SHWT	
49.35	ft	Epp = Elevation of the permanent pool (elevation of lowest orifice)[2]	← **≥ E_{SHWT} - 2 ft**
105.00	ft	Length of the flow path between the inlet and outlet in each cell	← **≥ 15 ft**
Trash rack		What mechanism is proposed to prevent the outlet structure from clogging (applicable for orifices/weirs with a dimension of ≤6")?	
55.01	ft	Peak elevation of the 50-year storm event (E_{50})	
56.00	ft	Berm elevation of the pond	
YES		E_{50} ≤ the berm elevation?	← **yes**

Qualified professional that developed the planting plan:
Name, Profession:

1. Volume stored above the wetland soil and below the high flow by-pass.
2. 4" to 8" below the wetland soil. If lowest orifice is less than 2 feet below SHWT, and saturated hydraulic conductivity (Ksat) is greater than 0.005 in/hr, the system must be lined.

Designer's Notes:

Stage-Discharge for Pond POND 1.1: GRAVEL WETLAND 2

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
47.55	0.00	49.67	0.00	51.79	0.14	53.91	3.57
47.59	0.00	49.71	0.00	51.83	0.14	53.95	4.07
47.63	0.00	49.75	0.00	51.87	0.15	53.99	4.59
47.67	0.00	49.79	0.00	51.91	0.15	54.03	5.13
47.71	0.00	49.83	0.00	51.95	0.15	54.07	5.68
47.75	0.00	49.87	0.00	51.99	0.15	54.11	6.26
47.79	0.00	49.91	0.01	52.03	0.15	54.15	6.85
47.83	0.00	49.95	0.01	52.07	0.15	54.19	7.45
47.87	0.00	49.99	0.02	52.11	0.15	54.23	8.08
47.91	0.00	50.03	0.03	52.15	0.16	54.27	8.72
47.95	0.00	50.07	0.04	52.19	0.16	54.31	9.37
47.99	0.00	50.11	0.04	52.23	0.16	54.35	10.04
48.03	0.00	50.15	0.05	52.27	0.16	54.39	10.72
48.07	0.00	50.19	0.05	52.31	0.16	54.43	11.41
48.11	0.00	50.23	0.06	52.35	0.16	54.47	12.11
48.15	0.00	50.27	0.06	52.39	0.16	54.51	12.83
48.19	0.00	50.31	0.06	52.43	0.17	54.55	13.56
48.23	0.00	50.35	0.07	52.47	0.17	54.59	14.30
48.27	0.00	50.39	0.07	52.51	0.17	54.63	15.05
48.31	0.00	50.43	0.07	52.55	0.17	54.67	15.81
48.35	0.00	50.47	0.08	52.59	0.17	54.71	16.59
48.39	0.00	50.51	0.08	52.63	0.17	54.75	17.37
48.43	0.00	50.55	0.08	52.67	0.17	54.79	18.16
48.47	0.00	50.59	0.09	52.71	0.18	54.83	18.96
48.51	0.00	50.63	0.09	52.75	0.18	54.87	19.77
48.55	0.00	50.67	0.09	52.79	0.18	54.91	20.59
48.59	0.00	50.71	0.09	52.83	0.18	54.95	21.42
48.63	0.00	50.75	0.09	52.87	0.18	54.99	22.25
48.67	0.00	50.79	0.10	52.91	0.18	55.03	23.10
48.71	0.00	50.83	0.10	52.95	0.18	55.07	23.95
48.75	0.00	50.87	0.10	52.99	0.18	55.11	24.81
48.79	0.00	50.91	0.10	53.03	0.18	55.15	25.68
48.83	0.00	50.95	0.11	53.07	0.19	55.19	26.55
48.87	0.00	50.99	0.11	53.11	0.19	55.23	27.43
48.91	0.00	51.03	0.11	53.15	0.19	55.27	28.32
48.95	0.00	51.07	0.11	53.19	0.19	55.31	29.21
48.99	0.00	51.11	0.11	53.23	0.19	55.35	30.11
49.03	0.00	51.15	0.12	53.27	0.19	55.39	31.02
49.07	0.00	51.19	0.12	53.31	0.19	55.43	31.93
49.11	0.00	51.23	0.12	53.35	0.19	55.47	32.51
49.15	0.00	51.27	0.12	53.39	0.20	55.51	32.65
49.19	0.00	51.31	0.12	53.43	0.20	55.55	32.79
49.23	0.00	51.35	0.13	53.47	0.20	55.59	32.93
49.27	0.00	51.39	0.13	53.51	0.21	55.63	33.07
49.31	0.00	51.43	0.13	53.55	0.35	55.67	33.21
49.35	0.00	51.47	0.13	53.59	0.55	55.71	33.35
49.39	0.00	51.51	0.13	53.63	0.81	55.75	33.48
49.43	0.00	51.55	0.13	53.67	1.11	55.79	33.62
49.47	0.00	51.59	0.14	53.71	1.45	55.83	33.76
49.51	0.00	51.63	0.14	53.75	1.82	55.87	33.89
49.55	0.00	51.67	0.14	53.79	2.22	55.91	34.03
49.59	0.00	51.71	0.14	53.83	2.65	55.95	34.16
49.63	0.00	51.75	0.14	53.87	3.10	55.99	**34.29**

Stage-Area-Storage for Pond POND 1.1: GRAVEL WETLAND 2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
47.55	6,269	0
47.65	6,269	188
47.75	6,269	376
47.85	6,269	564
47.95	6,269	752
48.05	6,269	940
48.15	6,269	1,128
48.25	6,269	1,316
48.35	6,269	1,505
48.45	6,269	1,693
48.55	6,269	1,881
48.65	6,269	2,069
48.75	6,269	2,257
48.85	6,269	2,445
48.95	6,269	2,633
49.05	6,269	2,821
49.15	6,269	3,009
49.25	6,269	3,197
49.35	6,269	3,385
49.45	6,269	3,573
49.55	6,269	3,761
49.65	6,269	3,949
49.75	6,269	4,138
49.85	6,269	4,326
49.95	6,269	4,608
50.05	6,269	4,890
50.15	6,269	5,172
50.25	6,269	5,454
50.35	6,269	5,736
50.45	6,269	6,018
50.55	6,362	6,475
50.65	6,548	7,121
50.75	6,734	7,785
50.85	6,920	8,467
50.95	7,106	9,169
51.05	7,298	9,889
51.15	7,497	10,629
51.25	7,696	11,388
51.35	7,895	12,168
51.45	8,094	12,967
51.55	8,292	13,786
51.65	8,491	14,626
51.75	8,690	15,485
51.85	8,889	16,364
51.95	9,088	17,262
52.05	9,295	18,181
52.15	9,511	19,122
52.25	9,727	20,083
52.35	9,942	21,067
52.45	10,158	22,072
52.55	10,374	23,099
52.65	10,590	24,147
52.75	10,806	25,216
52.85	11,021	26,308
52.95	11,237	27,421
53.05	11,468	28,556
53.15	11,715	29,715
53.25	11,962	30,899
53.35	12,209	32,107
53.45	12,456	33,341
53.55	12,703	34,598
53.65	12,950	35,881
53.75	13,197	37,188
53.85	13,444	38,520
53.95	13,691	39,877
54.05	13,956	41,259
54.15	14,239	42,669
54.25	14,522	44,107
54.35	14,805	45,573
54.45	15,088	47,068
54.55	15,371	48,591
54.65	15,654	50,142
54.75	15,937	51,722
54.85	16,220	53,329
54.95	16,503	54,966
55.05	16,803	56,630
55.15	17,119	58,327
55.25	17,435	60,054
55.35	17,751	61,814
55.45	18,067	63,604
55.55	18,383	65,427
55.65	18,699	67,281
55.75	19,015	69,167
55.85	19,331	71,084
55.95	**19,647**	**73,033**

FILTRATION PRACTICE DESIGN CRITERIA
(Env-Wq 1508.07)

Type/Node Name: **Rain Garden 1.0 (POND 1.5)**

Enter the type of filtration practice (e.g., bioretention system) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed the restrictions on unlined systems outlined in Env-Wq 1508.07(a)?	
4.93	ac	A = Area draining to the practice	
4.19	ac	A_I = Impervious area draining to the practice	
0.85	decimal	I = percent impervious area draining to the practice, in decimal form	
0.82	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
4.02	ac-in	WQV= 1" x Rv x A	
14,597	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
3,649	cf	25% x WQV (check calc for sediment forebay volume)	
10,947	cf	75% x WQV (check calc for surface sand filter volume)	
Deep sumps		Method of Pretreatment? (not required for clean or roof runoff)	
	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
10,217	sf	A_{SA} = surface area of the practice	
0.30	iph	I_{DESIGN} = design infiltration rate[1]	
Yes	Yes/No	If I_{DESIGN} is < 0.50 iph, has an underdrain been provided?	
57.1	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
43.50	feet	E_{FC} = elevation of the bottom of the filter course material[2]	
42.42	feet	E_{UD} = invert elevation of the underdrain (UD), if applicable	
39.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
36.50	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
1.08	feet	$D_{FC\ to\ UD}$ = depth to UD from the bottom of the filter course	← ≥ 1'
7.00	feet	$D_{FC\ to\ ROCK}$ = depth to bedrock from the bottom of the filter course	← ≥ 1'
4.50	feet	$D_{FC\ to\ SHWT}$ = depth to SHWT from the bottom of the filter course	← ≥ 1'
49.64	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
50.00	ft	Elevation of the top of the practice	
YES		50 peak elevation ≤ Elevation of the top of the practice	← yes

If a surface sand filter or underground sand filter is proposed:

YES	ac	Drainage Area check.	← < 10 ac
	cf	V = volume of storage[3] (attach a stage-storage table)	← ≥ 75%WQV
	inches	D_{FC} = filter course thickness	← 18", or 24" if within GPA
Sheet		Note what sheet in the plan set contains the filter course specification	
	Yes/No	Access grate provided?	← yes

If a bioretention area is proposed:

YES	ac	Drainage Area no larger than 5 ac?	← **yes**
34,000	cf	V = volume of storage[3] (attach a stage-storage table)	← **≥ WQV**
18.0	inches	D_{FC} = filter course thickness	← **18", or 24" if within GPA**
Sheet C-508		Note what sheet in the plan set contains the filter course specification	
3.0	:1	Pond side slopes	← **≥3:1**
Sheet C-508		Note what sheet in the plan set contains the planting plans and surface cover	

If porous pavement is proposed:

		Type of pavement proposed (concrete? Asphalt? Pavers? Etc)	
	acres	A_{SA} = surface area of the pervious pavement	
1.0	:1	ratio of the contributing area to the pervious surface area	← **5:1**
	inches	D_{FC} = filter course thickness	← **12", or 18" if within GPA**
Sheet		Note what sheet in the plan set contains the filter course spec.	← **304.1 sand**

1. Rate of the limiting layer (either the filter course or the underlying soil). See Env-Wq 1504.14 for guidance on determining the infiltration rate.

2. See lines 34, 40 and 48 for required depths of filter media.

3. Volume without depending on infiltration. The volume includes the storage above the filter (but below the invert of the outlet stucture, if any), the filter media voids, and the pretreatment area. The storage above the filter media shall not include the volume above the outlet structure, if any.

Designer's Notes:

Stage-Area-Storage for Pond POND 1.4: RAINGARDEN 1.0

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
42.17	10,217	0
42.27	10,217	409
42.37	10,217	817
42.47	10,217	1,226
42.57	10,217	1,635
42.67	10,217	2,043
42.77	10,217	2,452
42.87	10,217	2,861
42.97	10,217	3,269
43.07	10,217	3,678
43.17	10,217	4,087
43.27	10,217	4,495
43.37	10,217	4,904
43.47	10,217	5,313
43.57	10,217	5,507
43.67	10,217	5,609
43.77	10,217	5,711
43.87	10,217	5,813
43.97	10,217	5,916
44.07	10,217	6,018
44.17	10,217	6,120
44.27	10,217	6,222
44.37	10,217	6,324
44.47	10,217	6,426
44.57	10,217	6,529
44.67	10,217	6,631
44.77	10,217	6,733
44.87	10,217	6,835
44.97	10,217	6,937
45.07	10,309	7,686
45.17	10,441	8,724
45.27	10,572	9,775
45.37	10,704	10,838
45.47	10,835	11,915
45.57	10,967	13,005
45.67	11,098	14,109
45.77	11,230	15,225
45.87	11,361	16,354
45.97	11,493	17,497
46.07	11,630	18,653
46.17	11,770	19,823
46.27	11,910	21,007
46.37	12,050	22,205
46.47	12,190	23,417
46.57	12,330	24,643
46.67	12,470	25,883
46.77	12,610	27,137
46.87	12,750	28,405
46.97	12,890	29,687
47.07	13,030	30,983
47.17	13,170	32,293
47.27	13,310	33,617
47.37	13,450	34,955
47.47	13,590	36,307
47.57	13,730	37,673
47.67	13,870	39,053
47.77	14,010	40,447
47.87	14,150	41,855
47.97	14,290	43,277
48.07	14,444	44,714
48.17	14,604	46,166
48.27	14,764	47,634
48.37	14,924	49,119
48.47	15,084	50,619
48.57	15,243	52,135
48.67	15,403	53,668
48.77	15,563	55,216
48.87	15,723	56,780
48.97	15,883	58,361
49.07	16,043	59,957
49.17	16,203	61,569
49.27	16,363	63,198
49.37	16,523	64,842
49.47	16,683	66,502
49.57	16,842	68,178
49.67	17,002	69,871
49.77	17,162	71,579
49.87	17,322	73,303
49.97	**17,482**	**75,043**

Section 7
Drainage Analysis

7.1 Calculation Methods

The design storms analyzed in this study are the 2-year, 10-year, 25-year and 50-year 24-hour duration storm events. The pre-development 1-year, 24-hour duration storm was also analyzed for channel protection requirements. The stormwater modeling system, HydroCAD 10.0 was utilized to predict the peak runoff rates from these storm events. The peak discharge rates were determined by analyzing Type III 24-hour storm events. The rainfall data for these storm events was obtained from the data published by the Northeast Regional Climate Center at Cornell University, with an additional 15% added factor of safety as required by Env-Wq 1503.08(l).

The time of concentration was computed using the TR-55 Method, which provides a means of determining the time for an entire watershed to contribute runoff to a specific location via sheet flows, shallow concentrated flow and channel flow. Runoff curve numbers were calculated by estimating the coverage areas and then summing the curve number for the coverage area as a percent of the entire watershed.

References:

1. HydroCAD Stormwater Modeling System, by HydroCAD Software Solutions LLC, Chocorua, New Hampshire.

2. New Hampshire Stormwater Management Manual, Volume 2, Post-Construction Best Management Practices Selection and Design, December 2008.

7.2 Pre-Development Conditions

In order to analyze the pre-development condition, the site has been divided into two watershed areas modeled at two points of analysis. These points of analysis and watersheds are depicted on the plan entitled “Pre-Development Watershed Plan”, Sheet C-801.

Each of the points of analysis and their contributing watershed areas are described below:

Point of Analysis (PA1)

PRE 1.0 make up almost the entire area to be developed. This area consists of the entire undeveloped parcel, as well as, a portion of Corporate Drive that drains onto the parcel via a closed drainage system. Currently the watershed is an undeveloped field area that with a portion of the site being used as a temporary construction parking area with associated stormwater management controls near the center of the parcel. This parcel was previously developed as military housing that was demolished in the mid to late 1990’s. Runoff from this area travels southeast via overland flow to Point of Analysis 1 located at the existing Hodgson Brook outlet headwall. REACH 1.0 takes into account the existing flows for Hodgson Brook flowing through the site which also discharges at PA1.

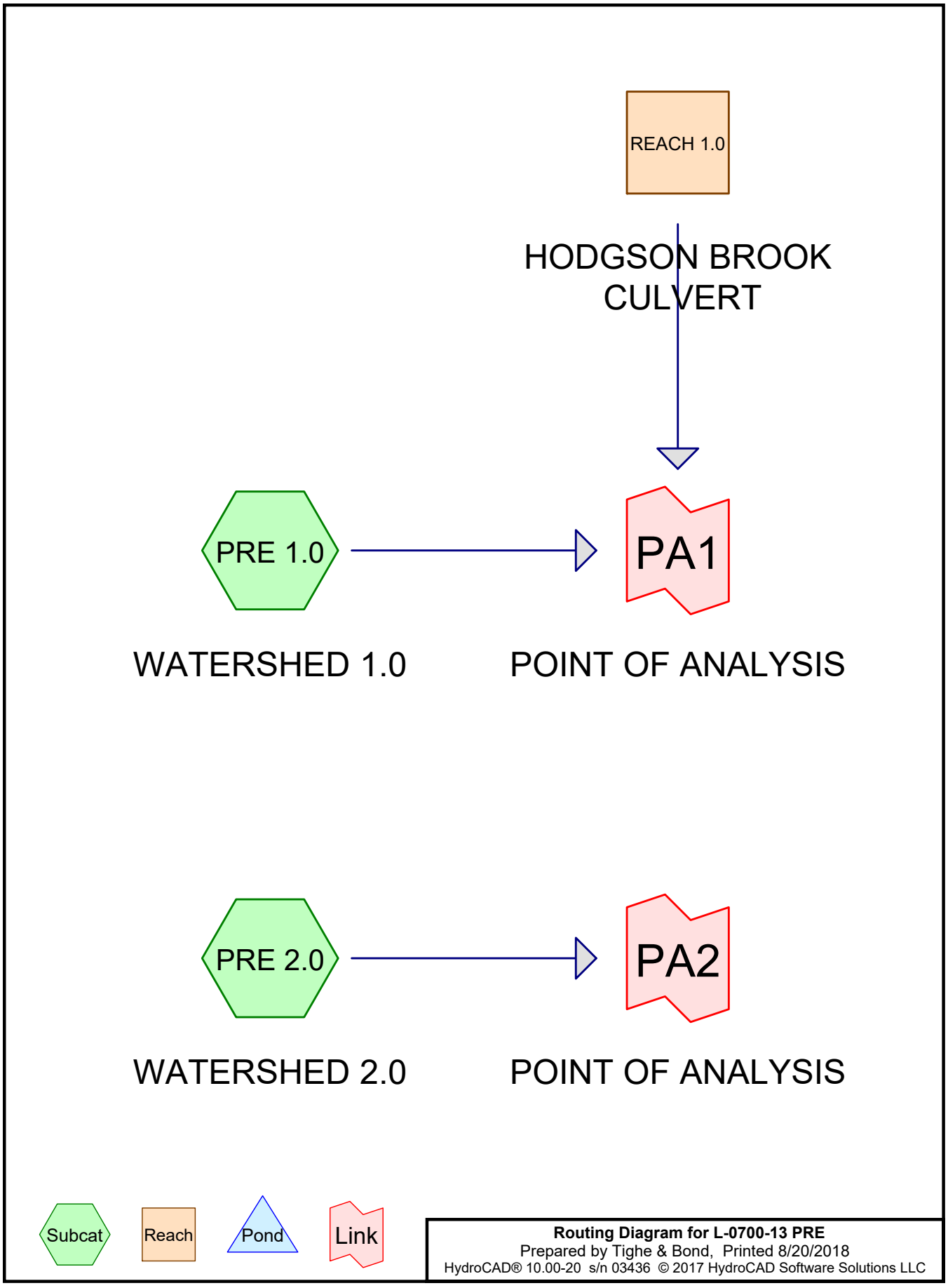
Point of Analysis (PA2)

PRE 2.0 is comprised mostly of runoff from Goose Bay Drive that is located between the undeveloped parcel and the existing Lonza facility. Runoff from this area travels via overland flow to the existing stormwater basin located at the existing Lonza facility. Point of Analysis 2 (PA2) is located at the existing basin.

7.2.1 Pre-Development Calculations

7.2.2 Pre-Development Watershed Plans

7.2.3 Pre-Development Soil Plan



Routing Diagram for L-0700-13 PRE
Prepared by Tighe & Bond, Printed 8/20/2018

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.181	74	>75% Grass cover, Good, HSG C (PRE 2.0)
2.274	91	Gravel roads, HSG D (PRE 1.0)
3.289	58	Meadow, non-grazed, HSG B (PRE 1.0)
19.425	71	Meadow, non-grazed, HSG C (PRE 1.0)
0.044	78	Meadow, non-grazed, HSG D (PRE 1.0)
3.281	98	Paved parking, HSG C (PRE 1.0, PRE 2.0)
0.297	55	Woods, Good, HSG B (PRE 1.0)
1.123	70	Woods, Good, HSG C (PRE 1.0)
29.915	**74**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.586	HSG B	PRE 1.0
24.010	HSG C	PRE 1.0, PRE 2.0
2.318	HSG D	PRE 1.0
0.000	Other	
29.915		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 PRE 1.0: WATERSHED 1.0 Runoff Area=1,275,946 sf 9.69% Impervious Runoff Depth>0.93"
Flow Length=1,805' Tc=34.4 min CN=74 Runoff=16.01 cfs 2.273 af

Subcatchment PRE 2.0: WATERSHED 2.0 Runoff Area=27,141 sf 70.91% Impervious Runoff Depth>2.12"
Flow Length=650' Slope=0.0250 '/' Tc=5.0 min CN=91 Runoff=1.53 cfs 0.110 af

Reach REACH 1.0: HODGSON BROOK Avg. Flow Depth=0.33' Max Vel=4.64 fps Inflow=2.33 cfs 4.631 af
50.0" Round Pipe n=0.012 L=1,260.0' S=0.0111 '/' Capacity=182.90 cfs Outflow=2.33 cfs 4.617 af

Link PA1: POINT OF ANALYSIS Inflow=18.34 cfs 6.890 af
Primary=18.34 cfs 6.890 af

Link PA2: POINT OF ANALYSIS Inflow=1.53 cfs 0.110 af
Primary=1.53 cfs 0.110 af

Total Runoff Area = 29.915 ac Runoff Volume = 2.383 af Average Runoff Depth = 0.96"
89.03% Pervious = 26.634 ac 10.97% Impervious = 3.281 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 PRE 1.0: WATERSHED 1.0 Runoff Area=1,275,946 sf 9.69% Impervious Runoff Depth>1.35"
Flow Length=1,805' Tc=34.4 min CN=74 Runoff=24.04 cfs 3.305 af

Subcatchment PRE 2.0: WATERSHED 2.0 Runoff Area=27,141 sf 70.91% Impervious Runoff Depth>2.71"
Flow Length=650' Slope=0.0250 '/' Tc=5.0 min CN=91 Runoff=1.94 cfs 0.141 af

Reach REACH 1.0: HODGSON BROOK Avg. Flow Depth=0.55' Max Vel=6.40 fps Inflow=6.80 cfs 13.516 af
50.0" Round Pipe n=0.012 L=1,260.0' S=0.0111 '/' Capacity=182.90 cfs Outflow=6.80 cfs 13.485 af

Link PA1: POINT OF ANALYSIS Inflow=30.84 cfs 16.790 af
Primary=30.84 cfs 16.790 af

Link PA2: POINT OF ANALYSIS Inflow=1.94 cfs 0.141 af
Primary=1.94 cfs 0.141 af

Total Runoff Area = 29.915 ac Runoff Volume = 3.446 af Average Runoff Depth = 1.38"
89.03% Pervious = 26.634 ac 10.97% Impervious = 3.281 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 PRE 1.0: WATERSHED 1.0 Runoff Area=1,275,946 sf 9.69% Impervious Runoff Depth>2.81"
Flow Length=1,805' Tc=34.4 min CN=74 Runoff=51.45 cfs 6.870 af

Subcatchment PRE 2.0: WATERSHED 2.0 Runoff Area=27,141 sf 70.91% Impervious Runoff Depth>4.54"
Flow Length=650' Slope=0.0250 '/' Tc=5.0 min CN=91 Runoff=3.18 cfs 0.236 af

Reach REACH 1.0: HODGSON Avg. Flow Depth=0.82' Max Vel=8.17 fps Inflow=15.50 cfs 30.808 af
50.0" Round Pipe n=0.012 L=1,260.0' S=0.0111 '/' Capacity=182.90 cfs Outflow=15.50 cfs 30.753 af

Link PA1: POINT OF ANALYSIS Inflow=66.95 cfs 37.623 af
Primary=66.95 cfs 37.623 af

Link PA2: POINT OF ANALYSIS Inflow=3.18 cfs 0.236 af
Primary=3.18 cfs 0.236 af

Total Runoff Area = 29.915 ac Runoff Volume = 7.106 af Average Runoff Depth = 2.85"
89.03% Pervious = 26.634 ac 10.97% Impervious = 3.281 ac

Summary for Subcatchment PRE 1.0: WATERSHED 1.0

Runoff = 51.45 cfs @ 12.49 hrs, Volume= 6.870 af, Depth> 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
143,279	58	Meadow, non-grazed, HSG B
12,922	55	Woods, Good, HSG B
846,158	71	Meadow, non-grazed, HSG C
123,662	98	Paved parking, HSG C
48,932	70	Woods, Good, HSG C
1,932	78	Meadow, non-grazed, HSG D
99,061	91	Gravel roads, HSG D
1,275,946	74	Weighted Average
1,152,284		90.31% Pervious Area
123,662		9.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	100	0.0400	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
0.1	11	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	70	0.0290	1.19		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.4	1,089	0.0147	0.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.6	120	0.0330	1.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	368	0.0160	1.90		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.2	47	0.0050	4.03	4.95	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
34.4	1,805	Total			

Summary for Subcatchment PRE 2.0: WATERSHED 2.0

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.18 cfs @ 12.07 hrs, Volume= 0.236 af, Depth> 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
7,895	74	>75% Grass cover, Good, HSG C
19,246	98	Paved parking, HSG C
27,141	91	Weighted Average
7,895		29.09% Pervious Area
19,246		70.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0250	1.61		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.68"
2.9	550	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.9	650	Total, Increased to minimum Tc = 5.0 min			

Summary for Reach REACH 1.0: HODGSON BROOK CULVERT

This reach takes into account the flows used for the Hodgson Brook stream restoration design. The flow rates were taken from "The Restoration of Hodgson Brook at the Iron Rail Parcel at Pease Tradeport in Portsmouth, NH" prepared by Streamworks, PLLC, dated May 28 2018. In the pre-development conditions of the site, the flow in the culvert flows throught the site to Point of Analysis 1, but does not collect additional runoff from the site.

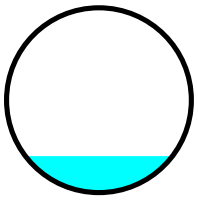
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow = 15.50 cfs @ 0.00 hrs, Volume= 30.808 af, Incl. 15.50 cfs Base Flow
Outflow = 15.50 cfs @ 0.80 hrs, Volume= 30.753 af, Atten= 0%, Lag= 48.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.17 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 8.17 fps, Avg. Travel Time= 2.6 min

Peak Storage= 2,390 cf @ 0.80 hrs
Average Depth at Peak Storage= 0.82'
Bank-Full Depth= 4.17' Flow Area= 13.6 sf, Capacity= 182.90 cfs

50.0" Round Pipe
n= 0.012 Concrete pipe, finished
Length= 1,260.0' Slope= 0.0111 '/'
Inlet Invert= 49.90', Outlet Invert= 35.90'



Summary for Link PA1: POINT OF ANALYSIS

Inflow Area = 29.292 ac, 9.69% Impervious, Inflow Depth > 15.41" for 10 Year event
Inflow = 66.95 cfs @ 12.49 hrs, Volume= 37.623 af
Primary = 66.95 cfs @ 12.49 hrs, Volume= 37.623 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link PA2: POINT OF ANALYSIS

Inflow Area = 0.623 ac, 70.91% Impervious, Inflow Depth > 4.54" for 10 Year event
Inflow = 3.18 cfs @ 12.07 hrs, Volume= 0.236 af
Primary = 3.18 cfs @ 12.07 hrs, Volume= 0.236 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 PRE 1.0: WATERSHED 1.0 Runoff Area=1,275,946 sf 9.69% Impervious Runoff Depth>4.08"
Flow Length=1,805' Tc=34.4 min CN=74 Runoff=74.65 cfs 9.948 af

Subcatchment PRE 2.0: WATERSHED 2.0 Runoff Area=27,141 sf 70.91% Impervious Runoff Depth>6.00"
Flow Length=650' Slope=0.0250 '/' Tc=5.0 min CN=91 Runoff=4.13 cfs 0.312 af

Reach REACH 1.0: HODGSON Avg. Flow Depth=1.02' Max Vel=9.28 fps Inflow=24.00 cfs 47.702 af
50.0" Round Pipe n=0.012 L=1,260.0' S=0.0111 '/' Capacity=182.90 cfs Outflow=24.00 cfs 47.628 af

Link PA1: POINT OF ANALYSIS Inflow=98.65 cfs 57.576 af
Primary=98.65 cfs 57.576 af

Link PA2: POINT OF ANALYSIS Inflow=4.13 cfs 0.312 af
Primary=4.13 cfs 0.312 af

Total Runoff Area = 29.915 ac Runoff Volume = 10.260 af Average Runoff Depth = 4.12"
89.03% Pervious = 26.634 ac 10.97% Impervious = 3.281 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 PRE 1.0: WATERSHED 1.0 Runoff Area=1,275,946 sf 9.69% Impervious Runoff Depth>5.30"
Flow Length=1,805' Tc=34.4 min CN=74 Runoff=96.92 cfs 12.949 af

Subcatchment PRE 2.0: WATERSHED 2.0 Runoff Area=27,141 sf 70.91% Impervious Runoff Depth>7.38"
Flow Length=650' Slope=0.0250 '/' Tc=5.0 min CN=91 Runoff=5.01 cfs 0.383 af

Reach REACH 1.0: HODGSON Avg. Flow Depth=1.29' Max Vel=10.60 fps Inflow=38.20 cfs 75.926 af
50.0" Round Pipe n=0.012 L=1,260.0' S=0.0111 '/' Capacity=182.90 cfs Outflow=38.22 cfs 75.822 af

Link PA1: POINT OF ANALYSIS Inflow=135.12 cfs 88.771 af
Primary=135.12 cfs 88.771 af

Link PA2: POINT OF ANALYSIS Inflow=5.01 cfs 0.383 af
Primary=5.01 cfs 0.383 af

Total Runoff Area = 29.915 ac Runoff Volume = 13.332 af Average Runoff Depth = 5.35"
89.03% Pervious = 26.634 ac 10.97% Impervious = 3.281 ac

NOTES:
1. SOIL SURVEY WAS PERFORMED BY GOVE ENVIRONMENTAL SERVICES.

SOIL IDENTIFICATION LEGEND

SYMBOL	SOIL TAXONOMIC NAME, SLOPE RATING
89C	CHATFIELD, 8 TO 15 PERCENT SLOPES
313B	DEERFIELD, 0 TO 8 PERCENT SLOPES
313C	DEERFIELD, 8 TO 15 PERCENT SLOPES
915B	DEERFIELD VARIANT, 0 TO 8 PERCENT SLOPES
546B/P	WALPOLE POORLY DRAINED, 0 TO 8 PERCENT SLOPES
799B	UDORTHENTS URBAN LAND, 0 TO 8 PERCENT SLOPES
799E	UDORTHENTS URBAN LAND, >25 PERCENT SLOPES

Tighe&Bond
Engineers | Environmental Specialists

Proposed Industrial Development

Lonza Biologics

Portsmouth,
New Hampshire

MARK	DATE	DESCRIPTION
D	8/21/2018	REVISED TAC SUBMISSION
C	6/18/2018	NHDES AOT SUBMISSION
B	5/21/2018	TAC SUBMISSION
A	4/3/2018	TAC WS SUBMISSION

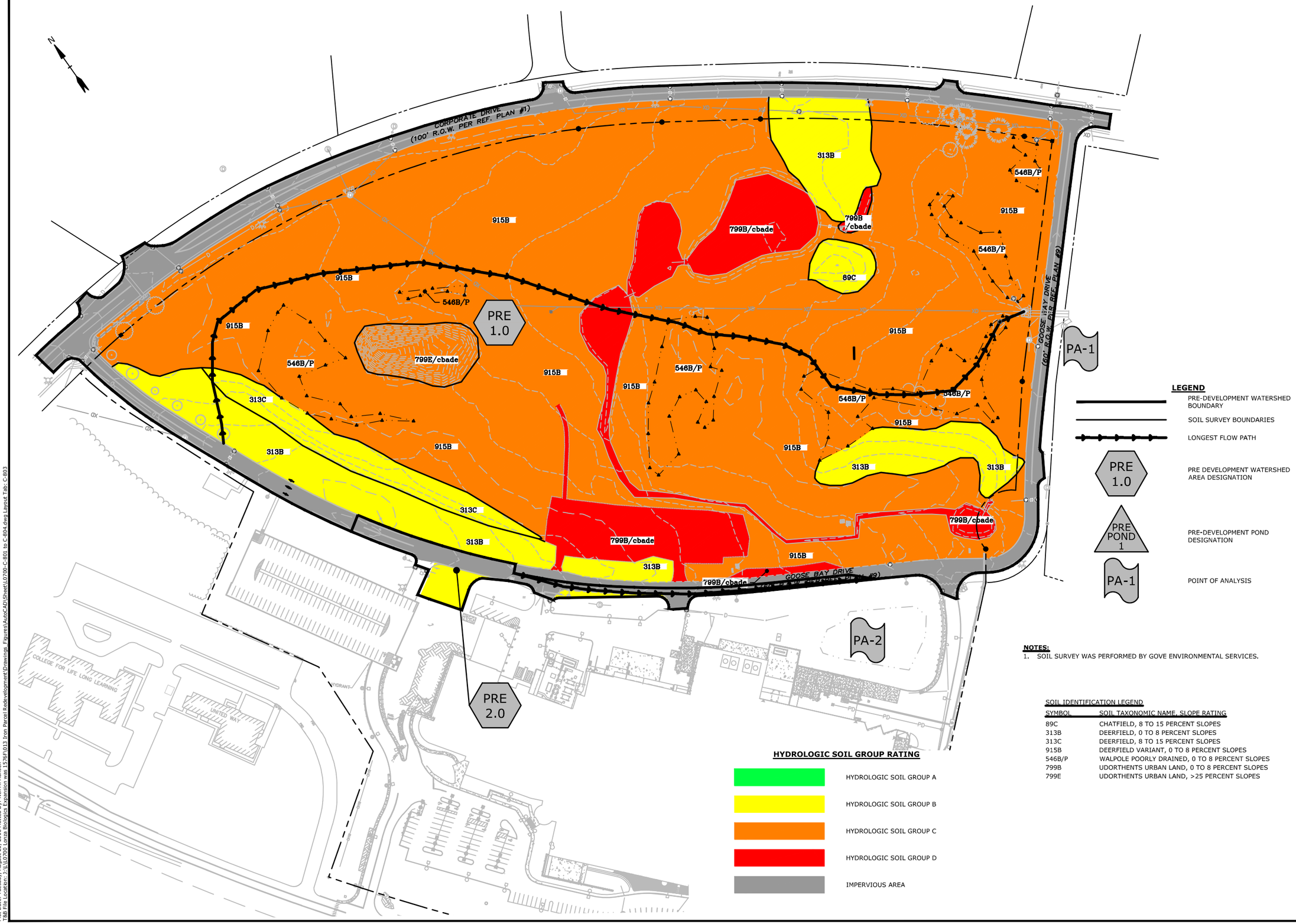
PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L0700-C-801 to C-804.dwg
DRAWN BY:	NAH
CHECKED:	PMC
APPROVED:	BLM

PRE-DEVELOPMENT WATERSHED AREA PLAN

SCALE: AS SHOWN

C-801

Last Save Date: August 20, 2018 4:05 PM By: NAHANSEN
Plot Date/Time: August 20, 2018 4:05 PM By: NAHANSEN
T&B File Location: J:\LL\L0700 Lonza Biologics Expansion was 1576F\013 Iron Parcel Redevelopment\Drawings_Figures\AutoCAD\Sheet\L0700-C-801 to C-804.dwg Layout Tab: C-801



LEGEND

- PRE-DEVELOPMENT WATERSHED BOUNDARY
- SOIL SURVEY BOUNDARIES
- LONGEST FLOW PATH
- PRE 1.0 — PRE DEVELOPMENT WATERSHED AREA DESIGNATION
- PRE POND 1 — PRE-DEVELOPMENT POND DESIGNATION
- PA-1 — POINT OF ANALYSIS

SCALE IN FEET
0 80' 160'
GRAPHIC SCALE

NOTES:
1. SOIL SURVEY WAS PERFORMED BY GOVE ENVIRONMENTAL SERVICES.

SOIL IDENTIFICATION LEGEND

SYMBOL	SOIL TAXONOMIC NAME, SLOPE RATING
89C	CHATFIELD, 8 TO 15 PERCENT SLOPES
313B	DEERFIELD, 0 TO 8 PERCENT SLOPES
313C	DEERFIELD, 8 TO 15 PERCENT SLOPES
915B	DEERFIELD VARIANT, 0 TO 8 PERCENT SLOPES
546B/P	WALPOLE POORLY DRAINED, 0 TO 8 PERCENT SLOPES
799B	UDORTHENTS URBAN LAND, 0 TO 8 PERCENT SLOPES
799E	UDORTHENTS URBAN LAND, >25 PERCENT SLOPES

HYDROLOGIC SOIL GROUP RATING

- HYDROLOGIC SOIL GROUP A
- HYDROLOGIC SOIL GROUP B
- HYDROLOGIC SOIL GROUP C
- HYDROLOGIC SOIL GROUP D
- IMPERVIOUS AREA

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Proposed Industrial Development

Lonza Biologics

Portsmouth,
New Hampshire

MARK	DATE	DESCRIPTION
D	8/21/2018	REVISED TAC SUBMISSION
C	6/18/2018	NHDES AOT SUBMISSION
B	5/21/2018	TAC SUBMISSION
A	4/3/2018	TAC WS SUBMISSION

PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L0700-C-801 to C-804.dwg
DRAWN BY:	NAH
CHECKED:	PMC
APPROVED:	BLM

PRE-DEVELOPMENT SOIL PLAN

SCALE: AS SHOWN

C-803

Last Save Date: August 20, 2018 5:35 PM By: NAHANSEN
Plotted: August 21, 2018 8:46 AM By: Nathan Hansen
T&B File Location: J:\LU\L0700 Lonza Biologics Expansion was 1576\013 Iron Parcel Redevelopment\Drawings, Figures\AutoCAD\Sheet\L0700-C-801 to C-804.dwg Layout Tab: C-803

7.3 Post-Development Conditions

The post-development condition was analyzed by dividing the watersheds into six sub-catchment areas. Stormwater runoff from these sub-catchment areas flow to two gravel wetlands and one rain garden for treatment prior to discharging to the existing Hodgson Brook outlet. Flows from these sub-catchment areas are modeled at the same two points of analysis that were modeled in the pre-development analysis, PA1 and PA2. These points of analysis and sub-catchment areas are depicted on the plan entitled "Post-Development Watershed Plan", Sheet C-802.

Subcatchment plans and calculations have also been performed to determine pipe sizes and grate capacities of the proposed drainage structures. These sub-catchment areas are depicted on the plan entitled "Post-Development Subcatchment Plan", Sheets C-802.1, C-802.2 and C-802.3.

Each of the points of analysis and their contributing watershed areas are described below:

Point of Analysis (PA1)

Point of Analysis 1 (PA1) is located at the existing Hodgson Brook outlet headwall. For the purposes of this analysis, the area contributing to Point of Analysis 1 (PA1) has been divided into five sub-catchment areas (see plan C-802). Sub-catchments POST 1.0, POST 1.1, POST 1.2, POST 1.3 and POST 1.4 contribute to this point of analysis and consist of grass, paved parking lots, concrete sidewalks, and roof areas. Runoff generated in these sub-catchment areas is collected via one rain garden and two gravel wetlands which treat and discharge stormwater runoff either to infiltration or to PA1. Runoff from sub-catchments POST 1.0, 1.1 and 1.4 flow via overland flow to the closed drainage then flows via underground piping to one of the gravel wetlands or rain garden. Flows from sub-catchment POST 1.2 flows via overland flow to the Hodgson Brook restoration area (REACH 1.2) then flows via the brook until reach PA1. The existing flows for Hodgson Brook have also been added to REACH 1.2 to account for the existing stream capacity flowing through the site. Runoff from POND 1.1 also flows via REACH 1.2 to PA1. Runoff from sub-catchment area POST 1.3 flows via overland flow to PA1. PA1 is shown on the Post-Development Watershed Plan (C-802).

Point of Analysis (PA2)

POST 2.0 is comprised mostly of runoff from Goose Bay Drive that is located between the undeveloped parcel and the existing Lonza facility. Runoff from this area travels via overland flow to the existing stormwater basin located at the existing Lonza facility. Point of Analysis 2 (PA2) is located at the existing basin.

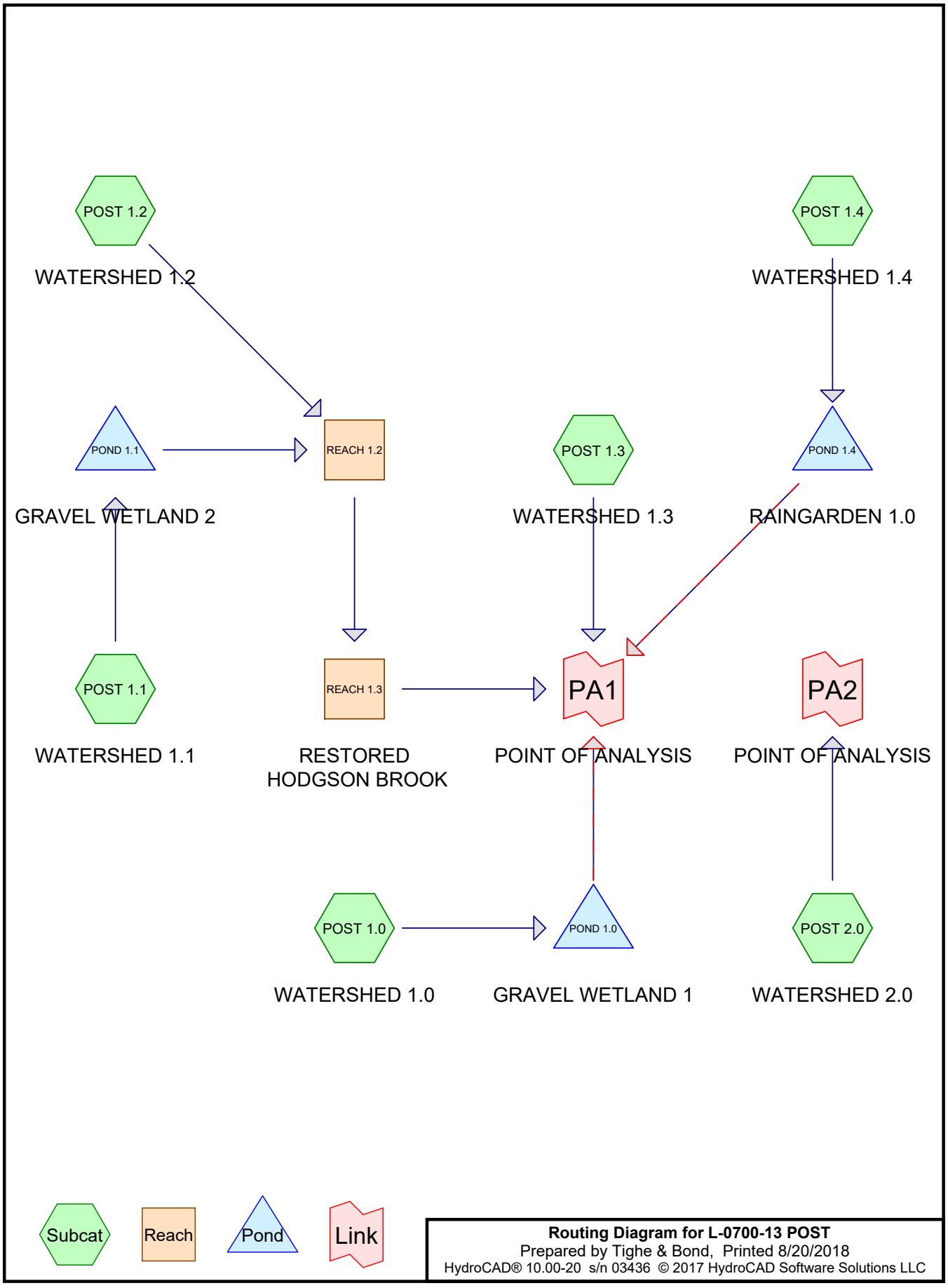
7.3.1 Post-Development Calculations

7.3.2 Post-Development Watershed Plans

7.3.3 Post-Development Soil Plan

7.3.4 Post-Development Subcatchment Calculations

7.3.5 Post-Development Subcatchment Plans



Routing Diagram for L-0700-13 POST
Prepared by Tighe & Bond, Printed 8/20/2018

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.198	61	>75% Grass cover, Good, HSG B (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4)
9.397	74	>75% Grass cover, Good, HSG C (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0)
0.419	80	>75% Grass cover, Good, HSG D (POST 1.0, POST 1.3, POST 1.4)
0.504	71	Meadow, non-grazed, HSG C (POST 1.3)
0.738	98	Paved parking, HSG B (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4)
7.011	98	Paved parking, HSG C (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0)
0.150	98	Paved parking, HSG D (POST 1.0, POST 1.3, POST 1.4)
0.649	98	Roofs, HSG B (POST 1.0, POST 1.1, POST 1.4)
7.098	98	Roofs, HSG C (POST 1.0, POST 1.1, POST 1.4)
1.749	98	Roofs, HSG D (POST 1.0, POST 1.4)
29.915	**87**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.586	HSG B	POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4
24.010	HSG C	POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0
2.318	HSG D	POST 1.0, POST 1.3, POST 1.4
0.000	Other	
29.915		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 POST 1.0: WATERSHED Runoff Area=432,096 sf 70.33% Impervious Runoff Depth>2.61"
Flow Length=933' Tc=11.4 min CN=90 Runoff=24.90 cfs 2.159 af

Subcatchment POST 1.1: WATERSHED Runoff Area=256,379 sf 53.87% Impervious Runoff Depth>2.17"
Flow Length=750' Tc=10.3 min CN=85 Runoff=12.84 cfs 1.064 af

Subcatchment POST 1.2: WATERSHED 1.2 Runoff Area=88,847 sf 67.84% Impervious Runoff Depth>2.61"
Flow Length=1,191' Tc=6.4 min CN=90 Runoff=5.96 cfs 0.444 af

Subcatchment POST 1.3: WATERSHED Runoff Area=306,909 sf 22.42% Impervious Runoff Depth>1.62"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=6.10 cfs 0.950 af

Subcatchment POST 1.4: WATERSHED Runoff Area=214,765 sf 85.08% Impervious Runoff Depth>3.01"
Flow Length=717' Tc=7.5 min CN=94 Runoff=15.51 cfs 1.236 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=4,091 sf 97.29% Impervious Runoff Depth>3.33"
Tc=5.0 min CN=97 Runoff=0.33 cfs 0.026 af

Reach REACH 1.2: Avg. Flow Depth=0.91' Max Vel=5.54 fps Inflow=12.87 cfs 14.244 af
54.0" Round Pipe n=0.013 L=259.0' S=0.0052 '/' Capacity=141.97 cfs Outflow=12.85 cfs 14.235 af

Reach REACH 1.3: RESTORED Avg. Flow Depth=0.91' Max Vel=2.26 fps Inflow=12.85 cfs 14.235 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=10.98 cfs 14.057 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=45.34' Storage=55,174 cf Inflow=24.90 cfs 2.159 af
Primary=2.96 cfs 1.247 af Secondary=0.00 cfs 0.000 af Outflow=2.96 cfs 1.247 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=53.58' Storage=34,983 cf Inflow=12.84 cfs 1.064 af
Outflow=0.49 cfs 0.283 af

Pond POND 1.4: RAINGARDEN 1.0 Peak Elev=47.32' Storage=34,238 cf Inflow=15.51 cfs 1.236 af
Primary=1.30 cfs 0.698 af Secondary=0.00 cfs 0.000 af Outflow=1.30 cfs 0.698 af

Link PA1: POINT OF ANALYSIS Inflow=18.01 cfs 16.953 af
Primary=18.01 cfs 16.953 af

Link PA2: POINT OF ANALYSIS Inflow=0.33 cfs 0.026 af
Primary=0.33 cfs 0.026 af

Total Runoff Area = 29.915 ac Runoff Volume = 5.880 af Average Runoff Depth = 2.36"
41.85% Pervious = 12.519 ac 58.15% Impervious = 17.396 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 POST 1.0: WATERSHED Runoff Area=432,096 sf 70.33% Impervious Runoff Depth>4.43"
Flow Length=933' Tc=11.4 min CN=90 Runoff=41.23 cfs 3.662 af

Subcatchment POST 1.1: WATERSHED Runoff Area=256,379 sf 53.87% Impervious Runoff Depth>3.90"
Flow Length=750' Tc=10.3 min CN=85 Runoff=22.77 cfs 1.914 af

Subcatchment POST 1.2: WATERSHED 1.2 Runoff Area=88,847 sf 67.84% Impervious Runoff Depth>4.43"
Flow Length=1,191' Tc=6.4 min CN=90 Runoff=9.84 cfs 0.754 af

Subcatchment POST 1.3: WATERSHED Runoff Area=306,909 sf 22.42% Impervious Runoff Depth>3.18"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=12.14 cfs 1.868 af

Subcatchment POST 1.4: WATERSHED Runoff Area=214,765 sf 85.08% Impervious Runoff Depth>4.88"
Flow Length=717' Tc=7.5 min CN=94 Runoff=24.45 cfs 2.004 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=4,091 sf 97.29% Impervious Runoff Depth>5.22"
Tc=5.0 min CN=97 Runoff=0.51 cfs 0.041 af

Reach REACH 1.2: Avg. Flow Depth=1.29' Max Vel=6.76 fps Inflow=25.50 cfs 32.683 af
54.0" Round Pipe n=0.013 L=259.0' S=0.0052 '/' Capacity=141.97 cfs Outflow=25.49 cfs 32.667 af

Reach REACH 1.3: RESTORED Avg. Flow Depth=1.06' Max Vel=2.02 fps Inflow=25.49 cfs 32.667 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=24.01 cfs 32.374 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=46.42' Storage=75,885 cf Inflow=41.23 cfs 3.662 af
Primary=17.67 cfs 2.638 af Secondary=0.00 cfs 0.000 af Outflow=17.67 cfs 2.638 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=54.14' Storage=42,592 cf Inflow=22.77 cfs 1.914 af
Outflow=6.75 cfs 1.122 af

Pond POND 1.4: RAINGARDEN 1.0 Peak Elev=48.13' Storage=45,582 cf Inflow=24.45 cfs 2.004 af
Primary=6.62 cfs 1.401 af Secondary=0.00 cfs 0.000 af Outflow=6.62 cfs 1.401 af

Link PA1: POINT OF ANALYSIS Inflow=60.03 cfs 38.280 af
Primary=60.03 cfs 38.280 af

Link PA2: POINT OF ANALYSIS Inflow=0.51 cfs 0.041 af
Primary=0.51 cfs 0.041 af

Total Runoff Area = 29.915 ac Runoff Volume = 10.242 af Average Runoff Depth = 4.11"
41.85% Pervious = 12.519 ac 58.15% Impervious = 17.396 ac

Summary for Subcatchment POST 1.0: WATERSHED 1.0

Runoff = 41.23 cfs @ 12.16 hrs, Volume= 3.662 af, Depth> 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
7,015	98	Roofs, HSG B
21,062	61	>75% Grass cover, Good, HSG B
18,252	98	Paved parking, HSG B
134,533	98	Roofs, HSG C
91,734	74	>75% Grass cover, Good, HSG C
106,649	98	Paved parking, HSG C
31,906	98	Roofs, HSG D
15,407	80	>75% Grass cover, Good, HSG D
5,538	98	Paved parking, HSG D
432,096	90	Weighted Average
128,203		29.67% Pervious Area
303,893		70.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	70	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
0.2	32	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	19	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.8	162	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.4	84	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.5	113	0.0050	3.72	4.57	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.2	299	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.4	94	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.1	46	0.0240	11.16	35.05	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.0	5	0.0800	7.16	0.98	**Pipe Channel,** 5.0" Round Area= 0.1 sf Perim= 1.3' r= 0.10' n= 0.013
0.0	9	0.0110	9.90	69.95	**Pipe Channel,** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75'

n= 0.013

11.4	933	Total

Summary for Subcatchment POST 1.1: WATERSHED 1.1

Runoff = 22.77 cfs @ 12.14 hrs, Volume= 1.914 af, Depth> 3.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
10,200	98	Roofs, HSG B
42,175	61	>75% Grass cover, Good, HSG B
3,434	98	Paved parking, HSG B
87,911	98	Roofs, HSG C
76,103	74	>75% Grass cover, Good, HSG C
36,556	98	Paved parking, HSG C
256,379	85	Weighted Average
118,278		46.13% Pervious Area
138,101		53.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0380	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.2	163	0.0245	2.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.5	283	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.1	81	0.0240	9.21	16.27	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.4	123	0.0050	5.09	16.00	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
10.3	750	Total			

Summary for Subcatchment POST 1.2: WATERSHED 1.2

Runoff = 9.84 cfs @ 12.09 hrs, Volume= 0.754 af, Depth> 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
3,104	61	>75% Grass cover, Good, HSG B
2,340	98	Paved parking, HSG B
25,469	74	>75% Grass cover, Good, HSG C
57,934	98	Paved parking, HSG C
88,847	90	Weighted Average
28,573		32.16% Pervious Area
60,274		67.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.68"
1.0	153	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	343	0.0050	3.47	2.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.1	13	0.0050	3.72	4.57	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
1.8	453	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	129	0.0050	5.91	29.00	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
6.4	1,191	Total			

Summary for Subcatchment POST 1.3: WATERSHED 1.3

Runoff = 12.14 cfs @ 12.63 hrs, Volume= 1.868 af, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
25,523	61	>75% Grass cover, Good, HSG B
903	98	Paved parking, HSG B
188,971	74	>75% Grass cover, Good, HSG C
67,403	98	Paved parking, HSG C
21,971	71	Meadow, non-grazed, HSG C
1,639	80	>75% Grass cover, Good, HSG D
499	98	Paved parking, HSG D
306,909	78	Weighted Average
238,104		77.58% Pervious Area
68,805		22.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0130	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.1	52	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	27	0.2720	7.82		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
33.8	1,346	0.0090	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
45.9	1,525	Total			

Summary for Subcatchment POST 1.4: WATERSHED 1.4

Runoff = 24.45 cfs @ 12.10 hrs, Volume= 2.004 af, Depth> 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
11,052	98	Roofs, HSG B
3,902	61	>75% Grass cover, Good, HSG B
7,239	98	Paved parking, HSG B
86,732	98	Roofs, HSG C
26,940	74	>75% Grass cover, Good, HSG C
32,896	98	Paved parking, HSG C
44,301	98	Roofs, HSG D
1,207	80	>75% Grass cover, Good, HSG D
496	98	Paved parking, HSG D
214,765	94	Weighted Average
32,049		14.92% Pervious Area
182,716		85.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	40	0.0150	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
0.3	53	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	65	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.4	115	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.7	140	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.9	275	0.0070	4.97	8.79	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.0	29	0.0550	13.94	24.63	**Pipe Channel,**

18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
n= 0.013

7.5	717	Total

Summary for Subcatchment POST 2.0: WATERSHED 2.0

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.51 cfs @ 12.07 hrs, Volume= 0.041 af, Depth> 5.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
111	74	>75% Grass cover, Good, HSG C
3,980	98	Paved parking, HSG C
4,091	97	Weighted Average
111		2.71% Pervious Area
3,980		97.29% Impervious Area

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

Summary for Reach REACH 1.2:

This reach takes into account the flows used for the Hodgson Brook stream restoration design. The flow rates were taken from "The Restoration of Hodgson Brook at the Iron Rail Parcel at Pease Tradeport in Portsmouth, NH" prepared by Streamworks, PLLC, dated May 28 2018. In the pre-development conditions of the site, the flow in the culvert flows throught the site to Point of Analysis 1, but does not collect additional runoff from the site.

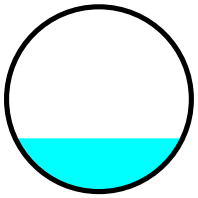
[52] Hint: Inlet/Outlet conditions not evaluated
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)
[80] Warning: Exceeded Pond POND 1.1 by 2.89' @ 0.05 hrs (0.07 cfs 0.059 af)

Inflow Area = 7.925 ac, 57.46% Impervious, Inflow Depth > 49.49" for 10 Year event
Inflow = 25.50 cfs @ 12.09 hrs, Volume= 32.683 af, Incl. 15.50 cfs Base Flow
Outflow = 25.49 cfs @ 12.10 hrs, Volume= 32.667 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.76 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 5.95 fps, Avg. Travel Time= 0.7 min

Peak Storage= 976 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.29'
Bank-Full Depth= 4.50' Flow Area= 15.9 sf, Capacity= 141.97 cfs

54.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 259.0' Slope= 0.0052 '/'
Inlet Invert= 49.35', Outlet Invert= 48.00'



Summary for Reach REACH 1.3: RESTORED HODGSON BROOK

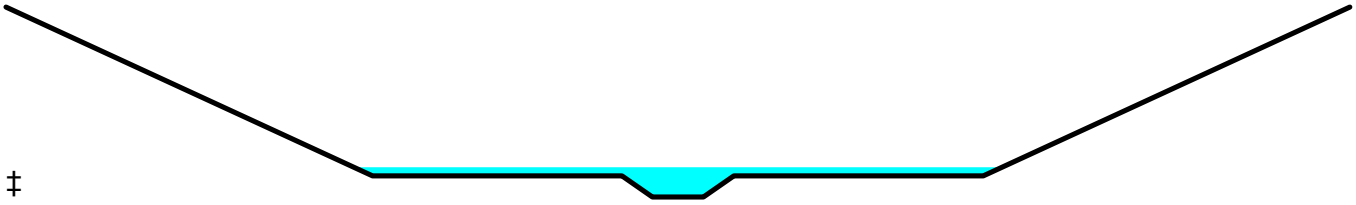
[61] Hint: Exceeded Reach REACH 1.2 outlet invert by 1.06' @ 12.55 hrs

Inflow Area = 7.925 ac, 57.46% Impervious, Inflow Depth > 49.46" for 10 Year event
Inflow = 25.49 cfs @ 12.10 hrs, Volume= 32.667 af
Outflow = 24.01 cfs @ 12.56 hrs, Volume= 32.374 af, Atten= 6%, Lag= 27.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.02 fps, Min. Travel Time= 10.8 min
Avg. Velocity = 1.64 fps, Avg. Travel Time= 13.3 min

Peak Storage= 16,504 cf @ 12.56 hrs
Average Depth at Peak Storage= 1.06'
Bank-Full Depth= 6.75' Flow Area= 291.0 sf, Capacity= 2,720.29 cfs

Custom cross-section, Length= 1,309.0' Slope= 0.0092 '/' (101 Elevation Intervals)
Constant n= 0.040 Winding stream, pools & shoals
Inlet Invert= 48.00', Outlet Invert= 36.00'



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Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	12.00	0.00
18.00	6.00	6.00
30.25	6.00	6.00
31.75	5.25	6.75
34.25	5.25	6.75
35.75	6.00	6.00
48.00	6.00	6.00
66.00	12.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	2.5	0	0.00
0.75	3.0	30.4	3,927	2.28
6.75	291.0	68.3	380,919	2,720.29

Summary for Pond POND 1.0: GRAVEL WETLAND 1

[95] Warning: Outlet Device #4 rise exceeded

Inflow Area = 9.920 ac, 70.33% Impervious, Inflow Depth > 4.43" for 10 Year event
Inflow = 41.23 cfs @ 12.16 hrs, Volume= 3.662 af
Outflow = 17.67 cfs @ 12.44 hrs, Volume= 2.638 af, Atten= 57%, Lag= 17.2 min
Primary = 17.67 cfs @ 12.44 hrs, Volume= 2.638 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 46.42' @ 12.44 hrs Surf.Area= 20,547 sf Storage= 75,885 cf
Flood Elev= 48.00' Surf.Area= 23,557 sf Storage= 110,845 cf

Plug-Flow detention time= 198.0 min calculated for 2.638 af (72% of inflow)
Center-of-Mass det. time= 109.9 min (900.9 - 791.0)

Volume	Invert	Avail.Storage	Storage Description
#1	39.05'	110,845 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.05	9,855	0.0	0	0
41.35	9,855	30.0	6,800	6,800
42.00	9,855	45.0	2,883	9,683
43.00	11,943	100.0	10,899	20,582
44.00	14,202	100.0	13,073	33,654
45.00	16,891	100.0	15,547	49,201
46.00	19,752	100.0	18,322	67,522
47.00	21,668	100.0	20,710	88,232
48.00	23,557	100.0	22,613	110,845

Device	Routing	Invert	Outlet Devices
#1	Primary	41.35'	**18.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 41.35' / 41.20' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	41.35'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	43.80'	**3.0" Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	45.00'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#5	Device 1	46.25'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads
#6	Secondary	46.50'	**15.0' long x 15.0' 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=17.67 cfs @ 12.44 hrs HW=46.41' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 17.67 cfs @ 10.00 fps)
  - **2=Orifice/Grate** (Passes < 0.53 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 0.75 cfs potential flow)
  - **4=Sharp-Crested Rectangular Weir** (Passes < 7.66 cfs potential flow)
  - **5=Orifice/Grate** (Passes < 22.93 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=39.05' TW=0.00' (Dynamic Tailwater)
- **6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond POND 1.1: GRAVEL WETLAND 2

Inflow Area = 5.886 ac, 53.87% Impervious, Inflow Depth > 3.90" for 10 Year event
Inflow = 22.77 cfs @ 12.14 hrs, Volume= 1.914 af
Outflow = 6.75 cfs @ 12.54 hrs, Volume= 1.122 af, Atten= 70%, Lag= 23.6 min
Primary = 6.75 cfs @ 12.54 hrs, Volume= 1.122 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 54.14' @ 12.54 hrs Surf.Area= 14,223 sf Storage= 42,592 cf
Flood Elev= 56.00' Surf.Area= 19,805 sf Storage= 74,019 cf

Plug-Flow detention time= 208.5 min calculated for 1.120 af (59% of inflow)
Center-of-Mass det. time= 105.6 min (911.9 - 806.3)

Volume	Invert	Avail.Storage	Storage Description
#1	47.55'	74,019 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
47.55	6,269	0.0	0	0
49.85	6,269	30.0	4,326	4,326
50.50	6,269	45.0	1,834	6,159
51.00	7,199	100.0	3,367	9,526
52.00	9,187	100.0	8,193	17,719
53.00	11,345	100.0	10,266	27,985
54.00	13,814	100.0	12,580	40,565
55.00	16,645	100.0	15,230	55,794
56.00	19,805	100.0	18,225	74,019

Device	Routing	Invert	Outlet Devices
#1	Primary	49.85'	**24.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.85' / 49.45' S= 0.0182 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	49.85'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	53.50'	**4.0' long x 2.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	55.50'	**4.0" W x 4.0" H Vert. Orifice/Grate X 106.00** C= 0.600

Primary OutFlow Max=6.73 cfs @ 12.54 hrs HW=54.14' TW=50.61' (Dynamic Tailwater)
- **1=Culvert** (Passes 6.73 cfs of 27.45 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.20 cfs @ 9.05 fps)
  - **3=Sharp-Crested Rectangular Weir** (Weir Controls 6.53 cfs @ 2.62 fps)
  - **4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond POND 1.4: RAINGARDEN 1.0

Inflow Area = 4.930 ac, 85.08% Impervious, Inflow Depth > 4.88" for 10 Year event
Inflow = 24.45 cfs @ 12.10 hrs, Volume= 2.004 af
Outflow = 6.62 cfs @ 12.47 hrs, Volume= 1.401 af, Atten= 73%, Lag= 22.2 min
Primary = 6.62 cfs @ 12.47 hrs, Volume= 1.401 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 48.13' @ 12.47 hrs Surf.Area= 14,540 sf Storage= 45,582 cf
Flood Elev= 50.00' Surf.Area= 17,530 sf Storage= 75,568 cf

Plug-Flow detention time= 234.5 min calculated for 1.401 af (70% of inflow)
Center-of-Mass det. time= 142.9 min (914.2 - 771.2)

Volume	Invert	Avail.Storage	Storage Description
#1	42.17'	75,568 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
42.17	10,217	0.0	0	0
43.50	10,217	40.0	5,435	5,435
45.00	10,217	10.0	1,533	6,968
46.00	11,532	100.0	10,875	17,842
48.00	14,332	100.0	25,864	43,706
50.00	17,530	100.0	31,862	75,568

Device	Routing	Invert	Outlet Devices
#1	Primary	42.42'	**12.0" Round Culvert** L= 48.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 42.42' / 42.20' S= 0.0046 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	42.42'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	45.00'	**10.000 in/hr Exfiltration over Surface area above 45.00'** Excluded Surface area = 10,217 sf
#4	Device 1	47.20'	**13.2" x 13.2" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	49.35'	**3.0' long x 8.9' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.46 2.55 2.70 2.69 2.68 2.68 2.67 2.64 2.64 2.64 2.65 2.64 2.65 2.65 2.66 2.67 2.69

Primary OutFlow Max=6.61 cfs @ 12.47 hrs HW=48.13' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 6.61 cfs of 6.81 cfs potential flow)
  - **2=Orifice/Grate** (Passes 1.00 cfs of 2.21 cfs potential flow)
    - **3=Exfiltration** (Exfiltration Controls 1.00 cfs)
  - **4=Orifice/Grate** (Orifice Controls 5.61 cfs @ 4.64 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=42.17' TW=0.00' (Dynamic Tailwater)
- **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link PA1: POINT OF ANALYSIS

Inflow Area = 29.821 ac, 58.03% Impervious, Inflow Depth > 15.40" for 10 Year event
Inflow = 60.03 cfs @ 12.54 hrs, Volume= 38.280 af
Primary = 60.03 cfs @ 12.54 hrs, Volume= 38.280 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link PA2: POINT OF ANALYSIS

Inflow Area = 0.094 ac, 97.29% Impervious, Inflow Depth > 5.22" for 10 Year event
Inflow = 0.51 cfs @ 12.07 hrs, Volume= 0.041 af
Primary = 0.51 cfs @ 12.07 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 POST 1.0: WATERSHED Runoff Area=432,096 sf 70.33% Impervious Runoff Depth>5.88"
Flow Length=933' Tc=11.4 min CN=90 Runoff=53.90 cfs 4.863 af

Subcatchment POST 1.1: WATERSHED Runoff Area=256,379 sf 53.87% Impervious Runoff Depth>5.31"
Flow Length=750' Tc=10.3 min CN=85 Runoff=30.60 cfs 2.605 af

Subcatchment POST 1.2: WATERSHED 1.2 Runoff Area=88,847 sf 67.84% Impervious Runoff Depth>5.89"
Flow Length=1,191' Tc=6.4 min CN=90 Runoff=12.86 cfs 1.001 af

Subcatchment POST 1.3: WATERSHED Runoff Area=306,909 sf 22.42% Impervious Runoff Depth>4.50"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=17.13 cfs 2.641 af

Subcatchment POST 1.4: WATERSHED Runoff Area=214,765 sf 85.08% Impervious Runoff Depth>6.35"
Flow Length=717' Tc=7.5 min CN=94 Runoff=31.40 cfs 2.610 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=4,091 sf 97.29% Impervious Runoff Depth>6.71"
Tc=5.0 min CN=97 Runoff=0.65 cfs 0.053 af

Reach REACH 1.2: Avg. Flow Depth=1.71' Max Vel=7.85 fps Inflow=43.70 cfs 50.511 af
54.0" Round Pipe n=0.013 L=259.0' S=0.0052 '/' Capacity=141.97 cfs Outflow=43.71 cfs 50.489 af

Reach REACH 1.3: RESTORED Avg. Flow Depth=1.23' Max Vel=2.36 fps Inflow=43.71 cfs 50.489 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=42.64 cfs 50.105 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=46.96' Storage=87,419 cf Inflow=53.90 cfs 4.863 af
Primary=18.76 cfs 3.453 af Secondary=12.73 cfs 0.324 af Outflow=31.50 cfs 3.777 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=54.62' Storage=49,684 cf Inflow=30.60 cfs 2.605 af
Outflow=14.85 cfs 1.808 af

Pond POND 1.4: RAINGARDEN 1.0 Peak Elev=48.96' Storage=58,144 cf Inflow=31.40 cfs 2.610 af
Primary=7.34 cfs 1.965 af Secondary=0.00 cfs 0.000 af Outflow=7.34 cfs 1.965 af

Link PA1: POINT OF ANALYSIS Inflow=94.11 cfs 58.489 af
Primary=94.11 cfs 58.489 af

Link PA2: POINT OF ANALYSIS Inflow=0.65 cfs 0.053 af
Primary=0.65 cfs 0.053 af

Total Runoff Area = 29.915 ac Runoff Volume = 13.773 af Average Runoff Depth = 5.52"
41.85% Pervious = 12.519 ac 58.15% Impervious = 17.396 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 POST 1.0: WATERSHED Runoff Area=432,096 sf 70.33% Impervious Runoff Depth>7.25"
Flow Length=933' Tc=11.4 min CN=90 Runoff=65.64 cfs 5.991 af

Subcatchment POST 1.1: WATERSHED Runoff Area=256,379 sf 53.87% Impervious Runoff Depth>6.65"
Flow Length=750' Tc=10.3 min CN=85 Runoff=37.88 cfs 3.261 af

Subcatchment POST 1.2: WATERSHED 1.2 Runoff Area=88,847 sf 67.84% Impervious Runoff Depth>7.25"
Flow Length=1,191' Tc=6.4 min CN=90 Runoff=15.65 cfs 1.233 af

Subcatchment POST 1.3: WATERSHED Runoff Area=306,909 sf 22.42% Impervious Runoff Depth>5.77"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=21.85 cfs 3.387 af

Subcatchment POST 1.4: WATERSHED Runoff Area=214,765 sf 85.08% Impervious Runoff Depth>7.73"
Flow Length=717' Tc=7.5 min CN=94 Runoff=37.84 cfs 3.177 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=4,091 sf 97.29% Impervious Runoff Depth>8.10"
Tc=5.0 min CN=97 Runoff=0.78 cfs 0.063 af

Reach REACH 1.2: Avg. Flow Depth=2.19' Max Vel=8.82 fps Inflow=67.76 cfs 79.618 af
54.0" Round Pipe n=0.013 L=259.0' S=0.0052 '/' Capacity=141.97 cfs Outflow=67.74 cfs 79.587 af

Reach REACH 1.3: RESTORED Avg. Flow Depth=1.40' Max Vel=2.79 fps Inflow=67.74 cfs 79.587 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=66.49 cfs 79.076 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=47.28' Storage=94,421 cf Inflow=65.64 cfs 5.991 af
Primary=19.37 cfs 4.059 af Secondary=27.44 cfs 0.811 af Outflow=46.81 cfs 4.870 af

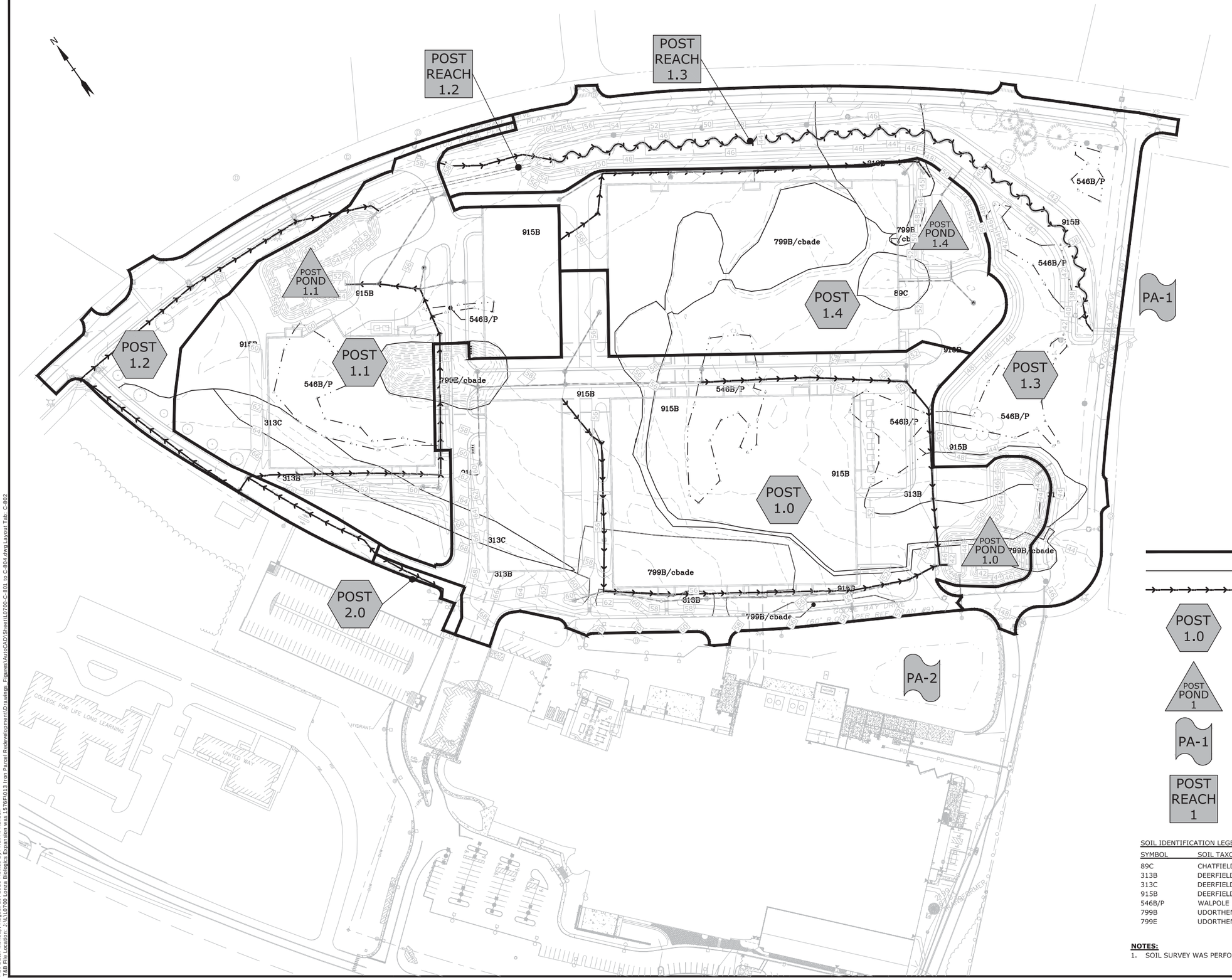
Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=55.01' Storage=55,890 cf Inflow=37.88 cfs 3.261 af
Outflow=22.54 cfs 2.458 af

Pond POND 1.4: RAINGARDEN 1.0 Peak Elev=49.64' Storage=69,323 cf Inflow=37.84 cfs 3.177 af
Primary=7.74 cfs 2.465 af Secondary=1.16 cfs 0.034 af Outflow=8.90 cfs 2.499 af

Link PA1: POINT OF ANALYSIS Inflow=134.81 cfs 89.833 af
Primary=134.81 cfs 89.833 af

Link PA2: POINT OF ANALYSIS Inflow=0.78 cfs 0.063 af
Primary=0.78 cfs 0.063 af

Total Runoff Area = 29.915 ac Runoff Volume = 17.113 af Average Runoff Depth = 6.86"
41.85% Pervious = 12.519 ac 58.15% Impervious = 17.396 ac



LEGEND

- POST-DEVELOPMENT WATERSHED BOUNDARY
- SOIL SURVEY BOUNDARIES
- LONGEST FLOW PATH
- POST 1.0 — PRE DEVELOPMENT WATERSHED AREA DESIGNATION
- POST POND 1 — POST-DEVELOPMENT POND DESIGNATION
- PA-1 — POINT OF ANALYSIS
- POST REACH 1 — POST-DEVELOPMENT REACH DESIGNATION

SOIL IDENTIFICATION LEGEND

SYMBOL	SOIL TAXONOMIC NAME, SLOPE RATING
89C	CHATFIELD, 8 TO 15 PERCENT SLOPES
313B	DEERFIELD, 0 TO 8 PERCENT SLOPES
313C	DEERFIELD, 8 TO 15 PERCENT SLOPES
915B	DEERFIELD VARIANT, 0 TO 8 PERCENT SLOPES
546B/P	WALPOLE POORLY DRAINED, 0 TO 8 PERCENT SLOPES
799B	UDORTHENTS URBAN LAND, 0 TO 8 PERCENT SLOPES
799E	UDORTHENTS URBAN LAND, >25 PERCENT SLOPES

NOTES:

1. SOIL SURVEY WAS PERFORMED BY GOVE ENVIRONMENTAL SERVICES.

SCALE IN FEET
0 80' 160'
GRAPHIC SCALE

Tighe&Bond
Engineers | Environmental Specialists

Proposed Industrial Development

Lonza Biologics

Portsmouth,
New Hampshire

MARK	DATE	DESCRIPTION
D	8/21/2018	REVISED TAC SUBMISSION
C	6/18/2018	NHDES AOT SUBMISSION
B	5/21/2018	TAC SUBMISSION
A	4/3/2018	TAC WS SUBMISSION

PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L0700-C-801 to C-804.dwg
DRAWN BY:	NAH
CHECKED:	PMC
APPROVED:	BLM

POST-DEVELOPMENT WATERSHED AREA PLAN

SCALE: AS SHOWN

C-802

Last Save Date: August 20, 2018 4:05 PM By: NAHANSEN
Plot Date: Monday, August 20, 2018 Plotted By: Nathan Hansen
T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576F\013 Iron Parcel Redevelopment\Drawings_Figures\AutoCAD\Sheet\L0700-C-801 to C-804.dwg Layout Tab: C-802

POST REACH 1.2

POST REACH 1.3

CORPORATE DRIVE (100' R.O.W. PER REF. PLAN #1)

POST POND 1.1

POST 1.2

POST 1.1

POST 1.4

POST POND 1.4

POST 1.3

POST 1.0

POST POND 1.0

POST 2.0

PA-1

PA-2

GOOSE BAY DRIVE (60' R.O.W. PER REF. PLAN #2)

COLLEGE FOR LIFE LONG LEARNING

UNITED WAY

HYDRANT

915B

799B/cbade

546B/P

89C

313B

313C

799E/cbade

LEGEND

- POST-DEVELOPMENT WATERSHED BOUNDARY
- SOIL SURVEY BOUNDARIES
- LONGEST FLOW PATH
- POST 1.0 — PRE DEVELOPMENT WATERSHED AREA DESIGNATION
- POST POND 1 — POST-DEVELOPMENT POND DESIGNATION
- PA-1 — POINT OF ANALYSIS
- POST REACH 1 — POST-DEVELOPMENT REACH DESIGNATION

SCALE IN FEET
0 80' 160'
GRAPHIC SCALE

NOTES:
1. SOIL SURVEY WAS PERFORMED BY GOVE ENVIRONMENTAL SERVICES.

HYDROLOGIC SOIL GROUP RATING

- HYDROLOGIC SOIL GROUP A
- HYDROLOGIC SOIL GROUP B
- HYDROLOGIC SOIL GROUP C
- HYDROLOGIC SOIL GROUP D
- IMPERVIOUS AREA

SOIL IDENTIFICATION LEGEND

SYMBOL	SOIL TAXONOMIC NAME, SLOPE RATING
89C	CHATFIELD, 8 TO 15 PERCENT SLOPES
313B	DEERFIELD, 0 TO 8 PERCENT SLOPES
313C	DEERFIELD, 8 TO 15 PERCENT SLOPES
915B	DEERFIELD VARIANT, 0 TO 8 PERCENT SLOPES
546B/P	WALPOLE POORLY DRAINED, 0 TO 8 PERCENT SLOPES
799B	UDORTHENTS URBAN LAND, 0 TO 8 PERCENT SLOPES
799E	UDORTHENTS URBAN LAND, >25 PERCENT SLOPES

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Proposed Industrial Development

Lonza Biologics

Portsmouth,
New Hampshire

MARK	DATE	DESCRIPTION
D	8/21/2018	REVISED TAC SUBMISSION
C	6/18/2018	NHDES AOT SUBMISSION
B	5/21/2018	TAC SUBMISSION
A	4/3/2018	TAC WS SUBMISSION

PROJECT NO:	L-0700-013
DATE:	04/03/2018
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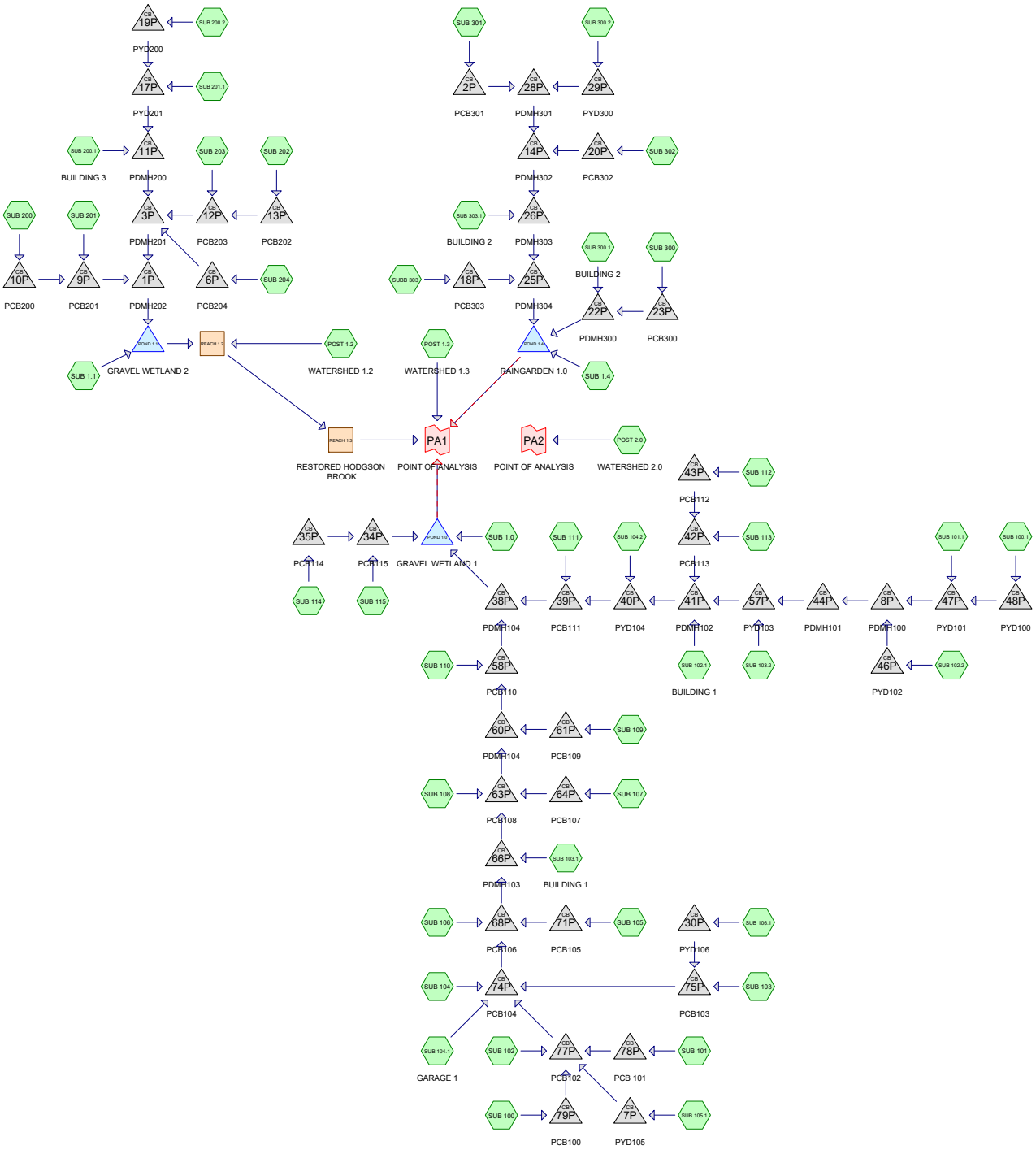
DRAWN BY:	NAH
CHECKED:	PMC
APPROVED:	BLM

POST-DEVELOPMENT SOIL PLAN

SCALE: AS SHOWN

C-804

Last Save Date: August 20, 2018, 5:35 PM By: NAHANSEN
Plot Date/Time: Monday, August 20, 2018 - 5:36PM By: Nick Hansen
T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576\F\013 Iron Parcel Redevelopment\Drawings, Figures\AutoCAD\Sheet\L0700-C-801 to C-804.dwg Layout Tab: C-804



Routing Diagram for L-0700-13 SUBCAT
Prepared by Tighe & Bond, Printed 8/20/2018
HydroCAD® 10.00-20 s/n 03436 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
8.606	98	(SUB 102.1, SUB 103.1, SUB 104.1, SUB 200.1, SUB 300.1, SUB 303.1)
2.201	61	>75% Grass cover, Good, HSG B (POST 1.2, POST 1.3, SUB 1.0, SUB 1.1, SUB 1.4, SUB 101.1, SUB 102.2, SUB 103.2, SUB 105.1, SUB 110, SUB 200.2, SUB 201.1, SUBB 303)
9.391	74	>75% Grass cover, Good, HSG C (POST 1.2, POST 1.3, POST 2.0, SUB 1.0, SUB 1.1, SUB 1.4, SUB 100, SUB 100.1, SUB 101, SUB 101.1, SUB 102, SUB 102.2, SUB 103, SUB 103.2, SUB 104, SUB 104.2, SUB 105, SUB 105.1, SUB 106, SUB 106.1, SUB 107, SUB 108, SUB 110, SUB 200, SUB 200.2, SUB 201.1, SUB 202, SUB 203, SUB 204, SUB 300, SUB 300.2, SUB 301, SUB 302, SUBB 303)
0.403	80	>75% Grass cover, Good, HSG D (POST 1.3, SUB 1.0, SUB 1.4, SUB 100.1, SUB 101.1, SUB 102.2, SUB 103.2, SUB 104.2, SUB 105, SUB 106)
0.504	71	Meadow, non-grazed, HSG C (POST 1.3)
0.747	98	Paved parking, HSG B (POST 1.2, POST 1.3, SUB 1.0, SUB 1.1, SUB 1.4, SUB 100, SUB 101.1, SUB 102, SUB 102.2, SUB 103.2, SUB 110, SUB 200.2, SUB 300, SUBB 303)
7.137	98	Paved parking, HSG C (POST 1.2, POST 1.3, POST 2.0, SUB 1.0, SUB 1.1, SUB 1.4, SUB 100, SUB 100.1, SUB 101, SUB 101.1, SUB 102, SUB 102.2, SUB 103, SUB 103.2, SUB 104, SUB 104.2, SUB 105, SUB 106, SUB 106.1, SUB 107, SUB 108, SUB 109, SUB 110, SUB 111, SUB 112, SUB 113, SUB 114, SUB 115, SUB 200, SUB 200.2, SUB 201, SUB 201.1, SUB 202, SUB 203, SUB 204, SUB 300, SUB 300.2, SUB 301, SUB 302, SUBB 303)
0.159	98	Paved parking, HSG D (POST 1.3, SUB 1.4, SUB 100.1, SUB 101.1, SUB 103.2, SUB 104.2, SUB 105, SUB 111)
29.148	**87**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 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 POST 1.2: WATERSHED 1.2 Runoff Area=88,847 sf 67.84% Impervious Runoff Depth>4.43"
Flow Length=1,191' Tc=6.4 min CN=90 Runoff=9.84 cfs 0.754 af

Subcatchment POST 1.3: WATERSHED Runoff Area=306,909 sf 22.42% Impervious Runoff Depth>3.18"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=12.14 cfs 1.868 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=4,086 sf 97.28% Impervious Runoff Depth>5.22"
Tc=5.0 min CN=97 Runoff=0.51 cfs 0.041 af

Subcatchment SUB 1.0: Runoff Area=36,598 sf 21.71% Impervious Runoff Depth>3.21"
Tc=5.0 min CN=78 Runoff=3.16 cfs 0.225 af

Subcatchment SUB 1.1: Runoff Area=81,352 sf 9.58% Impervious Runoff Depth>2.83"
Flow Length=285' Tc=8.3 min CN=74 Runoff=5.65 cfs 0.441 af

Subcatchment SUB 1.4: Runoff Area=23,747 sf 11.82% Impervious Runoff Depth>2.93"
Tc=5.0 min CN=75 Runoff=1.87 cfs 0.133 af

Subcatchment SUB 100: Runoff Area=13,615 sf 69.93% Impervious Runoff Depth>4.54"
Tc=5.0 min CN=91 Runoff=1.59 cfs 0.118 af

Subcatchment SUB 100.1: Runoff Area=12,798 sf 25.93% Impervious Runoff Depth>3.50"
Tc=5.0 min CN=81 Runoff=1.20 cfs 0.086 af

Subcatchment SUB 101: Runoff Area=4,346 sf 64.01% Impervious Runoff Depth>4.33"
Tc=5.0 min CN=89 Runoff=0.49 cfs 0.036 af

Subcatchment SUB 101.1: Runoff Area=16,430 sf 27.66% Impervious Runoff Depth>3.40"
Tc=5.0 min CN=80 Runoff=1.50 cfs 0.107 af

Subcatchment SUB 102: Runoff Area=10,832 sf 79.94% Impervious Runoff Depth>4.77"
Tc=5.0 min CN=93 Runoff=1.31 cfs 0.099 af

Subcatchment SUB 102.1: BUILDING 1 Runoff Area=65,920 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=8.32 cfs 0.673 af

Subcatchment SUB 102.2: Runoff Area=15,831 sf 38.13% Impervious Runoff Depth>3.40"
Tc=5.0 min CN=80 Runoff=1.45 cfs 0.103 af

Subcatchment SUB 103: Runoff Area=3,118 sf 53.75% Impervious Runoff Depth>4.11"
Tc=5.0 min CN=87 Runoff=0.34 cfs 0.025 af

Subcatchment SUB 103.1: BUILDING 1 Runoff Area=65,920 sf 100.00% Impervious Runoff Depth>5.34"
Tc=0.0 min CN=98 Runoff=9.46 cfs 0.674 af

Subcatchment SUB 103.2: Runoff Area=12,163 sf 22.22% Impervious Runoff Depth>2.93"
Flow Length=158' Tc=5.0 min CN=75 Runoff=0.96 cfs 0.068 af

Subcatchment SUB 104: Runoff Area=3,315 sf 50.44% Impervious Runoff Depth>4.01"
Tc=5.0 min CN=86 Runoff=0.35 cfs 0.025 af

Subcatchment SUB 104.1: GARAGE 1 Runoff Area=37,700 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=4.76 cfs 0.385 af

Subcatchment SUB 104.2: Runoff Area=13,198 sf 25.05% Impervious Runoff Depth>3.50"
Flow Length=262' Slope=0.0200 '/' Tc=10.4 min CN=81 Runoff=1.06 cfs 0.088 af

Subcatchment SUB 105: Runoff Area=10,018 sf 59.44% Impervious Runoff Depth>4.33"
Tc=5.0 min CN=89 Runoff=1.13 cfs 0.083 af

Subcatchment SUB 105.1: Runoff Area=5,907 sf 0.00% Impervious Runoff Depth>2.30"
Tc=5.0 min CN=68 Runoff=0.36 cfs 0.026 af

Subcatchment SUB 106: Runoff Area=10,579 sf 60.00% Impervious Runoff Depth>4.33"
Tc=5.0 min CN=89 Runoff=1.20 cfs 0.088 af

Subcatchment SUB 106.1: Runoff Area=12,358 sf 27.31% Impervious Runoff Depth>3.50"
Tc=5.0 min CN=81 Runoff=1.16 cfs 0.083 af

Subcatchment SUB 107: Runoff Area=11,825 sf 53.08% Impervious Runoff Depth>4.11"
Tc=5.0 min CN=87 Runoff=1.29 cfs 0.093 af

Subcatchment SUB 108: Runoff Area=17,538 sf 69.10% Impervious Runoff Depth>4.54"
Tc=5.0 min CN=91 Runoff=2.05 cfs 0.152 af

Subcatchment SUB 109: Runoff Area=3,285 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=0.41 cfs 0.034 af

Subcatchment SUB 110: Runoff Area=21,026 sf 85.31% Impervious Runoff Depth>4.88"
Tc=5.0 min CN=94 Runoff=2.57 cfs 0.196 af

Subcatchment SUB 111: Runoff Area=10,673 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=1.35 cfs 0.109 af

Subcatchment SUB 112: Runoff Area=7,229 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=0.91 cfs 0.074 af

Subcatchment SUB 113: Runoff Area=5,080 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=0.64 cfs 0.052 af

Subcatchment SUB 114: Runoff Area=2,372 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=0.30 cfs 0.024 af

Subcatchment SUB 115: Runoff Area=2,131 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=0.27 cfs 0.022 af

Subcatchment SUB 200: Runoff Area=2,760 sf 78.88% Impervious Runoff Depth>4.77"
Tc=5.0 min CN=93 Runoff=0.33 cfs 0.025 af

Subcatchment SUB 200.1: BUILDING 3 Runoff Area=63,221 sf 100.00% Impervious Runoff Depth>5.34"
Tc=0.0 min CN=98 Runoff=9.08 cfs 0.646 af

Subcatchment SUB 200.2: Runoff Area=21,678 sf 8.80% Impervious Runoff Depth>2.05"
Flow Length=270' Slope=0.0370 '/' Tc=8.1 min CN=65 Runoff=1.06 cfs 0.085 af

Subcatchment SUB 201: Runoff Area=6,729 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=0.85 cfs 0.069 af

Subcatchment SUB 201.1: Runoff Area=11,396 sf 2.84% Impervious Runoff Depth>2.05"
Flow Length=140' Tc=9.1 min CN=65 Runoff=0.54 cfs 0.045 af

Subcatchment SUB 202: Runoff Area=9,155 sf 43.41% Impervious Runoff Depth>3.80"
Tc=5.0 min CN=84 Runoff=0.93 cfs 0.067 af

Subcatchment SUB 203: Runoff Area=5,888 sf 55.93% Impervious Runoff Depth>4.11"
Tc=5.0 min CN=87 Runoff=0.64 cfs 0.046 af

Subcatchment SUB 204: Runoff Area=21,058 sf 73.63% Impervious Runoff Depth>4.65"
Tc=5.0 min CN=92 Runoff=2.50 cfs 0.188 af

Subcatchment SUB 300: Runoff Area=20,165 sf 92.03% Impervious Runoff Depth>5.11"
Tc=5.0 min CN=96 Runoff=2.51 cfs 0.197 af

Subcatchment SUB 300.1: BUILDING 2 Runoff Area=71,050 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=8.97 cfs 0.726 af

Subcatchment SUB 300.2: Runoff Area=12,032 sf 38.02% Impervious Runoff Depth>3.70"
Tc=5.0 min CN=83 Runoff=1.20 cfs 0.085 af

Subcatchment SUB 301: Runoff Area=4,090 sf 87.11% Impervious Runoff Depth>4.99"
Tc=5.0 min CN=95 Runoff=0.50 cfs 0.039 af

Subcatchment SUB 302: Runoff Area=6,122 sf 86.65% Impervious Runoff Depth>4.99"
Tc=5.0 min CN=95 Runoff=0.76 cfs 0.058 af

Subcatchment SUB 303.1: BUILDING 2 Runoff Area=71,050 sf 100.00% Impervious Runoff Depth>5.34"
Tc=5.0 min CN=98 Runoff=8.97 cfs 0.726 af

Subcatchment SUBB 303: Runoff Area=6,543 sf 89.30% Impervious Runoff Depth>4.99"
Tc=5.0 min CN=95 Runoff=0.81 cfs 0.062 af

Reach REACH 1.2: Avg. Flow Depth=1.29' Max Vel=6.76 fps Inflow=25.51 cfs 32.385 af
54.0" Round Pipe n=0.013 L=259.0' S=0.0052 '/' Capacity=141.97 cfs Outflow=25.50 cfs 32.369 af

Reach REACH 1.3: RESTORED Avg. Flow Depth=1.05' Max Vel=2.02 fps Inflow=25.50 cfs 32.369 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=22.99 cfs 32.076 af

Pond 1P: PDMH202 Peak Elev=53.94' Inflow=13.76 cfs 1.170 af
24.0" Round Culvert n=0.013 L=51.0' S=0.0049 '/' Outflow=13.76 cfs 1.170 af

Pond 2P: PCB301 Peak Elev=53.69' Inflow=0.50 cfs 0.039 af
12.0" Round Culvert n=0.013 L=81.0' S=0.0123 '/' Outflow=0.50 cfs 0.039 af

Pond 3P: PDMH201 Peak Elev=53.95' Inflow=12.83 cfs 1.076 af
24.0" Round Culvert n=0.013 L=68.0' S=0.0051 '/' Outflow=12.83 cfs 1.076 af

Pond 6P: PCB204 Peak Elev=54.07' Inflow=2.50 cfs 0.188 af
12.0" Round Culvert n=0.013 L=37.0' S=0.0054 '/' Outflow=2.50 cfs 0.188 af

Pond 7P: PYD105 Peak Elev=55.30' Inflow=0.36 cfs 0.026 af
12.0" Round Culvert n=0.013 L=127.0' S=0.0252 '/' Outflow=0.36 cfs 0.026 af

Pond 8P: PDMH100 Peak Elev=52.95' Inflow=4.15 cfs 0.296 af
15.0" Round Culvert n=0.013 L=95.0' S=0.0047 '/' Outflow=4.15 cfs 0.296 af

Pond 9P: PCB201 Peak Elev=53.94' Inflow=1.18 cfs 0.094 af
12.0" Round Culvert n=0.013 L=166.0' S=0.0051 '/' Outflow=1.18 cfs 0.094 af

Pond 10P: PCB200 Peak Elev=53.94' Inflow=0.33 cfs 0.025 af
12.0" Round Culvert n=0.013 L=18.0' S=0.0056 '/' Outflow=0.33 cfs 0.025 af

Pond 11P: PDMH200 Peak Elev=55.33' Inflow=9.82 cfs 0.776 af
18.0" Round Culvert n=0.013 L=81.0' S=0.0241 '/' Outflow=9.82 cfs 0.776 af

Pond 12P: PCB203 Peak Elev=53.96' Inflow=1.57 cfs 0.113 af
12.0" Round Culvert n=0.013 L=50.0' S=0.0050 '/' Outflow=1.57 cfs 0.113 af

Pond 13P: PCB202 Peak Elev=53.96' Inflow=0.93 cfs 0.067 af
12.0" Round Culvert n=0.013 L=18.0' S=0.0056 '/' Outflow=0.93 cfs 0.067 af

Pond 14P: PDMH302 Peak Elev=53.61' Inflow=2.46 cfs 0.183 af
12.0" Round Culvert n=0.013 L=137.0' S=0.0051 '/' Outflow=2.46 cfs 0.183 af

Pond 17P: PYD201 Peak Elev=55.72' Inflow=1.58 cfs 0.130 af
12.0" Round Culvert n=0.013 L=254.0' S=0.0051 '/' Outflow=1.58 cfs 0.130 af

Pond 18P: PCB303 Peak Elev=49.41' Inflow=0.81 cfs 0.062 af
12.0" Round Culvert n=0.013 L=23.0' S=0.0543 '/' Outflow=0.81 cfs 0.062 af

Pond 19P: PYD200 Peak Elev=55.85' Inflow=1.06 cfs 0.085 af
12.0" Round Culvert n=0.013 L=23.0' S=0.0109 '/' Outflow=1.06 cfs 0.085 af

Pond 20P: PCB302 Peak Elev=53.62' Inflow=0.76 cfs 0.058 af
12.0" Round Culvert n=0.013 L=4.0' S=0.0125 '/' Outflow=0.76 cfs 0.058 af

Pond 22P: PDMH300 Peak Elev=49.05' Inflow=11.48 cfs 0.923 af
18.0" Round Culvert n=0.013 L=29.0' S=0.0414 '/' Outflow=11.48 cfs 0.923 af

Pond 23P: PCB300 Peak Elev=49.41' Inflow=2.51 cfs 0.197 af
12.0" Round Culvert n=0.013 L=49.0' S=0.0061 '/' Outflow=2.51 cfs 0.197 af

Pond 25P: PDMH304 Peak Elev=49.41' Inflow=12.23 cfs 0.971 af
18.0" Round Culvert n=0.013 L=22.0' S=0.0727 '/' Outflow=12.23 cfs 0.971 af

Pond 26P: PDMH303 Peak Elev=53.09' Inflow=11.43 cfs 0.909 af
18.0" Round Culvert n=0.013 L=267.0' S=0.0069 '/' Outflow=11.43 cfs 0.909 af

Pond 28P: PDMH301 Peak Elev=53.73' Inflow=1.70 cfs 0.124 af
12.0" Round Culvert n=0.013 L=111.0' S=0.0099 '/' Outflow=1.70 cfs 0.124 af

Pond 29P: PYD300 Peak Elev=53.75' Inflow=1.20 cfs 0.085 af
12.0" Round Culvert n=0.013 L=65.0' S=0.0054 '/' Outflow=1.20 cfs 0.085 af

Pond 30P: PYD106 Peak Elev=52.74' Inflow=1.16 cfs 0.083 af
12.0" Round Culvert n=0.013 L=112.0' S=0.0054 '/' Outflow=1.16 cfs 0.083 af

Pond 34P: PCB115 Peak Elev=46.47' Inflow=0.57 cfs 0.046 af
12.0" Round Culvert n=0.013 L=29.0' S=0.0052 '/' Outflow=0.57 cfs 0.046 af

Pond 35P: PCB114 Peak Elev=46.47' Inflow=0.30 cfs 0.024 af
12.0" Round Culvert n=0.013 L=18.0' S=0.0056 '/' Outflow=0.30 cfs 0.024 af

Pond 38P: PDMH104 Peak Elev=47.03' Inflow=42.44 cfs 3.477 af
36.0" Round Culvert n=0.013 L=13.0' S=0.0077 '/' Outflow=42.44 cfs 3.477 af

Pond 39P: PCB111 Peak Elev=48.11' Inflow=17.19 cfs 1.360 af
24.0" Round Culvert n=0.013 L=5.0' S=0.0800 '/' Outflow=17.19 cfs 1.360 af

Pond 40P: PYD104 Peak Elev=48.69' Inflow=15.85 cfs 1.251 af
24.0" Round Culvert n=0.013 L=46.0' S=0.0239 '/' Outflow=15.85 cfs 1.251 af

Pond 41P: PDMH102 Peak Elev=50.94' Inflow=15.01 cfs 1.163 af
18.0" Round Culvert n=0.013 L=95.0' S=0.0053 '/' Outflow=15.01 cfs 1.163 af

Pond 42P: PCB113 Peak Elev=51.04' Inflow=1.55 cfs 0.126 af
12.0" Round Culvert n=0.013 L=20.0' S=0.0075 '/' Outflow=1.55 cfs 0.126 af

Pond 43P: PCB112 Peak Elev=51.06' Inflow=0.91 cfs 0.074 af
12.0" Round Culvert n=0.013 L=18.0' S=0.0056 '/' Outflow=0.91 cfs 0.074 af

Pond 44P: PDMH101 Peak Elev=52.77' Inflow=4.15 cfs 0.296 af
15.0" Round Culvert n=0.013 L=73.0' S=0.0048 '/' Outflow=4.15 cfs 0.296 af

Pond 46P: PYD102 Peak Elev=52.97' Inflow=1.45 cfs 0.103 af
12.0" Round Culvert n=0.013 L=50.0' S=0.0660 '/' Outflow=1.45 cfs 0.103 af

Pond 47P: PYD101 Peak Elev=53.10' Inflow=2.70 cfs 0.193 af
12.0" Round Culvert n=0.013 L=84.0' S=0.0048 '/' Outflow=2.70 cfs 0.193 af

Pond 48P: PYD100 Peak Elev=53.14' Inflow=1.20 cfs 0.086 af
12.0" Round Culvert n=0.013 L=162.0' S=0.0046 '/' Outflow=1.20 cfs 0.086 af

Pond 57P: PYD103 Peak Elev=52.51' Inflow=5.11 cfs 0.364 af
15.0" Round Culvert n=0.013 L=242.0' S=0.0054 '/' Outflow=5.11 cfs 0.364 af

Pond 58P: PCB110 Peak Elev=47.81' Inflow=25.59 cfs 2.117 af
30.0" Round Culvert n=0.013 L=107.0' S=0.0061 '/' Outflow=25.59 cfs 2.117 af

Pond 60P: PDMH104 Peak Elev=48.23' Inflow=23.11 cfs 1.920 af
30.0" Round Culvert n=0.013 L=147.0' S=0.0048 '/' Outflow=23.11 cfs 1.920 af

Pond 61P: PCB109 Peak Elev=48.24' Inflow=0.41 cfs 0.034 af
12.0" Round Culvert n=0.013 L=38.0' S=0.0053 '/' Outflow=0.41 cfs 0.034 af

Pond 63P: PCB108 Peak Elev=49.46' Inflow=22.71 cfs 1.887 af
24.0" Round Culvert n=0.013 L=56.0' S=0.0259 '/' Outflow=22.71 cfs 1.887 af

Pond 64P: PCB107 Peak Elev=49.56' Inflow=1.29 cfs 0.093 af
12.0" Round Culvert n=0.013 L=23.0' S=0.0391 '/' Outflow=1.29 cfs 0.093 af

Pond 66P: PDMH103 Peak Elev=51.18' Inflow=19.54 cfs 1.641 af
24.0" Round Culvert n=0.013 L=159.0' S=0.0050 '/' Outflow=19.54 cfs 1.641 af

Pond 68P: PCB106 Peak Elev=51.97' Inflow=12.70 cfs 0.967 af
24.0" Round Culvert n=0.013 L=178.0' S=0.0101 '/' Outflow=12.70 cfs 0.967 af

Pond 71P: PCB105 Peak Elev=52.01' Inflow=1.13 cfs 0.083 af
12.0" Round Culvert n=0.013 L=18.0' S=0.0056 '/' Outflow=1.13 cfs 0.083 af

Pond 74P: PCB104 Peak Elev=52.63' Inflow=10.37 cfs 0.797 af
24.0" Round Culvert n=0.013 L=226.0' S=0.0077 '/' Outflow=10.37 cfs 0.797 af

Pond 75P: PCB103 Peak Elev=52.69' Inflow=1.51 cfs 0.107 af
12.0" Round Culvert n=0.013 L=18.0' S=0.0056 '/' Outflow=1.51 cfs 0.107 af

Pond 77P: PCB102 Peak Elev=54.32' Inflow=3.75 cfs 0.279 af
12.0" Round Culvert n=0.013 L=143.0' S=0.0052 '/' Outflow=3.75 cfs 0.279 af

Pond 78P: PCB 101 Peak Elev=54.33' Inflow=0.49 cfs 0.036 af
12.0" Round Culvert n=0.013 L=23.0' S=0.0065 '/' Outflow=0.49 cfs 0.036 af

Pond 79P: PCB100 Peak Elev=54.42' Inflow=1.59 cfs 0.118 af
12.0" Round Culvert n=0.013 L=40.0' S=0.0050 '/' Outflow=1.59 cfs 0.118 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=46.47' Storage=77,040 cf Inflow=46.14 cfs 3.747 af
Primary=17.79 cfs 2.730 af Secondary=0.00 cfs 0.000 af Outflow=17.79 cfs 2.730 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=53.92' Storage=39,480 cf Inflow=17.35 cfs 1.611 af
Outflow=3.69 cfs 0.823 af

Pond POND 1.4: RAINGARDEN 1.0 Peak Elev=48.17' Storage=46,096 cf Inflow=25.59 cfs 2.027 af
Primary=6.74 cfs 1.427 af Secondary=0.00 cfs 0.000 af Outflow=6.74 cfs 1.427 af

Link PA1: POINT OF ANALYSIS Inflow=57.82 cfs 38.101 af
Primary=57.82 cfs 38.101 af

Link PA2: POINT OF ANALYSIS Inflow=0.51 cfs 0.041 af
Primary=0.51 cfs 0.041 af

Total Runoff Area = 29.148 ac Runoff Volume = 10.047 af Average Runoff Depth = 4.14"
42.88% Pervious = 12.499 ac 57.12% Impervious = 16.649 ac

Summary for Subcatchment POST 1.2: WATERSHED 1.2

Runoff = 9.84 cfs @ 12.09 hrs, Volume= 0.754 af, Depth> 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
3,104	61	>75% Grass cover, Good, HSG B
2,340	98	Paved parking, HSG B
25,469	74	>75% Grass cover, Good, HSG C
57,934	98	Paved parking, HSG C
88,847	90	Weighted Average
28,573		32.16% Pervious Area
60,274		67.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.68"
1.0	153	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	343	0.0050	3.47	2.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.1	13	0.0050	3.72	4.57	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
1.8	453	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	129	0.0050	5.91	29.00	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
6.4	1,191	Total			

Summary for Subcatchment POST 1.3: WATERSHED 1.3

Runoff = 12.14 cfs @ 12.63 hrs, Volume= 1.868 af, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
25,523	61	>75% Grass cover, Good, HSG B
903	98	Paved parking, HSG B
188,971	74	>75% Grass cover, Good, HSG C
67,403	98	Paved parking, HSG C
21,971	71	Meadow, non-grazed, HSG C
1,639	80	>75% Grass cover, Good, HSG D
499	98	Paved parking, HSG D
306,909	78	Weighted Average
238,104		77.58% Pervious Area
68,805		22.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0130	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.1	52	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	27	0.2720	7.82		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
33.8	1,346	0.0090	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
45.9	1,525	Total			

Summary for Subcatchment POST 2.0: WATERSHED 2.0

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.51 cfs @ 12.07 hrs, Volume= 0.041 af, Depth> 5.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
111	74	>75% Grass cover, Good, HSG C
3,975	98	Paved parking, HSG C
4,086	97	Weighted Average
111		2.72% Pervious Area
3,975		97.28% Impervious Area

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

Summary for Subcatchment SUB 1.0:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.16 cfs @ 12.08 hrs, Volume= 0.225 af, Depth> 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
6,335	61	>75% Grass cover, Good, HSG B
5,010	98	Paved parking, HSG B
18,780	74	>75% Grass cover, Good, HSG C
2,936	98	Paved parking, HSG C
3,537	80	>75% Grass cover, Good, HSG D
36,598	78	Weighted Average
28,652		78.29% Pervious Area
7,946		21.71% Impervious Area

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

Summary for Subcatchment SUB 1.1:

Runoff = 5.65 cfs @ 12.12 hrs, Volume= 0.441 af, Depth> 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
14,900	61	>75% Grass cover, Good, HSG B
2,623	98	Paved parking, HSG B
58,657	74	>75% Grass cover, Good, HSG C
5,172	98	Paved parking, HSG C
81,352	74	Weighted Average
73,557		90.42% Pervious Area
7,795		9.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	100	0.0450	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.7	170	0.0120	1.64		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	15	0.3330	8.66		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.3	285	Total			

Summary for Subcatchment SUB 1.4:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.87 cfs @ 12.08 hrs, Volume= 0.133 af, Depth> 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
3,560	61	>75% Grass cover, Good, HSG B
1,870	98	Paved parking, HSG B
16,172	74	>75% Grass cover, Good, HSG C
389	98	Paved parking, HSG C
1,207	80	>75% Grass cover, Good, HSG D
549	98	Paved parking, HSG D
23,747	75	Weighted Average
20,939		88.18% Pervious Area
2,808		11.82% Impervious Area

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

Summary for Subcatchment SUB 100:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.59 cfs @ 12.07 hrs, Volume= 0.118 af, Depth> 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
2,170	98	Paved parking, HSG B
4,094	74	>75% Grass cover, Good, HSG C
7,351	98	Paved parking, HSG C
13,615	91	Weighted Average
4,094		30.07% Pervious Area
9,521		69.93% Impervious Area

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

Summary for Subcatchment SUB 100.1:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.20 cfs @ 12.08 hrs, Volume= 0.086 af, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
8,607	74	>75% Grass cover, Good, HSG C
3,268	98	Paved parking, HSG C
872	80	>75% Grass cover, Good, HSG D
51	98	Paved parking, HSG D
12,798	81	Weighted Average
9,479		74.07% Pervious Area
3,319		25.93% Impervious Area

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

Summary for Subcatchment SUB 101:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.49 cfs @ 12.07 hrs, Volume= 0.036 af, Depth> 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
1,564	74	>75% Grass cover, Good, HSG C
2,782	98	Paved parking, HSG C
4,346	89	Weighted Average
1,564		35.99% Pervious Area
2,782		64.01% Impervious Area

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

Summary for Subcatchment SUB 101.1:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.50 cfs @ 12.08 hrs, Volume= 0.107 af, Depth> 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
2,191	61	>75% Grass cover, Good, HSG B
1,198	98	Paved parking, HSG B
5,351	74	>75% Grass cover, Good, HSG C
1,539	98	Paved parking, HSG C
4,344	80	>75% Grass cover, Good, HSG D
1,807	98	Paved parking, HSG D
16,430	80	Weighted Average
11,886		72.34% Pervious Area
4,544		27.66% Impervious Area

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

Summary for Subcatchment SUB 102:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.31 cfs @ 12.07 hrs, Volume= 0.099 af, Depth> 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
1,936	98	Paved parking, HSG B
2,173	74	>75% Grass cover, Good, HSG C
6,723	98	Paved parking, HSG C
10,832	93	Weighted Average
2,173		20.06% Pervious Area
8,659		79.94% Impervious Area

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

Summary for Subcatchment SUB 102.1: BUILDING 1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 8.32 cfs @ 12.07 hrs, Volume= 0.673 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

	Area (sf)	CN	Description
*	65,920	98	
	65,920		100.00% Impervious Area

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

Summary for Subcatchment SUB 102.2:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.45 cfs @ 12.08 hrs, Volume= 0.103 af, Depth> 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
3,253	61	>75% Grass cover, Good, HSG B
1,155	98	Paved parking, HSG B
6,508	74	>75% Grass cover, Good, HSG C
4,881	98	Paved parking, HSG C
34	80	>75% Grass cover, Good, HSG D
15,831	80	Weighted Average
9,795		61.87% Pervious Area
6,036		38.13% Impervious Area

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

Summary for Subcatchment SUB 103:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.34 cfs @ 12.07 hrs, Volume= 0.025 af, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
1,442	74	>75% Grass cover, Good, HSG C
1,676	98	Paved parking, HSG C
3,118	87	Weighted Average
1,442		46.25% Pervious Area
1,676		53.75% Impervious Area

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

Summary for Subcatchment SUB 103.1: BUILDING 1

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

Runoff = 9.46 cfs @ 12.00 hrs, Volume= 0.674 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

	Area (sf)	CN	Description
*	65,920	98	
	65,920		100.00% Impervious Area

Summary for Subcatchment SUB 103.2:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.96 cfs @ 12.08 hrs, Volume= 0.068 af, Depth> 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,336	61	>75% Grass cover, Good, HSG B
703	98	Paved parking, HSG B
1,954	74	>75% Grass cover, Good, HSG C
804	98	Paved parking, HSG C
2,170	80	>75% Grass cover, Good, HSG D
1,196	98	Paved parking, HSG D
12,163	75	Weighted Average
9,460		77.78% Pervious Area
2,703		22.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	35	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
0.0	13	0.3080	8.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.7	110	0.0270	2.46		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
3.4	158	Total, Increased to minimum Tc = 5.0 min			

Summary for Subcatchment SUB 104:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.35 cfs @ 12.07 hrs, Volume= 0.025 af, Depth> 4.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
1,643	74	>75% Grass cover, Good, HSG C
1,672	98	Paved parking, HSG C
3,315	86	Weighted Average
1,643		49.56% Pervious Area
1,672		50.44% Impervious Area

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

Summary for Subcatchment SUB 104.1: GARAGE 1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 4.76 cfs @ 12.07 hrs, Volume= 0.385 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

	Area (sf)	CN	Description
*	37,700	98	
	37,700		100.00% Impervious Area

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

Summary for Subcatchment SUB 104.2:

Runoff = 1.06 cfs @ 12.15 hrs, Volume= 0.088 af, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
2,498	98	Paved parking, HSG C
7,602	74	>75% Grass cover, Good, HSG C
2,290	80	>75% Grass cover, Good, HSG D
808	98	Paved parking, HSG D
13,198	81	Weighted Average
9,892		74.95% Pervious Area
3,306		25.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0200	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.3	162	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.4	262	Total			

Summary for Subcatchment SUB 105:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.13 cfs @ 12.07 hrs, Volume= 0.083 af, Depth> 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
3,004	74	>75% Grass cover, Good, HSG C
4,757	98	Paved parking, HSG C
1,059	80	>75% Grass cover, Good, HSG D
1,198	98	Paved parking, HSG D
10,018	89	Weighted Average
4,063		40.56% Pervious Area
5,955		59.44% Impervious Area

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

Summary for Subcatchment SUB 105.1:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.36 cfs @ 12.08 hrs, Volume= 0.026 af, Depth> 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
2,679	61	>75% Grass cover, Good, HSG B
3,228	74	>75% Grass cover, Good, HSG C
5,907	68	Weighted Average
5,907		100.00% Pervious Area

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

Summary for Subcatchment SUB 106:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.20 cfs @ 12.07 hrs, Volume= 0.088 af, Depth> 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
3,839	74	>75% Grass cover, Good, HSG C
5,700	98	Paved parking, HSG C
393	80	>75% Grass cover, Good, HSG D
647	98	Paved parking, HSG C
10,579	89	Weighted Average
4,232		40.00% Pervious Area
6,347		60.00% Impervious Area

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

Summary for Subcatchment SUB 106.1:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.16 cfs @ 12.08 hrs, Volume= 0.083 af, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
8,983	74	>75% Grass cover, Good, HSG C
3,375	98	Paved parking, HSG C
12,358	81	Weighted Average
8,983		72.69% Pervious Area
3,375		27.31% Impervious Area

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

Summary for Subcatchment SUB 107:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.29 cfs @ 12.07 hrs, Volume= 0.093 af, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,548	74	>75% Grass cover, Good, HSG C
6,277	98	Paved parking, HSG C
11,825	87	Weighted Average
5,548		46.92% Pervious Area
6,277		53.08% Impervious Area

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

Summary for Subcatchment SUB 108:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.05 cfs @ 12.07 hrs, Volume= 0.152 af, Depth> 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,419	74	>75% Grass cover, Good, HSG C
12,119	98	Paved parking, HSG C
17,538	91	Weighted Average
5,419		30.90% Pervious Area
12,119		69.10% Impervious Area

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

Summary for Subcatchment SUB 109:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.41 cfs @ 12.07 hrs, Volume= 0.034 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
3,285	98	Paved parking, HSG C
3,285		100.00% Impervious Area

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

Summary for Subcatchment SUB 110:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.57 cfs @ 12.07 hrs, Volume= 0.196 af, Depth> 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
1,371	61	>75% Grass cover, Good, HSG B
6,038	98	Paved parking, HSG B
1,718	74	>75% Grass cover, Good, HSG C
11,899	98	Paved parking, HSG C
21,026	94	Weighted Average
3,089		14.69% Pervious Area
17,937		85.31% Impervious Area

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

Summary for Subcatchment SUB 111:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.35 cfs @ 12.07 hrs, Volume= 0.109 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
9,876	98	Paved parking, HSG C
797	98	Paved parking, HSG D
10,673	98	Weighted Average
10,673		100.00% Impervious Area

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

Summary for Subcatchment SUB 112:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.91 cfs @ 12.07 hrs, Volume= 0.074 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
7,229	98	Paved parking, HSG C
7,229		100.00% Impervious Area

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

Summary for Subcatchment SUB 113:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.64 cfs @ 12.07 hrs, Volume= 0.052 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,080	98	Paved parking, HSG C
5,080		100.00% Impervious Area

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

Summary for Subcatchment SUB 114:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.30 cfs @ 12.07 hrs, Volume= 0.024 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
2,372	98	Paved parking, HSG C
2,372		100.00% Impervious Area

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

Summary for Subcatchment SUB 115:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.27 cfs @ 12.07 hrs, Volume= 0.022 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
2,131	98	Paved parking, HSG C
2,131		100.00% Impervious Area

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

Summary for Subcatchment SUB 200:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.33 cfs @ 12.07 hrs, Volume= 0.025 af, Depth> 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
583	74	>75% Grass cover, Good, HSG C
2,177	98	Paved parking, HSG C
2,760	93	Weighted Average
583		21.12% Pervious Area
2,177		78.88% Impervious Area

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

Summary for Subcatchment SUB 200.1: BUILDING 3

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

Runoff = 9.08 cfs @ 12.00 hrs, Volume= 0.646 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

	Area (sf)	CN	Description
*	63,221	98	
	63,221		100.00% Impervious Area

Summary for Subcatchment SUB 200.2:

Runoff = 1.06 cfs @ 12.12 hrs, Volume= 0.085 af, Depth> 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
18,788	61	>75% Grass cover, Good, HSG B
1,240	98	Paved parking, HSG B
982	74	>75% Grass cover, Good, HSG C
668	98	Paved parking, HSG C
21,678	65	Weighted Average
19,770		91.20% Pervious Area
1,908		8.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0370	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.0	170	0.0370	2.89		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.1	270	Total			

Summary for Subcatchment SUB 201:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.85 cfs @ 12.07 hrs, Volume= 0.069 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
6,729	98	Paved parking, HSG C
6,729		100.00% Impervious Area

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

Summary for Subcatchment SUB 201.1:

Runoff = 0.54 cfs @ 12.14 hrs, Volume= 0.045 af, Depth> 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
8,482	61	>75% Grass cover, Good, HSG B
2,590	74	>75% Grass cover, Good, HSG C
324	98	Paved parking, HSG C
11,396	65	Weighted Average
11,072		97.16% Pervious Area
324		2.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.0210	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
0.1	40	0.2250	7.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
9.1	140	Total			

Summary for Subcatchment SUB 202:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.93 cfs @ 12.07 hrs, Volume= 0.067 af, Depth> 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,181	74	>75% Grass cover, Good, HSG C
3,974	98	Paved parking, HSG C
9,155	84	Weighted Average
5,181		56.59% Pervious Area
3,974		43.41% Impervious Area

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

Summary for Subcatchment SUB 203:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.64 cfs @ 12.07 hrs, Volume= 0.046 af, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
2,595	74	>75% Grass cover, Good, HSG C
3,293	98	Paved parking, HSG C
5,888	87	Weighted Average
2,595		44.07% Pervious Area
3,293		55.93% Impervious Area

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

Summary for Subcatchment SUB 204:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.50 cfs @ 12.07 hrs, Volume= 0.188 af, Depth> 4.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,554	74	>75% Grass cover, Good, HSG C
15,504	98	Paved parking, HSG C
21,058	92	Weighted Average
5,554		26.37% Pervious Area
15,504		73.63% Impervious Area

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

Summary for Subcatchment SUB 300:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.51 cfs @ 12.07 hrs, Volume= 0.197 af, Depth> 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
2,018	98	Paved parking, HSG B
1,608	74	>75% Grass cover, Good, HSG C
16,539	98	Paved parking, HSG C
20,165	96	Weighted Average
1,608		7.97% Pervious Area
18,557		92.03% Impervious Area

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

Summary for Subcatchment SUB 300.1: BUILDING 2

[49] Hint: Tc<2dt may require smaller dt

Runoff = 8.97 cfs @ 12.07 hrs, Volume= 0.726 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

	Area (sf)	CN	Description
*	71,050	98	
	71,050		100.00% Impervious Area

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

Summary for Subcatchment SUB 300.2:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.20 cfs @ 12.07 hrs, Volume= 0.085 af, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
7,458	74	>75% Grass cover, Good, HSG C
4,574	98	Paved parking, HSG C
12,032	83	Weighted Average
7,458		61.98% Pervious Area
4,574		38.02% Impervious Area

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

Summary for Subcatchment SUB 301:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.50 cfs @ 12.07 hrs, Volume= 0.039 af, Depth> 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
3,563	98	Paved parking, HSG C
527	74	>75% Grass cover, Good, HSG C
4,090	95	Weighted Average
527		12.89% Pervious Area
3,563		87.11% Impervious Area

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

Summary for Subcatchment SUB 302:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.76 cfs @ 12.07 hrs, Volume= 0.058 af, Depth> 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,305	98	Paved parking, HSG C
817	74	>75% Grass cover, Good, HSG C
6,122	95	Weighted Average
817		13.35% Pervious Area
5,305		86.65% Impervious Area

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

Summary for Subcatchment SUB 303.1: BUILDING 2

[49] Hint: Tc<2dt may require smaller dt

Runoff = 8.97 cfs @ 12.07 hrs, Volume= 0.726 af, Depth> 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

	Area (sf)	CN	Description
*	71,050	98	
	71,050		100.00% Impervious Area

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

Summary for Subcatchment SUBB 303:

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.81 cfs @ 12.07 hrs, Volume= 0.062 af, Depth> 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
343	61	>75% Grass cover, Good, HSG B
3,350	98	Paved parking, HSG B
357	74	>75% Grass cover, Good, HSG C
2,493	98	Paved parking, HSG C
6,543	95	Weighted Average
700		10.70% Pervious Area
5,843		89.30% Impervious Area

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

Summary for Reach REACH 1.2:

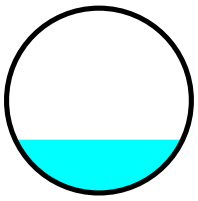
[52] Hint: Inlet/Outlet conditions not evaluated
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)
[80] Warning: Exceeded Pond POND 1.1 by 2.89' @ 0.05 hrs (0.07 cfs 0.054 af)

Inflow Area = 7.164 ac, 52.93% Impervious, Inflow Depth > 54.24" for 10 Year event
Inflow = 25.51 cfs @ 12.09 hrs, Volume= 32.385 af, Incl. 15.50 cfs Base Flow
Outflow = 25.50 cfs @ 12.10 hrs, Volume= 32.369 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.76 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 5.94 fps, Avg. Travel Time= 0.7 min

Peak Storage= 977 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.29'
Bank-Full Depth= 4.50' Flow Area= 15.9 sf, Capacity= 141.97 cfs

54.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 259.0' Slope= 0.0052 '/'
Inlet Invert= 49.35', Outlet Invert= 48.00'



Summary for Reach REACH 1.3: RESTORED HODGSON BROOK

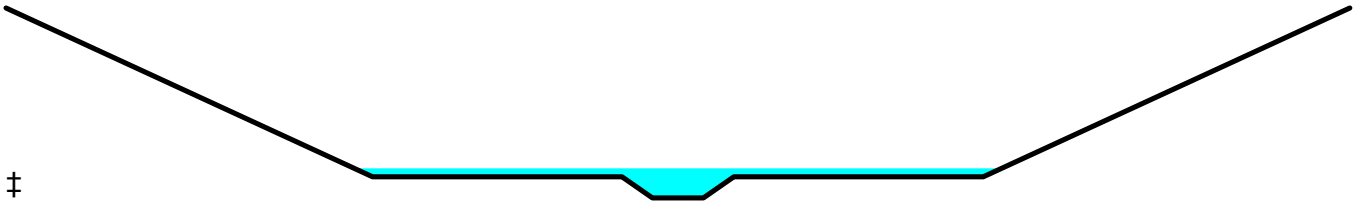
[61] Hint: Exceeded Reach REACH 1.2 outlet invert by 1.05' @ 12.20 hrs

Inflow Area = 7.164 ac, 52.93% Impervious, Inflow Depth > 54.22" for 10 Year event
Inflow = 25.50 cfs @ 12.10 hrs, Volume= 32.369 af
Outflow = 22.99 cfs @ 12.18 hrs, Volume= 32.076 af, Atten= 10%, Lag= 4.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.02 fps, Min. Travel Time= 10.8 min
Avg. Velocity = 1.64 fps, Avg. Travel Time= 13.3 min

Peak Storage= 16,060 cf @ 12.18 hrs
Average Depth at Peak Storage= 1.05'
Bank-Full Depth= 6.75' Flow Area= 291.0 sf, Capacity= 2,720.29 cfs

Custom cross-section, Length= 1,309.0' Slope= 0.0092 '/' (101 Elevation Intervals)
Constant n= 0.040 Winding stream, pools & shoals
Inlet Invert= 48.00', Outlet Invert= 36.00'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	12.00	0.00
18.00	6.00	6.00
30.25	6.00	6.00
31.75	5.25	6.75
34.25	5.25	6.75
35.75	6.00	6.00
48.00	6.00	6.00
66.00	12.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	2.5	0	0.00
0.75	3.0	30.4	3,927	2.28
6.75	291.0	68.3	380,919	2,720.29

Summary for Pond 1P: PDMH202

[80] Warning: Exceeded Pond 9P by 0.30' @ 12.00 hrs (1.33 cfs 0.025 af)

Inflow Area = 3.257 ac, 68.46% Impervious, Inflow Depth > 4.31" for 10 Year event
Inflow = 13.76 cfs @ 12.02 hrs, Volume= 1.170 af
Outflow = 13.76 cfs @ 12.02 hrs, Volume= 1.170 af, Atten= 0%, Lag= 0.0 min
Primary = 13.76 cfs @ 12.02 hrs, Volume= 1.170 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.94' @ 12.57 hrs
Flood Elev= 56.55'

Device	Routing	Invert	Outlet Devices
#1	Primary	50.75'	**24.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 50.75' / 50.50' S= 0.0049 '/' Cc= 0.900
n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=10.77 cfs @ 12.02 hrs HW=53.13' TW=52.62' (Dynamic Tailwater)
1=Culvert (Inlet Controls 10.77 cfs @ 3.43 fps)

Summary for Pond 2P: PCB301

Inflow Area = 0.094 ac, 87.11% Impervious, Inflow Depth > 4.99" for 10 Year event
Inflow = 0.50 cfs @ 12.07 hrs, Volume= 0.039 af
Outflow = 0.50 cfs @ 12.07 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min
Primary = 0.50 cfs @ 12.07 hrs, Volume= 0.039 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.69' @ 12.23 hrs
Flood Elev= 55.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.65'	**12.0" Round Culvert**
			L= 81.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 51.65' / 50.65' S= 0.0123 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.43 cfs @ 12.07 hrs HW=52.01' TW=51.38' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.43 cfs @ 2.54 fps)

Summary for Pond 3P: PDMH201

[80] Warning: Exceeded Pond 6P by 0.21' @ 11.95 hrs (1.75 cfs 0.042 af)
[80] Warning: Exceeded Pond 12P by 0.32' @ 12.00 hrs (2.04 cfs 0.087 af)

Inflow Area = 3.039 ac, 66.64% Impervious, Inflow Depth > 4.25" for 10 Year event
Inflow = 12.83 cfs @ 12.02 hrs, Volume= 1.076 af
Outflow = 12.83 cfs @ 12.02 hrs, Volume= 1.076 af, Atten= 0%, Lag= 0.0 min
Primary = 12.83 cfs @ 12.02 hrs, Volume= 1.076 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.95' @ 12.61 hrs
Flood Elev= 56.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.20'	**24.0" Round Culvert**
			L= 68.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 51.20' / 50.85' S= 0.0051 '/' Cc= 0.900
			n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=8.74 cfs @ 12.02 hrs HW=53.45' TW=53.11' (Dynamic Tailwater)
1=Culvert (Inlet Controls 8.74 cfs @ 2.78 fps)

Summary for Pond 6P: PCB204

Inflow Area = 0.483 ac, 73.63% Impervious, Inflow Depth > 4.65" for 10 Year event
Inflow = 2.50 cfs @ 12.07 hrs, Volume= 0.188 af
Outflow = 2.50 cfs @ 12.07 hrs, Volume= 0.188 af, Atten= 0%, Lag= 0.0 min
Primary = 2.50 cfs @ 12.07 hrs, Volume= 0.188 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 54.07' @ 12.11 hrs
Flood Elev= 55.25'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.40'	**12.0" Round Culvert** L= 37.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.40' / 51.20' S= 0.0054 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.79 cfs @ 12.07 hrs HW=53.89' TW=53.66' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.79 cfs @ 2.28 fps)

Summary for Pond 7P: PYD105

Inflow Area = 0.136 ac, 0.00% Impervious, Inflow Depth > 2.30" for 10 Year event
Inflow = 0.36 cfs @ 12.08 hrs, Volume= 0.026 af
Outflow = 0.36 cfs @ 12.08 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min
Primary = 0.36 cfs @ 12.08 hrs, Volume= 0.026 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 55.30' @ 12.09 hrs
Flood Elev= 59.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	55.00'	**12.0" Round Culvert** L= 127.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 55.00' / 51.80' S= 0.0252 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.32 cfs @ 12.08 hrs HW=55.29' TW=54.20' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.32 cfs @ 2.53 fps)

Summary for Pond 8P: PDMH100

[80] Warning: Exceeded Pond 46P by 0.47' @ 12.20 hrs (1.91 cfs 0.008 af)
[80] Warning: Exceeded Pond 47P by 1.12' @ 12.20 hrs (3.27 cfs 0.027 af)

Inflow Area = 1.034 ac, 30.85% Impervious, Inflow Depth > 3.43" for 10 Year event
Inflow = 4.15 cfs @ 12.08 hrs, Volume= 0.296 af
Outflow = 4.15 cfs @ 12.08 hrs, Volume= 0.296 af, Atten= 0%, Lag= 0.0 min
Primary = 4.15 cfs @ 12.08 hrs, Volume= 0.296 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 52.95' @ 12.21 hrs
Flood Elev= 59.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	48.60'	**15.0" Round Culvert** L= 95.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.60' / 48.15' S= 0.0047 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.00 cfs @ 12.08 hrs HW=49.98' TW=50.37' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 9P: PCB201

[80] Warning: Exceeded Pond 10P by 1.70' @ 17.20 hrs (3.93 cfs 0.447 af)

Inflow Area = 0.218 ac, 93.86% Impervious, Inflow Depth > 5.17" for 10 Year event
Inflow = 1.18 cfs @ 12.07 hrs, Volume= 0.094 af
Outflow = 1.18 cfs @ 12.07 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min
Primary = 1.18 cfs @ 12.07 hrs, Volume= 0.094 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.94' @ 12.62 hrs
Flood Elev= 56.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.70'	**12.0" Round Culvert** L= 166.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.70' / 50.85' S= 0.0051 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.69 cfs @ 12.07 hrs HW=53.35' TW=53.27' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.69 cfs @ 0.88 fps)

Summary for Pond 10P: PCB200

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=98)

Inflow Area = 0.063 ac, 78.88% Impervious, Inflow Depth > 4.77" for 10 Year event
Inflow = 0.33 cfs @ 12.07 hrs, Volume= 0.025 af
Outflow = 0.33 cfs @ 12.07 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min
Primary = 0.33 cfs @ 12.07 hrs, Volume= 0.025 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.94' @ 12.67 hrs
Flood Elev= 56.65'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.90'	**12.0" Round Culvert** L= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.90' / 51.80' S= 0.0056 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=52.98' TW=53.35' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 11P: PDMH200

[80] Warning: Exceeded Pond 17P by 0.03' @ 12.00 hrs (0.18 cfs 0.001 af)

Inflow Area = 2.211 ac, 67.97% Impervious, Inflow Depth > 4.21" for 10 Year event
Inflow = 9.82 cfs @ 12.00 hrs, Volume= 0.776 af
Outflow = 9.82 cfs @ 12.00 hrs, Volume= 0.776 af, Atten= 0%, Lag= 0.0 min
Primary = 9.82 cfs @ 12.00 hrs, Volume= 0.776 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 55.33' @ 12.00 hrs
Flood Elev= 60.25'

Device	Routing	Invert	Outlet Devices
#1	Primary	53.25'	**18.0" Round Culvert** L= 81.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 53.25' / 51.30' S= 0.0241 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=9.69 cfs @ 12.00 hrs HW=55.30' TW=53.36' (Dynamic Tailwater)
1=Culvert (Inlet Controls 9.69 cfs @ 5.48 fps)

Summary for Pond 12P: PCB203

[80] Warning: Exceeded Pond 13P by 0.44' @ 12.05 hrs (2.51 cfs 0.145 af)

Inflow Area = 0.345 ac, 48.31% Impervious, Inflow Depth > 3.93" for 10 Year event
Inflow = 1.57 cfs @ 12.07 hrs, Volume= 0.113 af
Outflow = 1.57 cfs @ 12.07 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min
Primary = 1.57 cfs @ 12.07 hrs, Volume= 0.113 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.96' @ 12.66 hrs
Flood Elev= 56.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.55'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.55' / 51.30' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.35 cfs @ 12.07 hrs HW=53.67' TW=53.66' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.35 cfs @ 0.45 fps)

Summary for Pond 13P: PCB202

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=52)

Inflow Area = 0.210 ac, 43.41% Impervious, Inflow Depth > 3.80" for 10 Year event
Inflow = 0.93 cfs @ 12.07 hrs, Volume= 0.067 af
Outflow = 0.93 cfs @ 12.07 hrs, Volume= 0.067 af, Atten= 0%, Lag= 0.0 min
Primary = 0.93 cfs @ 12.07 hrs, Volume= 0.067 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.96' @ 12.71 hrs
Flood Elev= 56.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.75'	**12.0" Round Culvert** L= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.75' / 51.65' S= 0.0056 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=53.32' TW=53.67' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 14P: PDMH302

[58] Hint: Peaked 0.01' above defined flood level
[80] Warning: Exceeded Pond 20P by 2.05' @ 12.10 hrs (5.41 cfs 0.056 af)
[80] Warning: Exceeded Pond 28P by 1.59' @ 12.10 hrs (3.56 cfs 0.020 af)

Inflow Area = 0.511 ac, 60.43% Impervious, Inflow Depth > 4.29" for 10 Year event
Inflow = 2.46 cfs @ 12.07 hrs, Volume= 0.183 af
Outflow = 2.46 cfs @ 12.07 hrs, Volume= 0.183 af, Atten= 0%, Lag= 0.0 min
Primary = 2.46 cfs @ 12.07 hrs, Volume= 0.183 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.61' @ 12.13 hrs
Flood Elev= 53.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	49.35'	**12.0" Round Culvert** L= 137.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.35' / 48.65' S= 0.0051 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=51.94' TW=52.62' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 17P: PYD201

[80] Warning: Exceeded Pond 19P by 0.14' @ 12.05 hrs (0.84 cfs 0.003 af)

Inflow Area = 0.759 ac, 6.75% Impervious, Inflow Depth > 2.05" for 10 Year event
Inflow = 1.58 cfs @ 12.13 hrs, Volume= 0.130 af
Outflow = 1.58 cfs @ 12.13 hrs, Volume= 0.130 af, Atten= 0%, Lag= 0.0 min
Primary = 1.58 cfs @ 12.13 hrs, Volume= 0.130 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 55.72' @ 12.07 hrs
Flood Elev= 59.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	54.65'	**12.0" Round Culvert** L= 254.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 54.65' / 53.35' S= 0.0051 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.71 cfs @ 12.13 hrs HW=55.58' TW=54.52' (Dynamic Tailwater)
1=Culvert (Outlet Controls 1.71 cfs @ 2.94 fps)

Summary for Pond 18P: PCB303

Inflow Area = 0.150 ac, 89.30% Impervious, Inflow Depth > 4.99" for 10 Year event
Inflow = 0.81 cfs @ 12.07 hrs, Volume= 0.062 af
Outflow = 0.81 cfs @ 12.07 hrs, Volume= 0.062 af, Atten= 0%, Lag= 0.0 min
Primary = 0.81 cfs @ 12.07 hrs, Volume= 0.062 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 49.41' @ 12.12 hrs
Flood Elev= 52.25'

Device	Routing	Invert	Outlet Devices
#1	Primary	48.25'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.25' / 47.00' S= 0.0543 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=48.99' TW=49.29' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 19P: PYD200

Inflow Area = 0.498 ac, 8.80% Impervious, Inflow Depth > 2.05" for 10 Year event
Inflow = 1.06 cfs @ 12.12 hrs, Volume= 0.085 af
Outflow = 1.06 cfs @ 12.12 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min
Primary = 1.06 cfs @ 12.12 hrs, Volume= 0.085 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 55.85' @ 12.12 hrs
Flood Elev= 59.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	55.00'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 55.00' / 54.75' S= 0.0109 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.27 cfs @ 12.12 hrs HW=55.80' TW=55.59' (Dynamic Tailwater)
1=Culvert (Outlet Controls 1.27 cfs @ 2.56 fps)

Summary for Pond 20P: PCB302

[58] Hint: Peaked 0.12' above defined flood level

Inflow Area = 0.141 ac, 86.65% Impervious, Inflow Depth > 4.99" for 10 Year event
Inflow = 0.76 cfs @ 12.07 hrs, Volume= 0.058 af
Outflow = 0.76 cfs @ 12.07 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 12.07 hrs, Volume= 0.058 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.62' @ 12.18 hrs
Flood Elev= 53.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	49.50'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.50' / 49.45' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=50.65' TW=51.87' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 22P: PDMH300

[80] Warning: Exceeded Pond 23P by 0.56' @ 12.05 hrs (2.71 cfs 0.017 af)

Inflow Area = 2.094 ac, 98.24% Impervious, Inflow Depth > 5.29" for 10 Year event
Inflow = 11.48 cfs @ 12.07 hrs, Volume= 0.923 af
Outflow = 11.48 cfs @ 12.07 hrs, Volume= 0.923 af, Atten= 0%, Lag= 0.0 min
Primary = 11.48 cfs @ 12.07 hrs, Volume= 0.923 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 49.05' @ 12.09 hrs
Flood Elev= 51.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	46.20'	**18.0" Round Culvert** L= 29.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.20' / 45.00' S= 0.0414 '/' Cc= 0.900

n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=10.13 cfs @ 12.07 hrs HW=48.93' TW=47.51' (Dynamic Tailwater)
1=Culvert (Inlet Controls 10.13 cfs @ 5.73 fps)

Summary for Pond 23P: PCB300

Inflow Area = 0.463 ac, 92.03% Impervious, Inflow Depth > 5.11" for 10 Year event
Inflow = 2.51 cfs @ 12.07 hrs, Volume= 0.197 af
Outflow = 2.51 cfs @ 12.07 hrs, Volume= 0.197 af, Atten= 0%, Lag= 0.0 min
Primary = 2.51 cfs @ 12.07 hrs, Volume= 0.197 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 49.41' @ 12.12 hrs
Flood Elev= 50.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	46.60'	**12.0" Round Culvert** L= 49.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.60' / 46.30' S= 0.0061 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=48.71' TW=48.93' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 25P: PDMH304

[80] Warning: Exceeded Pond 18P by 0.58' @ 12.05 hrs (2.83 cfs 0.012 af)

Inflow Area = 2.292 ac, 90.48% Impervious, Inflow Depth > 5.08" for 10 Year event
Inflow = 12.23 cfs @ 12.07 hrs, Volume= 0.971 af
Outflow = 12.23 cfs @ 12.07 hrs, Volume= 0.971 af, Atten= 0%, Lag= 0.0 min
Primary = 12.23 cfs @ 12.07 hrs, Volume= 0.971 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 49.41' @ 12.07 hrs
Flood Elev= 51.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	46.60'	**18.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.60' / 45.00' S= 0.0727 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=11.33 cfs @ 12.07 hrs HW=49.29' TW=47.51' (Dynamic Tailwater)
1=Culvert (Inlet Controls 11.33 cfs @ 6.41 fps)

Summary for Pond 26P: PDMH303

[80] Warning: Exceeded Pond 14P by 1.28' @ 12.05 hrs (2.96 cfs 0.012 af)

Inflow Area = 2.142 ac, 90.57% Impervious, Inflow Depth > 5.09" for 10 Year event
Inflow = 11.43 cfs @ 12.07 hrs, Volume= 0.909 af
Outflow = 11.43 cfs @ 12.07 hrs, Volume= 0.909 af, Atten= 0%, Lag= 0.0 min
Primary = 11.43 cfs @ 12.07 hrs, Volume= 0.909 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.09' @ 12.09 hrs
Flood Elev= 55.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	48.55'	**18.0" Round Culvert** L= 267.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.55' / 46.70' S= 0.0069 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=10.21 cfs @ 12.07 hrs HW=52.60' TW=49.29' (Dynamic Tailwater)
1=Culvert (Outlet Controls 10.21 cfs @ 5.78 fps)

Summary for Pond 28P: PDMH301

[80] Warning: Exceeded Pond 2P by 1.28' @ 12.15 hrs (3.54 cfs 0.022 af)
[80] Warning: Exceeded Pond 29P by 1.56' @ 12.15 hrs (4.18 cfs 0.024 af)

Inflow Area = 0.370 ac, 50.47% Impervious, Inflow Depth > 4.03" for 10 Year event
Inflow = 1.70 cfs @ 12.07 hrs, Volume= 0.124 af
Outflow = 1.70 cfs @ 12.07 hrs, Volume= 0.124 af, Atten= 0%, Lag= 0.0 min
Primary = 1.70 cfs @ 12.07 hrs, Volume= 0.124 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.73' @ 12.18 hrs
Flood Elev= 54.45'

Device	Routing	Invert	Outlet Devices
#1	Primary	50.55'	**12.0" Round Culvert** L= 111.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 50.55' / 49.45' S= 0.0099 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=51.39' TW=51.98' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 29P: PYD300

Inflow Area = 0.276 ac, 38.02% Impervious, Inflow Depth > 3.70" for 10 Year event
Inflow = 1.20 cfs @ 12.07 hrs, Volume= 0.085 af
Outflow = 1.20 cfs @ 12.07 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.0 min
Primary = 1.20 cfs @ 12.07 hrs, Volume= 0.085 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.75' @ 12.23 hrs
Flood Elev= 55.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.00'	**12.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.00' / 50.65' S= 0.0054 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.90 cfs @ 12.07 hrs HW=51.67' TW=51.39' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.90 cfs @ 2.27 fps)

Summary for Pond 30P: PYD106

Inflow Area = 0.284 ac, 27.31% Impervious, Inflow Depth > 3.50" for 10 Year event
Inflow = 1.16 cfs @ 12.08 hrs, Volume= 0.083 af
Outflow = 1.16 cfs @ 12.08 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min
Primary = 1.16 cfs @ 12.08 hrs, Volume= 0.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 52.74' @ 12.23 hrs
Flood Elev= 55.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.75'	**12.0" Round Culvert** L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.75' / 51.15' S= 0.0054 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.67 cfs @ 12.08 hrs HW=52.51' TW=52.35' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.67 cfs @ 1.46 fps)

Summary for Pond 34P: PCB115

[80] Warning: Exceeded Pond 35P by 1.86' @ 15.95 hrs (4.29 cfs 1.351 af)

Inflow Area = 0.103 ac,100.00% Impervious, Inflow Depth > 5.34" for 10 Year event
Inflow = 0.57 cfs @ 12.07 hrs, Volume= 0.046 af
Outflow = 0.57 cfs @ 12.07 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min
Primary = 0.57 cfs @ 12.07 hrs, Volume= 0.046 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 46.47' @ 12.36 hrs
Flood Elev= 49.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	43.15'	**12.0" Round Culvert** L= 29.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 43.15' / 43.00' S= 0.0052 '/' Cc= 0.900

n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=45.53' TW=45.86' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 35P: PCB114

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=106)

Inflow Area = 0.054 ac,100.00% Impervious, Inflow Depth > 5.34" for 10 Year event
Inflow = 0.30 cfs @ 12.07 hrs, Volume= 0.024 af
Outflow = 0.30 cfs @ 12.07 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min
Primary = 0.30 cfs @ 12.07 hrs, Volume= 0.024 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 46.47' @ 12.41 hrs
Flood Elev= 49.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	43.35'	**12.0" Round Culvert** L= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 43.35' / 43.25' S= 0.0056 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=45.20' TW=45.53' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 38P: PDMH104

Inflow Area = 8.969 ac, 74.75% Impervious, Inflow Depth > 4.65" for 10 Year event
Inflow = 42.44 cfs @ 12.06 hrs, Volume= 3.477 af
Outflow = 42.44 cfs @ 12.06 hrs, Volume= 3.477 af, Atten= 0%, Lag= 0.0 min
Primary = 42.44 cfs @ 12.06 hrs, Volume= 3.477 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 47.03' @ 12.09 hrs
Flood Elev= 49.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	43.10'	**36.0" Round Culvert** L= 13.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 43.10' / 43.00' S= 0.0077 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf

Primary OutFlow Max=36.23 cfs @ 12.06 hrs HW=46.92' TW=45.79' (Dynamic Tailwater)
1=Culvert (Inlet Controls 36.23 cfs @ 5.13 fps)

Summary for Pond 39P: PCB111

Inflow Area = 3.658 ac, 68.30% Impervious, Inflow Depth > 4.46" for 10 Year event
Inflow = 17.19 cfs @ 12.07 hrs, Volume= 1.360 af
Outflow = 17.19 cfs @ 12.07 hrs, Volume= 1.360 af, Atten= 0%, Lag= 0.0 min
Primary = 17.19 cfs @ 12.07 hrs, Volume= 1.360 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 48.11' @ 12.11 hrs
Flood Elev= 49.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	44.40'	**24.0" Round Culvert** L= 5.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.40' / 44.00' S= 0.0800 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=13.14 cfs @ 12.07 hrs HW=47.72' TW=46.96' (Dynamic Tailwater)
1=Culvert (Inlet Controls 13.14 cfs @ 4.18 fps)

Summary for Pond 40P: PYD104

Inflow Area = 3.413 ac, 66.02% Impervious, Inflow Depth > 4.40" for 10 Year event
Inflow = 15.85 cfs @ 12.07 hrs, Volume= 1.251 af
Outflow = 15.85 cfs @ 12.07 hrs, Volume= 1.251 af, Atten= 0%, Lag= 0.0 min
Primary = 15.85 cfs @ 12.07 hrs, Volume= 1.251 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 48.69' @ 12.14 hrs
Flood Elev= 51.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	45.60'	**24.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 45.60' / 44.50' S= 0.0239 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=7.92 cfs @ 12.07 hrs HW=48.00' TW=47.72' (Dynamic Tailwater)
1=Culvert (Inlet Controls 7.92 cfs @ 2.52 fps)

Summary for Pond 41P: PDMH102

[80] Warning: Exceeded Pond 42P by 1.54' @ 12.05 hrs (4.70 cfs 0.070 af)
[80] Warning: Exceeded Pond 57P by 0.04' @ 12.00 hrs (0.69 cfs 0.003 af)

Inflow Area = 3.110 ac, 70.01% Impervious, Inflow Depth > 4.49" for 10 Year event
Inflow = 15.01 cfs @ 12.07 hrs, Volume= 1.163 af
Outflow = 15.01 cfs @ 12.07 hrs, Volume= 1.163 af, Atten= 0%, Lag= 0.0 min
Primary = 15.01 cfs @ 12.07 hrs, Volume= 1.163 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 50.94' @ 12.09 hrs
Flood Elev= 53.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	46.20'	**18.0" Round Culvert** L= 95.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.20' / 45.70' S= 0.0053 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf

Primary OutFlow Max=13.17 cfs @ 12.07 hrs HW=50.75' TW=47.96' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 13.17 cfs @ 7.45 fps)

Summary for Pond 42P: PCB113

[80] Warning: Exceeded Pond 43P by 1.64' @ 12.10 hrs (4.85 cfs 0.069 af)

Inflow Area = 0.283 ac,100.00% Impervious, Inflow Depth > 5.34" for 10 Year event
Inflow = 1.55 cfs @ 12.07 hrs, Volume= 0.126 af
Outflow = 1.55 cfs @ 12.07 hrs, Volume= 0.126 af, Atten= 0%, Lag= 0.0 min
Primary = 1.55 cfs @ 12.07 hrs, Volume= 0.126 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 51.04' @ 12.14 hrs
Flood Elev= 53.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	46.45'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.45' / 46.30' S= 0.0075 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=49.76' TW=50.74' (Dynamic Tailwater)
↑**1=Culvert** (Controls 0.00 cfs)

Summary for Pond 43P: PCB112

Inflow Area = 0.166 ac,100.00% Impervious, Inflow Depth > 5.34" for 10 Year event
Inflow = 0.91 cfs @ 12.07 hrs, Volume= 0.074 af
Outflow = 0.91 cfs @ 12.07 hrs, Volume= 0.074 af, Atten= 0%, Lag= 0.0 min
Primary = 0.91 cfs @ 12.07 hrs, Volume= 0.074 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 51.06' @ 12.19 hrs
Flood Elev= 53.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	46.65'	**12.0" Round Culvert** L= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.65' / 46.55' S= 0.0056 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=48.43' TW=49.76' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 44P: PDMH101

[80] Warning: Exceeded Pond 8P by 1.17' @ 12.10 hrs (5.52 cfs 0.045 af)

Inflow Area = 1.034 ac, 30.85% Impervious, Inflow Depth > 3.43" for 10 Year event
Inflow = 4.15 cfs @ 12.08 hrs, Volume= 0.296 af
Outflow = 4.15 cfs @ 12.08 hrs, Volume= 0.296 af, Atten= 0%, Lag= 0.0 min
Primary = 4.15 cfs @ 12.08 hrs, Volume= 0.296 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 52.77' @ 12.16 hrs
Flood Elev= 56.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	48.05'	**15.0" Round Culvert** L= 73.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.05' / 47.70' S= 0.0048 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=0.00 cfs @ 12.08 hrs HW=50.37' TW=51.59' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 46P: PYD102

Inflow Area = 0.363 ac, 38.13% Impervious, Inflow Depth > 3.40" for 10 Year event
Inflow = 1.45 cfs @ 12.08 hrs, Volume= 0.103 af
Outflow = 1.45 cfs @ 12.08 hrs, Volume= 0.103 af, Atten= 0%, Lag= 0.0 min
Primary = 1.45 cfs @ 12.08 hrs, Volume= 0.103 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 52.97' @ 12.25 hrs
Flood Elev= 59.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	52.00'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 52.00' / 48.70' S= 0.0660 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=1.40 cfs @ 12.08 hrs HW=52.63' TW=49.98' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.40 cfs @ 2.70 fps)

Summary for Pond 47P: PYD101

[80] Warning: Exceeded Pond 48P by 1.23' @ 12.25 hrs (2.72 cfs 0.022 af)

Inflow Area = 0.671 ac, 26.90% Impervious, Inflow Depth > 3.45" for 10 Year event
Inflow = 2.70 cfs @ 12.08 hrs, Volume= 0.193 af
Outflow = 2.70 cfs @ 12.08 hrs, Volume= 0.193 af, Atten= 0%, Lag= 0.0 min
Primary = 2.70 cfs @ 12.08 hrs, Volume= 0.193 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.10' @ 12.26 hrs
Flood Elev= 55.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	49.10'	**12.0" Round Culvert** L= 84.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.10' / 48.70' S= 0.0048 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=2.12 cfs @ 12.08 hrs HW=50.45' TW=49.98' (Dynamic Tailwater)
1=Culvert (Outlet Controls 2.12 cfs @ 2.70 fps)

Summary for Pond 48P: PYD100

Inflow Area = 0.294 ac, 25.93% Impervious, Inflow Depth > 3.50" for 10 Year event
Inflow = 1.20 cfs @ 12.08 hrs, Volume= 0.086 af
Outflow = 1.20 cfs @ 12.08 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.0 min
Primary = 1.20 cfs @ 12.08 hrs, Volume= 0.086 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.14' @ 12.31 hrs
Flood Elev= 55.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	49.95'	**12.0" Round Culvert** L= 162.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.95' / 49.20' S= 0.0046 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.81 cfs @ 12.08 hrs HW=50.72' TW=50.45' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.81 cfs @ 1.71 fps)

Summary for Pond 57P: PYD103

[80] Warning: Exceeded Pond 44P by 1.25' @ 12.05 hrs (6.15 cfs 0.050 af)

Inflow Area = 1.314 ac, 29.01% Impervious, Inflow Depth > 3.32" for 10 Year event
Inflow = 5.11 cfs @ 12.08 hrs, Volume= 0.364 af
Outflow = 5.11 cfs @ 12.08 hrs, Volume= 0.364 af, Atten= 0%, Lag= 0.0 min
Primary = 5.11 cfs @ 12.08 hrs, Volume= 0.364 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 52.51' @ 12.11 hrs
Flood Elev= 55.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	47.60'	**15.0" Round Culvert** L= 242.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 47.60' / 46.30' S= 0.0054 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf

Primary OutFlow Max=3.36 cfs @ 12.08 hrs HW=51.61' TW=50.77' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 3.36 cfs @ 2.74 fps)

Summary for Pond 58P: PCB110

Inflow Area = 5.312 ac, 79.19% Impervious, Inflow Depth > 4.78" for 10 Year event
Inflow = 25.59 cfs @ 12.05 hrs, Volume= 2.117 af
Outflow = 25.59 cfs @ 12.05 hrs, Volume= 2.117 af, Atten= 0%, Lag= 0.0 min
Primary = 25.59 cfs @ 12.05 hrs, Volume= 2.117 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 47.81' @ 12.11 hrs
Flood Elev= 49.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	43.85'	**30.0" Round Culvert** L= 107.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 43.85' / 43.20' S= 0.0061 '/' Cc= 0.900 n= 0.013, Flow Area= 4.91 sf

Primary OutFlow Max=15.39 cfs @ 12.05 hrs HW=47.31' TW=46.89' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 15.39 cfs @ 3.14 fps)

Summary for Pond 60P: PDMH104

[80] Warning: Exceeded Pond 61P by 0.49' @ 12.10 hrs (2.65 cfs 0.082 af)

Inflow Area = 4.829 ac, 78.58% Impervious, Inflow Depth > 4.77" for 10 Year event
Inflow = 23.11 cfs @ 12.05 hrs, Volume= 1.920 af
Outflow = 23.11 cfs @ 12.05 hrs, Volume= 1.920 af, Atten= 0%, Lag= 0.0 min
Primary = 23.11 cfs @ 12.05 hrs, Volume= 1.920 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 48.23' @ 12.14 hrs
Flood Elev= 50.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	44.65'	**30.0" Round Culvert** L= 147.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.65' / 43.95' S= 0.0048 '/' Cc= 0.900 n= 0.013, Flow Area= 4.91 sf

Primary OutFlow Max=11.58 cfs @ 12.05 hrs HW=47.53' TW=47.26' (Dynamic Tailwater)
1=Culvert (Outlet Controls 11.58 cfs @ 2.57 fps)

Summary for Pond 61P: PCB109

Inflow Area = 0.075 ac,100.00% Impervious, Inflow Depth > 5.34" for 10 Year event
Inflow = 0.41 cfs @ 12.07 hrs, Volume= 0.034 af
Outflow = 0.41 cfs @ 12.07 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min
Primary = 0.41 cfs @ 12.07 hrs, Volume= 0.034 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 48.24' @ 12.19 hrs
Flood Elev= 50.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	44.95'	**12.0" Round Culvert** L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.95' / 44.75' S= 0.0053 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=47.32' TW=47.76' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 63P: PCB108

[80] Warning: Exceeded Pond 64P by 0.85' @ 12.00 hrs (3.50 cfs 0.031 af)

Inflow Area = 4.754 ac, 78.24% Impervious, Inflow Depth > 4.76" for 10 Year event
Inflow = 22.71 cfs @ 12.05 hrs, Volume= 1.887 af
Outflow = 22.71 cfs @ 12.05 hrs, Volume= 1.887 af, Atten= 0%, Lag= 0.0 min
Primary = 22.71 cfs @ 12.05 hrs, Volume= 1.887 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 49.46' @ 12.06 hrs
Flood Elev= 51.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	46.20'	**24.0" Round Culvert** L= 56.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.20' / 44.75' S= 0.0259 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=20.82 cfs @ 12.05 hrs HW=49.42' TW=47.52' (Dynamic Tailwater)
1=Culvert (Inlet Controls 20.82 cfs @ 6.63 fps)

Summary for Pond 64P: PCB107

Inflow Area = 0.271 ac, 53.08% Impervious, Inflow Depth > 4.11" for 10 Year event
Inflow = 1.29 cfs @ 12.07 hrs, Volume= 0.093 af
Outflow = 1.29 cfs @ 12.07 hrs, Volume= 0.093 af, Atten= 0%, Lag= 0.0 min
Primary = 1.29 cfs @ 12.07 hrs, Volume= 0.093 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 49.56' @ 12.11 hrs
Flood Elev= 51.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	47.20'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 47.20' / 46.30' S= 0.0391 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=49.33' TW=49.35' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 66P: PDMH103

Inflow Area = 4.080 ac, 80.81% Impervious, Inflow Depth > 4.83" for 10 Year event
Inflow = 19.54 cfs @ 12.04 hrs, Volume= 1.641 af
Outflow = 19.54 cfs @ 12.04 hrs, Volume= 1.641 af, Atten= 0%, Lag= 0.0 min
Primary = 19.54 cfs @ 12.04 hrs, Volume= 1.641 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 51.18' @ 12.07 hrs
Flood Elev= 54.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	47.10'	**24.0" Round Culvert** L= 159.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 47.10' / 46.30' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=16.76 cfs @ 12.04 hrs HW=50.90' TW=49.36' (Dynamic Tailwater)
1=Culvert (Outlet Controls 16.76 cfs @ 5.33 fps)

Summary for Pond 68P: PCB106

[80] Warning: Exceeded Pond 71P by 0.74' @ 12.10 hrs (3.24 cfs 0.049 af)

Inflow Area = 2.566 ac, 69.49% Impervious, Inflow Depth > 4.52" for 10 Year event
Inflow = 12.70 cfs @ 12.07 hrs, Volume= 0.967 af
Outflow = 12.70 cfs @ 12.07 hrs, Volume= 0.967 af, Atten= 0%, Lag= 0.0 min
Primary = 12.70 cfs @ 12.07 hrs, Volume= 0.967 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Elev= 51.97' @ 12.10 hrs
Flood Elev= 54.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	49.00'	**24.0" Round Culvert** L= 178.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.00' / 47.20' S= 0.0101 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=9.30 cfs @ 12.07 hrs HW=51.50' TW=51.03' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 9.30 cfs @ 3.04 fps)

Summary for Pond 71P: PCB105

Inflow Area = 0.230 ac, 59.44% Impervious, Inflow Depth > 4.33" for 10 Year event
Inflow = 1.13 cfs @ 12.07 hrs, Volume= 0.083 af
Outflow = 1.13 cfs @ 12.07 hrs, Volume= 0.083 af, Atten= 0%, Lag= 0.0 min
Primary = 1.13 cfs @ 12.07 hrs, Volume= 0.083 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 52.01' @ 12.15 hrs
Flood Elev= 54.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	49.20'	**12.0" Round Culvert** L= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.20' / 49.10' S= 0.0056 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=50.85' TW=51.51' (Dynamic Tailwater)
↑**1=Culvert** (Controls 0.00 cfs)

Summary for Pond 74P: PCB104

[80] Warning: Exceeded Pond 75P by 0.16' @ 12.05 hrs (1.51 cfs 0.018 af)

Inflow Area = 2.093 ac, 71.70% Impervious, Inflow Depth > 4.57" for 10 Year event
Inflow = 10.37 cfs @ 12.07 hrs, Volume= 0.797 af
Outflow = 10.37 cfs @ 12.07 hrs, Volume= 0.797 af, Atten= 0%, Lag= 0.0 min
Primary = 10.37 cfs @ 12.07 hrs, Volume= 0.797 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 52.63' @ 12.13 hrs
Flood Elev= 57.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	50.85'	**24.0" Round Culvert** L= 226.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 50.85' / 49.10' S= 0.0077 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=7.50 cfs @ 12.07 hrs HW=52.43' TW=51.50' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 7.50 cfs @ 3.87 fps)

Summary for Pond 75P: PCB103

Inflow Area = 0.355 ac, 32.64% Impervious, Inflow Depth > 3.62" for 10 Year event
Inflow = 1.51 cfs @ 12.07 hrs, Volume= 0.107 af
Outflow = 1.51 cfs @ 12.07 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min
Primary = 1.51 cfs @ 12.07 hrs, Volume= 0.107 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 52.69' @ 12.18 hrs
Flood Elev= 57.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.05'	**12.0" Round Culvert** L= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.05' / 50.95' S= 0.0056 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=52.35' TW=52.44' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)

Summary for Pond 77P: PCB102

[80] Warning: Exceeded Pond 78P by 1.19' @ 12.05 hrs (4.13 cfs 0.036 af)
[80] Warning: Exceeded Pond 79P by 1.00' @ 12.05 hrs (3.78 cfs 0.023 af)

Inflow Area = 0.797 ac, 60.41% Impervious, Inflow Depth > 4.20" for 10 Year event
Inflow = 3.75 cfs @ 12.07 hrs, Volume= 0.279 af
Outflow = 3.75 cfs @ 12.07 hrs, Volume= 0.279 af, Atten= 0%, Lag= 0.0 min
Primary = 3.75 cfs @ 12.07 hrs, Volume= 0.279 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 54.32' @ 12.09 hrs
Flood Elev= 56.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.70'	**12.0" Round Culvert** L= 143.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.70' / 50.95' S= 0.0052 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.38 cfs @ 12.07 hrs HW=54.15' TW=52.43' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 3.38 cfs @ 4.31 fps)

Summary for Pond 78P: PCB 101

Inflow Area = 0.100 ac, 64.01% Impervious, Inflow Depth > 4.33" for 10 Year event
Inflow = 0.49 cfs @ 12.07 hrs, Volume= 0.036 af
Outflow = 0.49 cfs @ 12.07 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min
Primary = 0.49 cfs @ 12.07 hrs, Volume= 0.036 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 54.33' @ 12.14 hrs
Flood Elev= 56.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	51.95'	**12.0" Round Culvert** L= 23.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.95' / 51.80' S= 0.0065 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=53.39' TW=54.15' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond 79P: PCB100

Inflow Area = 0.313 ac, 69.93% Impervious, Inflow Depth > 4.54" for 10 Year event
Inflow = 1.59 cfs @ 12.07 hrs, Volume= 0.118 af
Outflow = 1.59 cfs @ 12.07 hrs, Volume= 0.118 af, Atten= 0%, Lag= 0.0 min
Primary = 1.59 cfs @ 12.07 hrs, Volume= 0.118 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 54.42' @ 12.13 hrs
Flood Elev= 56.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	52.00'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 52.00' / 51.80' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.07 hrs HW=53.55' TW=54.15' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond POND 1.0: GRAVEL WETLAND 1

[95] Warning: Outlet Device #4 rise exceeded
[80] Warning: Exceeded Pond 34P by 1.85' @ 19.60 hrs (4.05 cfs 0.445 af)

Inflow Area = 9.913 ac, 70.51% Impervious, Inflow Depth > 4.54" for 10 Year event
Inflow = 46.14 cfs @ 12.06 hrs, Volume= 3.747 af
Outflow = 17.79 cfs @ 12.31 hrs, Volume= 2.730 af, Atten= 61%, Lag= 14.9 min
Primary = 17.79 cfs @ 12.31 hrs, Volume= 2.730 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 46.47' @ 12.31 hrs Surf.Area= 20,655 sf Storage= 77,040 cf
Flood Elev= 48.00' Surf.Area= 23,557 sf Storage= 110,845 cf

Plug-Flow detention time= 208.0 min calculated for 2.725 af (73% of inflow)
Center-of-Mass det. time= 118.5 min (887.3 - 768.8)

Volume	Invert	Avail.Storage	Storage Description
#1	39.05'	110,845 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.05	9,855	0.0	0	0
41.35	9,855	30.0	6,800	6,800
42.00	9,855	45.0	2,883	9,683
43.00	11,943	100.0	10,899	20,582
44.00	14,202	100.0	13,073	33,654
45.00	16,891	100.0	15,547	49,201
46.00	19,752	100.0	18,322	67,522
47.00	21,668	100.0	20,710	88,232
48.00	23,557	100.0	22,613	110,845

Device	Routing	Invert	Outlet Devices
#1	Primary	41.35'	**18.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 41.35' / 41.20' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	41.35'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	43.80'	**3.0" Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	45.00'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#5	Device 1	46.25'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads
#6	Secondary	46.50'	**15.0' long x 15.0' 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=17.79 cfs @ 12.31 hrs HW=46.47' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 17.79 cfs @ 10.06 fps)
  - **2=Orifice/Grate** (Passes < 0.53 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 0.75 cfs potential flow)
  - **4=Sharp-Crested Rectangular Weir** (Passes < 7.84 cfs potential flow)
  - **5=Orifice/Grate** (Passes < 26.55 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=39.05' TW=0.00' (Dynamic Tailwater)
- **6=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond POND 1.1: GRAVEL WETLAND 2

Inflow Area = 5.125 ac, 47.00% Impervious, Inflow Depth > 3.77" for 10 Year event
Inflow = 17.35 cfs @ 12.05 hrs, Volume= 1.611 af
Outflow = 3.69 cfs @ 12.55 hrs, Volume= 0.823 af, Atten= 79%, Lag= 30.1 min
Primary = 3.69 cfs @ 12.55 hrs, Volume= 0.823 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 53.92' @ 12.55 hrs Surf.Area= 13,619 sf Storage= 39,480 cf
Flood Elev= 56.00' Surf.Area= 19,805 sf Storage= 74,019 cf

Plug-Flow detention time= 265.0 min calculated for 0.821 af (51% of inflow)
Center-of-Mass det. time= 143.1 min (927.7 - 784.6)

Volume	Invert	Avail.Storage	Storage Description
#1	47.55'	74,019 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
47.55	6,269	0.0	0	0
49.85	6,269	30.0	4,326	4,326
50.50	6,269	45.0	1,834	6,159
51.00	7,199	100.0	3,367	9,526
52.00	9,187	100.0	8,193	17,719
53.00	11,345	100.0	10,266	27,985
54.00	13,814	100.0	12,580	40,565
55.00	16,645	100.0	15,230	55,794
56.00	19,805	100.0	18,225	74,019

Device	Routing	Invert	Outlet Devices
#1	Primary	49.85'	**24.0" Round Culvert** L= 22.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.85' / 49.45' S= 0.0182 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	49.85'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	53.50'	**4.0' long x 2.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	55.50'	**4.0" W x 4.0" H Vert. Orifice/Grate X 106.00** C= 0.600

Primary OutFlow Max=3.69 cfs @ 12.55 hrs HW=53.92' TW=50.52' (Dynamic Tailwater)
- **1=Culvert** (Passes 3.69 cfs of 26.51 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.19 cfs @ 8.88 fps)
  - **3=Sharp-Crested Rectangular Weir** (Weir Controls 3.50 cfs @ 2.12 fps)
  - **4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond POND 1.4: RAINGARDEN 1.0

Inflow Area = 4.931 ac, 85.08% Impervious, Inflow Depth > 4.93" for 10 Year event
Inflow = 25.59 cfs @ 12.07 hrs, Volume= 2.027 af
Outflow = 6.74 cfs @ 12.42 hrs, Volume= 1.427 af, Atten= 74%, Lag= 21.2 min
Primary = 6.74 cfs @ 12.42 hrs, Volume= 1.427 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 48.17' @ 12.42 hrs Surf.Area= 14,596 sf Storage= 46,096 cf
Flood Elev= 50.00' Surf.Area= 17,530 sf Storage= 75,568 cf

Plug-Flow detention time= 245.8 min calculated for 1.427 af (70% of inflow)
Center-of-Mass det. time= 151.5 min (907.4 - 755.9)

Volume	Invert	Avail.Storage	Storage Description
#1	42.17'	75,568 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
42.17	10,217	0.0	0	0
43.50	10,217	40.0	5,435	5,435
45.00	10,217	10.0	1,533	6,968
46.00	11,532	100.0	10,875	17,842
48.00	14,332	100.0	25,864	43,706
50.00	17,530	100.0	31,862	75,568

Device	Routing	Invert	Outlet Devices
#1	Primary	42.42'	**12.0" Round Culvert** L= 48.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 42.42' / 42.20' S= 0.0046 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	42.42'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	45.00'	**10.000 in/hr Exfiltration over Surface area above 45.00'** Excluded Surface area = 10,217 sf
#4	Device 1	47.20'	**13.2" x 13.2" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	49.35'	**3.0' long x 8.9' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.46 2.55 2.70 2.69 2.68 2.68 2.67 2.64 2.64 2.64 2.65 2.64 2.65 2.65 2.66 2.67 2.69

Primary OutFlow Max=6.73 cfs @ 12.42 hrs HW=48.16' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 6.73 cfs of 6.84 cfs potential flow)
  ├─**2=Orifice/Grate** (Passes 1.01 cfs of 2.22 cfs potential flow)
  │ └─**3=Exfiltration** (Exfiltration Controls 1.01 cfs)
  └─**4=Orifice/Grate** (Orifice Controls 5.72 cfs @ 4.73 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=42.17' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link PA1: POINT OF ANALYSIS

Inflow Area = 29.054 ac, 56.99% Impervious, Inflow Depth > 15.74" for 10 Year event
Inflow = 57.82 cfs @ 12.48 hrs, Volume= 38.101 af
Primary = 57.82 cfs @ 12.48 hrs, Volume= 38.101 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link PA2: POINT OF ANALYSIS

Inflow Area = 0.094 ac, 97.28% Impervious, Inflow Depth > 5.22" for 10 Year event
Inflow = 0.51 cfs @ 12.07 hrs, Volume= 0.041 af
Primary = 0.51 cfs @ 12.07 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

LEGEND

- POST-DEVELOPMENT WATERSHED BOUNDARY
- SOIL SURVEY BOUNDARIES
- LONGEST FLOW PATH
- POST 1.0 — PRE DEVELOPMENT WATERSHED AREA DESIGNATION
- POST POND 1 — POST-DEVELOPMENT POND DESIGNATION
- PA-1 — POINT OF ANALYSIS
- POST REACH 1 — POST-DEVELOPMENT REACH DESIGNATION
- SUB 1 — POST-DEVELOPMENT SUBCATCHMENT AREA DESIGNATION

SOIL IDENTIFICATION LEGEND

SYMBOL	SOIL TAXONOMIC NAME, SLOPE RATING
89C	CHATFIELD, 8 TO 15 PERCENT SLOPES
313B	DEERFIELD, 0 TO 8 PERCENT SLOPES
313C	DEERFIELD, 8 TO 15 PERCENT SLOPES
915B	DEERFIELD VARIANT, 0 TO 8 PERCENT SLOPES
546B/P	WALPOLE POORLY DRAINED, 0 TO 8 PERCENT SLOPES
799B	UDORTHENTS URBAN LAND, 0 TO 8 PERCENT SLOPES
799E	UDORTHENTS URBAN LAND, >25 PERCENT SLOPES

NOTES:
1. SOIL SURVEY WAS PERFORMED BY GOVE ENVIRONMENTAL SERVICES.

SCALE IN FEET
0 40' 80'
GRAPHIC SCALE

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Proposed Industrial Development

Lonza Biologics

Portsmouth,
New Hampshire

MARK	DATE	DESCRIPTION
D	8/21/2018	REVISED TAC SUBMISSION
C	6/18/2018	NHDES AOT SUBMISSION
B	5/21/2018	TAC SUBMISSION
A	4/3/2018	TAC WS SUBMISSION

PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L0700-C-801 to C-804.dwg
DRAWN BY:	NAH
CHECKED:	PMC
APPROVED:	BLM

POST-DEVELOPMENT SUBCATCHMENT AREA PLAN

SCALE: AS SHOWN

C-802.1

Last Save Date: August 20, 2018 4:03 PM By: NAHANSEN
Plot Date: August 20, 2018 4:03 PM By: NAHANSEN
T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576\F013 Iron Parcel Redevelopment\Drawings_Figures\AutoCAD\Sheet\L0700-C-801 to C-804.dwg Layout Tab: C-802.1

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POST 2.0

MATCH LINE SHEET 1
MATCH LINE SHEET 2

POST REACH 1.2

POST REACH 1.3

SUB 200.2
SUB 200.1
SUB 204
SUB 201
SUB 201.1
SUB 100
SUB 203
SUB 202
SUB 102
SUB 105.1
SUB 101
SUB 200
SUB 301
SUB 102.2
SUB 104.1
SUB 104
SUB 103
SUB 101.1
SUB 100.1
SUB 106.1
SUB 300.1
SUB 302
SUB 102.1
SUB 103.1
SUB 106
SUB 303.1
SUB 103.2
SUB 112
SUB 105
SUB 113

799E/cbade
546B/P
915B
313C
313B
799B/cbade

SCALE IN FEET
0 40' 80'
GRAPHIC SCALE

Proposed Industrial Development

Lonza Biologics

Portsmouth,
New Hampshire

MARK	DATE	DESCRIPTION
D	8/21/2018	REVISED TAC SUBMISSION
C	6/18/2018	NHDES AOT SUBMISSION
B	5/21/2018	TAC SUBMISSION
A	4/3/2018	TAC WS SUBMISSION

PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L0700-C-801 to C-804.dwg
DRAWN BY:	NAH
CHECKED:	PMC
APPROVED:	BLM

POST-DEVELOPMENT SUBCATCHMENT AREA PLAN

SCALE: AS SHOWN

C-802.2

Last Save Date: August 20, 2018, 4:02 PM By: NAHANSEN
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T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576\F\013 Iron Parcel Redevelopment\Drawings_Figures\AutoCAD\Sheet\L0700-C-801 to C-804.dwg Layout Tab: C-802.2

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SCALE IN FEET
0 40' 80'
GRAPHIC SCALE

Proposed Industrial Development

Lonza Biologics

Portsmouth,
New Hampshire

MARK	DATE	DESCRIPTION
D	8/21/2018	REVISED TAC SUBMISSION
C	6/18/2018	NHDES AOT SUBMISSION
B	5/21/2018	TAC SUBMISSION
A	4/3/2018	TAC WS SUBMISSION

PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L0700-C-801 to C-804.dwg
DRAWN BY:	NAH
CHECKED:	PMC
APPROVED:	BLM

POST-DEVELOPMENT SUBCATCHMENT AREA PLAN

SCALE: AS SHOWN

C-802.3

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T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576\FIG\13 Iron Parcel Redevelopment\Drawings_Figures\AutoCAD\Sheet\L0700-C-801 to C-804.dwg Layout Tab: C-802.3

7.4 Peak Rate Comparisons

The following table summarizes and compares the pre- and post-development peak runoff rates for the 2-year, 10-year, 25-year and 50-year storm events at each point of analysis. The pre-development 1-year storm event is also included for channel protection requirements.

Point of Analysis	Pre 1-Year Storm (cfs)	Pre/**Post** 2-Year Storm (cfs)	Pre/**Post** 10-Year Storm (cfs)	Pre/**Post** 25-Year Storm (cfs)	Pre/**Post** 50-Year Storm (cfs)
PA1	18.34	30.84/**18.01**	66.95/**60.03**	98.65/**94.11**	135.12/**134.81**
PA2	1.53	1.94/**0.33**	3.18/**0.51**	4.13/**0.65**	5.01/**0.78**

7.5 Mitigation Description

7.5.1 Mitigation Calculations

The proposed project area has been evaluated to provide the required water quality volume (WQV) and groundwater recharge volume (GRV) per the requirements of Env-Wq 1500. These calculations have been provided in Sections 5 and 6 respectively. The required groundwater recharge volumes (GRV) and water quality volumes (WQV) have been provided below outlets.

7.5.2 Pre-Treatment Methods for Protecting Water Quality

Pre-treatment for the two (2) proposed gravel wetlands is provided by a sediment forebay. Pre-treatment for the raingarden consists of deep sump catchbasins.

7.5.3 Treatment Methods for Protecting Water Quality

Treatment for the increased impervious area comes from one rain gardens/bio-retention basins and three gravel wetlands.

The BMP Worksheets for each treatment practice have been included in Section 6 of this report.

Section 8
Rip Rap Apron Calculations

Tighe&Bond

Engineers | Environmental Specialists

Project: Lonza Biologics
Location: Portsmouth, NH
T&B #: L-0700-013
Calculations By: NAH
Checked By: PMC
Date: 8/21/2018

APRON DESIGN

Terms: HW200

length of pool base (ft.)	L_a	
discharge from pipe (cfs)	Q	(25 YR STORM EVENT)
pipe dia. or channel width (ft.)	Do	
tailwater depth (ft.)	T_w	
width of pool base (at outlet)(ft)	W1	
median stone diameter (ft.)	d_{50}	

Equations Used:

Length of Apron (L_a)

when Tw < .5*Do $L_a = \frac{1.8(Q)}{Do^{(3/2)}} + 7Do$

when Tw >= .5*Do $L_a = \frac{3(Q)}{Do^{(3/2)}} + 7Do$

Width of Apron (W1)

$W1 = 3Do$

Width of Apron (W2)

when Tw < .5*Do $W2 = 3Do + La$

when Tw >= .5*Do $W2 = 3Do + 0.4La$

Median Diameter $d_{50} = \frac{0.02 * Q^{(1.3)}}{(Tw * Do)}$

Input:

Q (cfs)	43.71	cfs
Do (ft.)	4.50	ft
T_w (ft.)	1.80	ft

Output:

Width of Pool Base (W1)	9	ft.
Length of Pool Base (L_a)	14	ft.
Median Diameter	0.50	ft.
Riprap min. depth	1.13	ft.
Depth of Pool (S)	2.25	ft.

Tighe&Bond

Engineers | Environmental Specialists

Project: Lonza Biologics
Location: Portsmouth, NH
T&B #: L-0700-13
Calculations By: NAH
Checked By: PMC
Date: 8/21/2018

APRON DESIGN

Terms: HW100

length of apron (ft.)	L_a	
discharge from pipe (cfs)	Q	(25 YR STORM EVENT)
pipe dia. or channel width (ft.)	Do	
tailwater depth (ft.)	T_w	
width of apron (at outlet)(ft)	W1	
width of apron (downstream)(ft)	W2	
median stone diameter (ft.)	d_{50}	

Equations Used:

Length of Apron (L_a)

when Tw < .5*Do $L_a = \frac{1.8(Q)}{Do^{(3/2)}} + 7Do$

when Tw >= .5*Do $L_a = \frac{3(Q)}{Do^{(3/2)}} + 7Do$

Width of Apron (W1)

$W1 = 3Do$

Width of Apron (W2)

when Tw < .5*Do $W2 = 3Do + La$

when Tw >= .5*Do $W2 = 3Do + 0.4La$

Median Diameter $d_{50} = \frac{0.02 * Q^{(1.3)}}{(Tw * Do)}$

Input:		
Q (cfs)	18.76	cfs
Do (ft.)	1.50	ft
T_w (ft.)	0.60	ft

Output:		
Width of Apron (W1)	5	ft.
Width of Apron (W2)	33	ft.
Length of Apron (L_a)	29	ft.
Median Diameter	1.00	ft.
Riprap min. depth	2.26	ft.

Tighe&Bond

Engineers | Environmental Specialists

Project: Lonza Biologics
Location: Portsmouth, NH
T&B #: L-0700-13
Calculations By: NAH
Checked By: PMC
Date: 8/21/2018

APRON DESIGN

Terms: FES300

length of apron (ft.)	L_a	
discharge from pipe (cfs)	Q	(25 YR STORM EVENT)
pipe dia. or channel width (ft.)	Do	
tailwater depth (ft.)	T_w	
width of apron (at outlet)(ft)	W1	
width of apron (downstream)(ft)	W2	
median stone diameter (ft.)	d_{50}	

Equations Used:

Length of Apron (L_a)

when Tw < .5*Do $L_a = \frac{1.8(Q)}{Do^{(3/2)}} + 7Do$

when Tw >= .5*Do $L_a = \frac{3(Q)}{Do^{(3/2)}} + 7Do$

Width of Apron (W1)

$W1 = 3Do$

Width of Apron (W2)

when Tw < .5*Do $W2 = 3Do + La$

when Tw >= .5*Do $W2 = 3Do + 0.4La$

Median Diameter $d_{50} = \frac{0.02 * Q^{(1.3)}}{(Tw * Do)}$

Input:		
Q (cfs)	12.67	cfs
Do (ft.)	1.50	ft
T_w (ft.)	0.60	ft

Output:		
Width of Apron (W1)	5	ft.
Width of Apron (W2)	27	ft.
Length of Apron (L_a)	23	ft.
Median Diameter	0.60	ft.
Riprap min. depth	1.36	ft.

Tighe&Bond

Engineers | Environmental Specialists

Project: Lonza Biologics
Location: Portsmouth, NH
T&B #: L-0700-13
Calculations By: NAH
Checked By: PMC
Date: 8/21/2018

APRON DESIGN

Terms: FES301

length of apron (ft.)	L_a	
discharge from pipe (cfs)	Q	(25 YR STORM EVENT)
pipe dia. or channel width (ft.)	Do	
tailwater depth (ft.)	T_w	
width of apron (at outlet)(ft)	W1	
width of apron (downstream)(ft)	W2	
median stone diameter (ft.)	d_{50}	

Equations Used:

Length of Apron (L_a)

when Tw < .5*Do $L_a = \frac{1.8(Q)}{Do^{(3/2)}} + 7Do$

when Tw >= .5*Do $L_a = \frac{3(Q)}{Do^{(3/2)}} + 7Do$

Width of Apron (W1)

$W1 = 3Do$

Width of Apron (W2)

when Tw < .5*Do $W2 = 3Do + La$

when Tw >= .5*Do $W2 = 3Do + 0.4La$

Median Diameter $d_{50} = \frac{0.02 * Q^{(1.3)}}{(Tw * Do)}$

Input:		
Q (cfs)	13.54	cfs
Do (ft.)	1.50	ft
T_w (ft.)	0.60	ft

Output:		
Width of Apron (W1)	5	ft.
Width of Apron (W2)	28	ft.
Length of Apron (L_a)	24	ft.
Median Diameter	0.66	ft.
Riprap min. depth	1.48	ft.

Tighe&Bond

Engineers | Environmental Specialists

Project: Lonza Biologics
Location: Portsmouth, NH
T&B #: L-0700-13
Calculations By: NAH
Checked By: PMC
Date: 8/21/2018

APRON DESIGN

Terms: FES302

length of apron (ft.)	L_a	
discharge from pipe (cfs)	Q	(25 YR STORM EVENT)
pipe dia. or channel width (ft.)	Do	
tailwater depth (ft.)	T_w	
width of apron (at outlet)(ft)	W1	
width of apron (downstream)(ft)	W2	
median stone diameter (ft.)	d_{50}	

Equations Used:

Length of Apron (L_a)

when Tw < .5*Do $L_a = \frac{1.8(Q)}{Do^{(3/2)}} + 7Do$

when Tw >= .5*Do $L_a = \frac{3(Q)}{Do^{(3/2)}} + 7Do$

Width of Apron (W1)

$W1 = 3Do$

Width of Apron (W2)

when Tw < .5*Do $W2 = 3Do + La$

when Tw >= .5*Do $W2 = 3Do + 0.4La$

Median Diameter $d_{50} = \frac{0.02 * Q^{(1.3)}}{(Tw * Do)}$

Input:		
Q (cfs)	7.03	cfs
Do (ft.)	1.00	ft
T_w (ft.)	0.40	ft

Output:		
Width of Apron (W1)	3	ft.
Width of Apron (W2)	23	ft.
Length of Apron (L_a)	20	ft.
Median Diameter	0.63	ft.
Riprap min. depth	1.42	ft.

Section 11
Long Term Operation & Maintenance Plan

It is the intent of this Operation and Maintenance Plan to identify the areas of this site that need special attention and consideration, as well as implementing a plan to assure routine maintenance. By identifying the areas of concern as well as implementing a frequent and routine maintenance schedule the site will maintain a high quality stormwater runoff.

11.1 Contact/Responsible Party

Lonza Biologics
101 International Drive
Portsmouth, NH 03801

(Note: The contact information for the Contact/Responsible Party shall be kept current. If ownership changes, the Operation and Maintenance Plan must be transferred to the new party.)

11.2 Maintenance Items

Maintenance of the following items shall be recorded:

- Litter/Debris Removal
- Landscaping
- Catchbasin Cleaning
- Pavement Sweeping
- Gravel Wetland Maintenance
- Rain Garden Maintenance
- Stream Maintenance

The following maintenance items and schedule represent the minimum action required. Periodic site inspections shall be conducted and all measures must be maintained in effective operating condition. The following items shall be observed during site inspection and maintenance:

- Inspect vegetated areas, particularly slopes and embankments for areas of erosion. Replant and restore as necessary
- Inspect catch basins for sediment buildup
- Inspect site for trash and debris

11.3 Overall Site Operation & Maintenance Schedule

Overall Site Operation and Maintenance Schedule		
Maintenance Item	**Frequency of Maintenance**	**Operation**
Litter/Debris Removal	Weekly	Management Company
Pavement Sweeping - Sweep impervious areas to remove sand and litter.	Annually	Parking Lot Sweeper
Sediment Forebay - Trash and debris to be removed including at check dam. - Embankment to be mowed. - Any required maintenance shall be addressed. - Inspect sediment accumulation and clean as needed.	Periodically (At least two (2) times annually)	Management Company
Gravel wetland - Trash and debris to be removed including at outlet structure. - Embankment to be mowed. - Any required maintenance shall be addressed.	Periodically (At least two (2) times annually)	Management Company
Rain Gardens/Infiltration Basin - Trash and debris to be removed. - Any required maintenance shall be addressed.	Two (2) times annually and after any rainfall event exceeding 2.5" in a 24-hr period	Management Company
Rip Rap Aprons - Trash and debris to be removed. - Any required maintenance shall be addressed.	Annually	Management Company
Catch Basin (CB) Cleaning - CB to be cleaned of solids and oils.	Annually	Vacuum Truck
Landscaping - Landscaped islands to be maintained and mulched.	Maintained as required and mulched each Spring	Management Company

Sediment Forebay Inspection/Maintenance Requirements		
Inspection/ Maintenance	**Frequency**	**Action**
Monitor Sediment Accumulation	Annually	- Install and maintain a staff gage or other measuring devise, to indicate depth of sediment accumulation and level at which clean-out is required
Visual inspection	Annually	- Remove trash and debris as needed - Remove any woody vegetation - Inspect and repair embankments - Inspect check dam
Mowing	Periodically (At least two (2) times annually)	- Embankments shall be mowed

Gravel Wetland Inspection/Maintenance Requirements		
Inspection/ Maintenance	**Frequency**	**Action**
Inspect inlets and outlets to ensure good condition and no evidence of deterioration. Check to see if high-flow bypass is functioning.	Annually, more frequently in the first year of operation	Repair or replace any damaged structural parts, inlets and outlets. Clear or remove debris or restrictions.
Check for internal erosion, evidence of short circuiting, and animal burrows.	Annually, more frequently in the first year of operation	Soil erosion from short-circuiting or animal boroughs should be repaired when they occur.
Monitor to ensure that Gravel Wetland functions effectively after storms	Four (4) times annually (quarterly) and after any rainfall event exceeding 2.5" in a 24-hr period	- Trash and debris to be removed - Any required maintenance shall be addressed

Inspect Vegetation	Annually	- Inspect the condition of all gravel wetland vegetation -Vegetation should cover >75% of the system and should be reseeded and cared for as needed. - Prune back overgrowth - Replace dead vegetation - Remove any invasive species -Coordinate with UNH Stormwater Center for further vegetation management guidelines
Cut and remove vegetation from the Gravel Wetland System and forebay in order to maintain nitrogen removal performance.	Once every 3 years	- The vegetation should be cut and removed from the system to prevent nitrogen from cycling back into the system.
Inspect Drawdown Time - The system shall drawdown between 24 and 48-hours following a rainfall event.	Annually, more frequently in the first year of operation	- Hire qualified professional to assess the condition of the facility to determine measures required to restore the filtration function, including but not limited to removal of accumulated sediments or reconstruction of the filter.

Additional Gravel Wetland Operation and Maintenance Requirements:

- ***1st Year Post-Construction:*** Inspection frequency shall be after every storm in the first year following construction.
- Inspect to be certain system drains within 24 - 48 hours (within the design period, but also not so quickly as to minimize stormwater treatment).
- Watering plants as necessary during the first growing season.
- Re-vegetating poorly established areas as necessary.
- Treating diseased vegetation as necessary.
- Inspect soil and repair eroded areas, especially on slopes, at a minimum quarterly.
- Check inlets, outlets, and overflow spillway for blockage, structural integrity and evidence of erosion.

Cleaning Criteria for Gravel Wetland Treatment Cells: Sediment shall be removed from the gravel wetland surface when it accumulates to a depth of several inches (>10 cm) across the wetland surface. Materials shall be removed with rakes rather than heavy construction equipment to avoid compaction of the gravel wetland surface. Heavy equipment may be used if the equipment is located outside the gravel wetland, while a backhoe shovel reaches inside the gravel wetland to remove sediment. Removed sediments shall be dewatered (if necessary) and disposed of in accordance with all local, state and federal requirements. Removal of vegetation within the gravel wetland shall

occur every three (3) growing seasons, or the end of the summer of the third year. This is to prevent decay and release of nutrients from accumulated biomass.

Rain Garden Inspection/Maintenance Requirements		
Inspection/ Maintenance	**Frequency**	**Action**
Monitor to ensure that Rain Gardens function effectively after storms	Two (2) times annually and after any rainfall event exceeding 2.5" in a 24-hr period	- Trash and debris to be removed - Any required maintenance shall be addressed
Inspect Vegetation	Annually	- Inspect the condition of all Rain Garden vegetation - Prune back overgrowth - Replace dead vegetation - Remove any invasive species
Inspect Drawdown Time - The system shall drawdown within 48-hours following a rainfall event.	Annually	- Assess the condition of the facility to determine measures required to restore the filtration function, including but not limited to removal of accumulated sediments or reconstruction of the filter.

Rip Rap Inspection/Maintenance Requirements		
Inspection/ Maintenance	**Frequency**	**Action**
Visual Inspection	Annually	- Visually inspect for damage and deterioration - Repair damages immediately

Stream Restoration Operation and Maintenance Requirements:

Stream restoration operation and maintenance requirements are detailed in the Stream Restoration report prepared by Streamworks PLLC, and in the NHDES Hodgson Brook Watershed Management Plan.

11.3.1 Disposal Requirements

Disposal of debris, trash, sediment and other waste material should be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations.

11.3.2 Snow & Ice Management for Standard Asphalt and Walkways

Snow storage areas shall be located such that no direct untreated discharges are possible to receiving waters from the storage site (snow storage areas have been shown on the Site Plan).

11.3.3 Annual Updates and Log Requirements

The Owner and/or Contact/Responsible Party shall review this Operation and Maintenance Plan once per year for its effectiveness and adjust the plan and deed as necessary.

A log of all preventative and corrective measures for the stormwater system shall be kept on-site and be made available upon request by any public entity with administrative, health environmental or safety authority over the site.

Stormwater Management Report						
Project Name		**Lonza – Iron Parcel**				
BMP Description	**Date of Inspection**	**Inspector**	**BMP Installed and Operating Properly?**	**Cleaning / Corrective Action Needed**	**Date of Cleaning / Repair**	**Performed By**
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			
			❑Yes ❑No			

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Tighe&Bond
Engineers | Environmental Specialists

Project/Site Information

Proposed Industrial Development
101 International Drive
Portsmouth, NH

Test Pit No.	**TP-1**
Page No.	1 of 1
File No.	L-0700-013
Checked By:	D. Brogan

T&B Rep.	M. Trovato	Contractor	New England Boring Contractors			Date	03/21/18
		Operator	Ben Cross			Ground Elev.	± 48'
Weather	30 Degrees - Cloudy	Make	Kubota	Model	KX080	Time Started	7:50
		Capacity	0.3 yd^3	Reach	15.1 ft.	Time Completed	9:05

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	Dark brown fine to coarse SAND and fine to coarse GRAVEL, little Silt (FILL) 0.5'		0.0	D	5-10%/A	1
1'	Brown, fine to coarse SAND and fine to coarse GRAVEL, some Silt, trace Brick, Wood, Clay Pipe (FILL)	S-1		E	5-10%/A	
2'				E	5-10%/A	
3'	3.5'			E	5-10%/A	
4'	Grayish-brown, fine to coarse SAND and SILT, with thin seems of Silty Clay (FILL)	S-2	0.0	E	5%/A	
5'	6'			E	5%/A	
6'	Grayish-brown, fine to medium SAND, some Silty Clay, some fine to coarse Gravel	S-3		E	5%/A	
7'				M	5%/A	
8'	8.5'		0.0	M	5%/A	2
9'	Bottom of exploration at 8.5 feet due to bedrock refusal					
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1) Frost layer observed to be approximately 6-inches thick.

2) Groundwater observed to infiltrate test pit at approximately 8.5 feet.

Test Pit Plan

3' × 13'

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
0.25	8.5'

Tighe&Bond
Engineers | Environmental Specialists

Project/Site Information

Proposed Industrial Development
101 International Drive
Portsmouth, NH

Test Pit No.	**TP-6**
Page No.	1 of 1
File No.	L-0700-013
Checked By:	D. Brogan

T&B Rep.	M. Trovato	Contractor	New England Boring Contractors			Date	03/21/18
		Operator	Ben Cross			Ground Elev.	± 44'
Weather	36 Degrees - Cloudy	Make	Kubota	Model	KX080	Time Started	13:55
		Capacity	0.3 yd^3	Reach	15.1 ft.	Time Completed	14:35

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0						
	Dark brown, fine to coarse SAND and SILT, little fine to coarse Gravel, trace Brick, Wood (FILL)			E	5%/A	
1'				E	5%/A-B	
2'	2'			E	5%/A	
3'	Light gray, Silty CLAY, trace Wood (FILL)			E	5%/A	
4'				E	5%/A	
5'	5'			E	5%/A	1
6'	Light gray, Silty CLAY, trace fine to coarse Gravel			E	0%	
7'	7.5'			E	0%	
8'	Bottom of exploration at 7.5 feet due to bedrock refusal					
9'						
10'						
11'						
12'						
13'						
14'						
15'						
16'						

Notes:

1) Groundwater observed to infiltrate test pit sidewalls at approximately 5 feet below grade.

Test Pit Plan

3' / 13'

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
0.25	5'

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Tighe&Bond
Engineers | Environmental Specialists

Project/Site Information

Proposed Industrial Development
101 International Drive
Portsmouth, NH

Test Pit No.	**TP-17**
Page No.	1 of 1
File No.	L-0700-013
Checked By:	D. Brogan

T&B Rep.	M. Trovato	Contractor	New England Boring Contractors			Date	03/23/18
		Operator	Ben Cross			Ground Elev.	± 57'
Weather	36 Degrees - Sunny	Make	Kubota	Model	KX080	Time Started	9:10
		Capacity	0.3 yd^3	Reach	15.1 ft.	Time Completed	10:00

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	Brown, fine to coarse SAND, some fine to coarse Gravel, some Silt, trace Clay Pipe, Trash (FILL)		0.0	E	5%/A	
1'				E	5%/A	
2'	Gray, fine to medium SAND and SILT 2'	S-1	0.0	E	5%/A	
3'				E	0%	1
4'	Gray, Silty CLAY	S-2		E	0%	
5'				E	0%	
6'	6.5'			E	5%/A	
7'			0.0	E	0%	
8'	Grayish-brown, fine to medium SAND and SILT	S-3		E	0%	
9'				E	0%	
10'	11'			E	0%	
11'	Bottom of exploration at 11 feet					
12'						
13'						
14'						
15'						
16'						

Notes:

1) 4-inch metal pipe encountered at approximately 3 feet below grade running perpendicular with test pit.

Test Pit Plan

3' / 12'

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
( ) Encountered
(X) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water

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Tighe&Bond
Engineers | Environmental Specialists

Project/Site Information

Proposed Industrial Development
101 International Drive
Portsmouth, NH

Test Pit No.	**TP-18**
Page No.	1 of 1
File No.	L-0700-013
Checked By:	D. Brogan

T&B Rep.	M. Trovato	Contractor	New England Boring Contractors			Date	03/23/18
		Operator	Ben Cross			Ground Elev.	± 59'
Weather	38 Degrees - Sunny	Make	Kubota	Model	KX080	Time Started	10:10
		Capacity	0.3 yd^3	Reach	15.1 ft.	Time Completed	11:15

Depth	Soil Description	Sample No.	PID Reading (ppm)	Excav. Effort	Boulder Count/ Class	Note No.
0	Brown, fine to coarse SAND and fine to coarse GRAVEL, some Silt, trace Trash, Clay Pipe, Brick (FILL) 1.5'			E	5-10%/A	
1'	Light brown, fine to coarse SAND, some Silt, little fine to coarse Gravel, trace Brick (FILL) 3.5'			E	5-10%/A	1
2'				E	10%/A	
3'				E	10%/A	
4'	Brown, fine to coarse SAND, some Silt, little fine to coarse Gravel (FILL) 7.4'	S-1		E	10-15%/A	
5'				E	10-15%/A	
6'				E	10%/A	
7'				E	10%/A	
8'	Light brown, fine to coarse SAND, some fine to coarse Gravel, little Silt 11'	S-2		E	10%/A	
9'				E	10%/A	
10'				E	10%/A	
11'	WEATHERED ROCK			M	10%/A	2
12'	Bottom of exploration at 11.4 feet					
13'						
14'						
15'						
16'						

Notes:

1) Metal pipe encountered at approximately 1 foot below grade.

2) Groundwater observed to infiltrate test pit at approximately 11 feet below grade.

Test Pit Plan

3' x 13'

Volume = _____ cu. yd.

Boulder Class

Letter Designation	Size Range Classification
A	6" - 17"
B	18" - 36"
C	36" +

Excavation Effort
E-----Easy
M-----Moderate
D-----Difficult

Proportions Used

TRACE (TR.)	0 - 10%
LITTLE (LI.)	10 - 20%
SOME (SO.)	20 - 35%
AND	35 - 50%

Abbreviations
F = Fine
M = Medium
C = Coarse
V = Very
F/M = Fine to medium
F/C = Fine to coarse
GR = Gray
BN = Brown
YEL = Yellow

GROUNDWATER
(X) Encountered
( ) Not Encountered

Elapsed Time to Reading (Hours)	Depth to Ground-water
0.25	11'

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LEGEND:

- B-1 — APPROXIMATE LOCATION OF TEST BORINGS DRILLED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NH AND GEOSEARCH, INC. OF FITCHBURG, MA BETWEEN APRIL 9 AND JUNE 8, 2018
- TP-1 — APPROXIMATE LOCATION OF TEST PITS EXCAVATED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NH BETWEEN MARCH 21 AND MAY 30, 2018
- MW-1 — MONITORING WELL

CORPORATE DRIVE

GOOSE BAY DRIVE

HODGSON STREAM RESTORATION AREA

PROPOSED 4-STORY PARKING GARAGE #2 325 SPACES F.F=58.0

PROPOSED BUILDING #2 3-STORY 450,000± SF F.F=56.5

PROPOSED RAIN GARDEN #1

PROPOSED GRAVEL WETLAND #2

PROPOSED BUILDING #3 3-STORY 186,000± SF F.F=62.0

PROPOSED 4-STORY PARKING GARAGE #1 375 SPACES F.F=58.0

PROPOSED BUILDING #1 3-STORY 395,520± SF F.F=56.5

PROPOSED UTILITY YARD #1

PROPOSED UTILITY YARD #2

PROPOSED GRAVEL WETLAND #1

PROPOSED CAFE

PROPOSED GYM/LOBBY

EXISTING STORMWATER MANAGEMENT AREA

SCALE IN FEET
0 60' 120'
GRAPHIC SCALE

Tighe&Bond
Engineers | Environmental Specialists

Proposed Industrial Development

Lonza Biologics

Portsmouth, New Hampshire

July 19, 2018

MARK	DATE	DESCRIPTION

PROJECT NO:	L-0700-13
DATE:	07/19/2018
FILE:	L0700-CTP-TEST PITS.dwg
DRAWN BY:	BJL
CHECKED:	DRB
APPROVED:	DRB

SUBSURFACE EXPLORATION PLAN

SCALE: AS SHOWN

FIGURE 2

Last Save Date: August 2, 2018 3:22 PM By: BJL
Plot Date: Thursday, August 2, 2018 3:22 PM By: Neil A. Hansen
T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576\L013 Iron Parcel Redevelopment\Drawings, Figures\AutoCAD\Sheet\L0700-CTP-TEST PITS.dwg Layout Tab: SUBSURFACE

PROPOSED IRON PARCEL REDEVELOPMENT PROJECT - SITE REVIEW COMMENT RESPONSE **Date: August 21, 2018**

City of Portsmouth TAC, June 5, 2018:			
	TAC Comment	**Applicant Response**	**Sheet**
1	Call out the location of bus stops on site plan and verify there is pedestrian access from bus stops to the site.	Added note to site plan indications direction and access to nearest bus stop	C-104 & C-105
2	Add on-site hydrants at buildings and dry stand pipes at parking garages, coordinate with fire department.	Two coordination meetings with the fire department took place on July 5, 2018 and August 6, 2018 to review hydrant, fire department connections and dry stand pipe locations. 20' wide fire lanes were also added to the site based on fire code requirements discussed at these meetings.	C-104 - C-107, & C-111 - C-113
3	Add “CONST.” to legend.	CONST. was added to abbreviation list on site plan legend.	C-105
4	Make sure fire truck can fit through entrance gate on Goose Bay Drive.	Confirmed with fire department that 14' wide access is adequate	N/A
5	Prepare a regional distribution analysis to supplement the traffic study.	A Regional Distribution Memo has been prepared and is enclosed.	N/A

City of Portsmouth Fire Department: Comments from meetings on July 5, 2018 and August 6,2018			
	Fire Department Comment	**Applicant Response**	**Sheet**
1	Add note: Fire lanes and access points shall be kept clear at all times, including during winter conditions.	Note 17 was added to the site plan.	C-105
2	Buildings 1 and 2 should have minimum of two (2) fire department connections (FDC).	Buildings 1 & 2 have two FDC's each. Building 3 has 1 FDC.	C-111 - C-113
3	Hydrant required within 100’ of FDC.	Hydrants are shown within 100' of all FDC's	C-111 - C-113
4	Hydrant required at each parking garage with dry stand pipe connection to garage.	Each parking garage has its own dry stand pipe and fire hydrant	C-111 - C-113
5	Minimum 15’ high overhead clearance on overhead building connections.	Overhead building connections will have over 15' of clearance	N/A
6	20’ wide fire lane behind Building 2 and between parking garages and Buildings 1 & 2.	20' wide fire lanes have been added to access all sides of every building on site.	C-104 - C-107
7	Correct number of building exits required by code are to be shown along with site access to each exit point.	Building exits with access to the site have been added to each building. Final number of doors and location of doors to be approved by building and fire departments.	C-104 - C-107
8	Final number of doors and location of doors to be approved by building and fire departments.	Note 18 was added to the site plan.	C-105
9	20’ wide fire access behind Building #3. Provide turn around or gated access to Corporate Drive (preferred).	20' wide fire lanes have been added to access all sides of every building on site.	C-104 & C-105
10	Show stair towers and elevators, two (2) minimum	Stair tower locations have been added to the plans.	C-104 - C-107
11	Run fire truck turning templates in both directions for all fire lanes.	Fire truck turning exhibits have been prepared for each fire lane	Fire Truck Turning Exhibits
12	Have hydrant on each side of the street between Buildings 1 and 2	Fire hydrants are located on both sides of the center access road.	C-112
13	Ensure year-round access at each FDC.	Note 17 was added to the site plan.	C-105