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MEMORANDUM

TO: City of Mount Vernon

FROM: Danny Ochoa, P.E. – Davido Consulting Group, Inc.

DATE: August 21, 2017

RE: Skagit YMCA Existing Bioswale – Mount Vernon, WA

This memorandum serves as an analysis report to the research done on the existing bioswale northwest of the proposed YMCA Facility. To summarize, the existing bioswale captures runoff from an unknown basin and discharges stormwater north through Lindgren Creek and eventually into the Skagit River. Davido Consulting Group, Inc. (DCG) was tasked with determining the existing capacity of the bioswale and potential impact from the runoff of the proposed YMCA project. FIGURE 1 below shows the location of the YMCA project site in relation to the existing bioswale. The bioswale is bound by Lindgren Creek to the north, a multi-family development to the east, proposed YMCA project site to the south, and wetland areas to the west.

FIGURE 1 Vicinity Map

Mount Vernon Office
2210 Riverside Drive, Suite 110
Mount Vernon, WA 98273
Tel 360.899.1110

Lake Forest Park Office
15029 Bothell Way NE, Suite 600
Lake Forest Park, WA 98155
Tel 206.523.0024

Whidbey Island Office
PO Box 1132
Freeland, WA 98249
Tel 360.331.4131

To: City of Mount Vernon
Date: August 21, 2017

Drainage Basin Delineation

A contributing drainage basin area to the existing bioswale was delineated and found to be approximately 94.4 acres. The delineated basin was determined using aerial photography, Skagit County's iMap, Light Detection and Ranging (LIDAR), and field verification. Approximately 3.4 acres out of 5.3 acres of the proposed YMCA project site will contribute to the existing bioswale directly due to YMCA project improvements. The remaining 1.9 acres will discharge into wetlands to the west and eventually discharge to the bioswale via overflow and ditching. Stormwater runoff from the YMCA site is generated by the projects 125,586 square feet (2.9 acres) of impervious surfaces and 104,544 square feet (2.4 acres) of pervious surface. The remaining 89.1 acres comes from contributing areas to the northeast. Existing impervious surface areas within the delineated basin include existing roadways, the multi-family development to the north, and Salem Lutheran Church to the east totaling approximately 716,256 square feet (16.4 acres). Full built-out single family parcels within the delineated basin were identified and based on zoning (*R-1*) and a maximum coverage percentage of 35%, totaled approximately 1,039,374 square feet (23.9 acres) of impervious surfaces. The remaining area within the delineated basin, approximately 2,123,450 square feet (48.8 acres), was identified as pervious surface. The drainage basin map can be found in Attachment A at the end of this memorandum.

TABLE 1 Contributing Drainage Basin Areas

Drainage Basin Area		
	Square Feet	Acres
Impervious Areas		
Roads, Multi-Family Dev. to north, Salem Lutheran Church	716,256	16.4
Full Built-out Single Family Parcels	1,039,374	23.9
Proposed YMCA Building, parking lot, sidewalks	125,586	2.9
Pervious Areas		
Undeveloped land	2,123,450	48.8
Proposed YMCA green space	23,461	2.4
Total:	4,028,127	94.4

Existing Bioswale

The earliest record of the existing bioswale was found from the project plan set for the Salem Lutheran Church dated April 1, 1996. A design detail of the bioswale can be found in Attachment G of this memo; however a detailed report of the bioswale design could not be obtained. The existing bioswale is assumed to receive stormwater runoff from the drainage basin mentioned above via open channel ditches and the city's storm drainage system. Discharge from the bioswale was observed through a small ravine to Lindgren Creek eventually discharging to the Skagit River. A recent topographic survey was conducted on the bioswale to help better determine its dimensions and characteristics. Attachment C and Attachment D show a plan view and cross sections created from the survey. As shown in the attachments, seven cross sections were taken of the bioswale. Two cross sections (A-A & B-B) were taken near the entrance of the bioswale, one in a transition between the entrance and main body of the bioswale (C-C), two were taken in the main body of the bioswale (D-D & E-E) and the final two were taken from the discharge ravine portion of the bioswale at the north end. The discharge end of a 12" culvert was found at the north end of the bioswale and appeared to be partially filled with debris; however, the inlet of the culvert was not found. An 18"culvert was found, at a much higher elevation than flow within the discharge ravine, near the north east corner of the bioswale and appeared to be partially filled with debris.

A site visit took place on Monday, August 14th, 2017 to investigate the bioswale and determine its discharge point. FIGURE 2 was taken looking west down Lindgren Creek. The 18" culvert outlet is shown in the photograph however, no inlet was found. The existing bioswale discharges into Lindgren Creek through the ravine type channel north of the bioswale, just west of the existing 12" partially filled culvert.

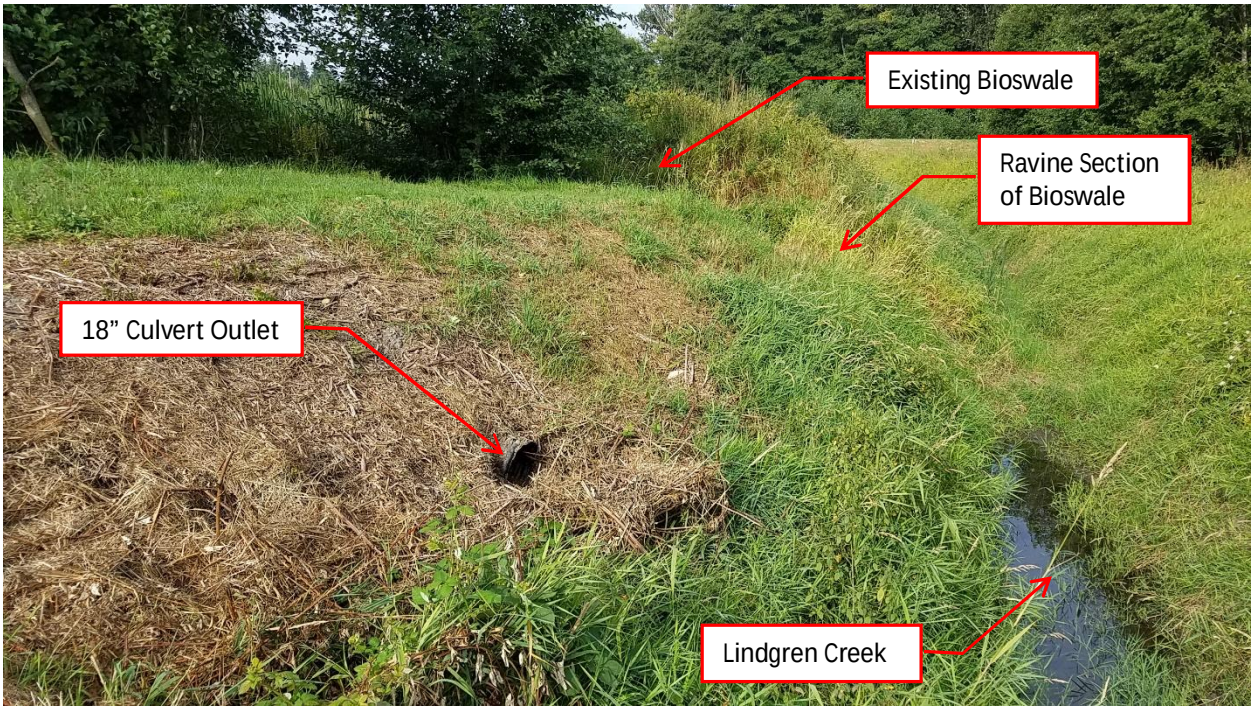


FIGURE 2 Looking West down Lindgren Creek

Modeling

The contributing drainage area was modeled using the 2012 Western Washington Hydrology Model (WWHM). The major contributing factors to the resulting stormwater discharge are basin area, land coverage, hydrologic soil group, and time of concentration. Site soils for the contributing drainage area were obtained from the Natural Resources Conservation Service (NRCS) website. The contributing site soils were found to be Hoogdal silt loam, 8 to 15 percent slopes and Bow gravelly loam, 3 to 8 percent slopes. They are categorized as belonging to the hydraulic soil group C/D. See Attachment H for NRCS soil characteristics and details. For preliminary modeling purposes, it was assumed that during most significant rain events the soils within the drainage basin would be saturated and would perform as type 'C' soils. Detailed results from the WWHM Model can be found in Attachment B of this memorandum. A summary of the modeling results are included in TABLE 2.

The area contributing to the existing bioswale was delineated as 94.4 acres. The 100-year peak flow from the delineated basin was calculated to be 80.6 cubic feet per second (cfs) assuming full build out conditions. Stormwater runoff generated by the proposed YMCA project site results in 4.5 cfs, roughly 5.6% of the total delineated basin runoff.

Modeling was also done to calculate existing predevelopment runoff from the YMCA site contributing to adjacent wetlands located west of the site. Approximately 2.7 acres of the 5.3 acre YMCA site flows towards the wetlands to the west. Predevelopment flow from this area to the wetland results in approximately 0.4 cfs. Approximately 1.9 acres of the YMCA site, comprised mostly of wetland buffer, will not be developed and will continue to discharge to the existing wetlands at a rate of 0.3 cfs. To limit any project impact to the wetlands, a portion of non-pollution generating hard surface (Non-PGHS) in the form of roof runoff could be tightlined and discharge to the wetland via a Department of Ecology (DOE) approved dispersion trench totaling approximately 0.1 cfs (4,798 square foot of roof area). Attachment I to this memo shows the roof area that could be directed back into the wetland.

TABLE 2 Contributing Drainage Basin Flows

Drainage Basin Flows		
	Predeveloped (cfs)	Mitigated (cfs)
Drainage Basin excluding YMCA Project		
Roads, Multi-Family Dev. to north, Salem Lutheran Church	11.6	76.1
Full Built-out Single Family Parcels		
Pervious Areas		
Flows Contributing from YMCA Project		
Flows from YMCA	0.7	4.5
Total Drainage Basin:	12.3	80.6

Bioswale Capacity

Representative cross sections from the existing bioswale were modeled through Hydraflow to determine the swales capacity and are included in Attachment E and Attachment F. Attachment E represents the cross section taken at station 55+00. The cross section dimensions were entered into Hydraflow and a representative cross section was created. The Hydraflow channel report, Attachment E, shows that at the highlighted depth of 0.77 feet, the bioswale has a flow capacity of 89.6 cfs. This is greater than the 100-year flow rate for the delineated basin of 80.6 cfs. Full flow depth (2.9 feet) at this cross section results in a maximum flow capacity of approximately 936 cfs.

Attachment F represents the cross section taken at station 56+70 of the bioswale. This cross section represents the ravine portion of the bioswale acting as its discharge outlet. The cross section dimensions were entered into Hydraflow and a representative cross section was created. The Hydraflow channel report, Attachment F, shows that at the highlighted depth of 2.32 feet, the discharge portion of the bioswale has a flow capacity of 94.9 cfs. This section is also greater than the 100-year flow rate for the delineated basin of 80.6 cfs. Full flow depth (5.8 feet) at this cross section results in a maximum flow capacity of approximately 513 cfs.

Conclusion

Based on the contributing drainage basin delineation performed and utilizing the latest topographic survey information of the existing bioswale, stormwater modeling of the existing bioswale and discharge outlet as a channel to convey runoff from the proposed YMCA project to Lindgren Creek shows that the existing bioswale and discharge outlet, in its current state, has sufficient capacity to handle the full build-out of the contributing drainage basin and the proposed YMCA project flows. Additionally, preliminary stormwater modeling shows limited impact to the wetlands along the west boundary of the proposed YMCA project site. To further limit minor impacts to the wetlands, the proposed YMCA project could direct a portion of Non-PGHS stormwater runoff to the wetlands to provide hydrologic consistency should that be deemed necessary.

Attachments:

Attachment A Drainage Basin
Attachment B WWHM Results
Attachment C Conveyance Cross Section Plan View
Attachment D Conveyance Cross Sections
Attachment E Bioswale Cross Section – 100yr Flow
Attachment F Ravine Cross Section – 100yr Flow
Attachment G Salem Lutheran Church Bioswale Detail
Attachment H NRCS Soil Classifications
Attachment I Wetland Plan

ATTACHMENT A

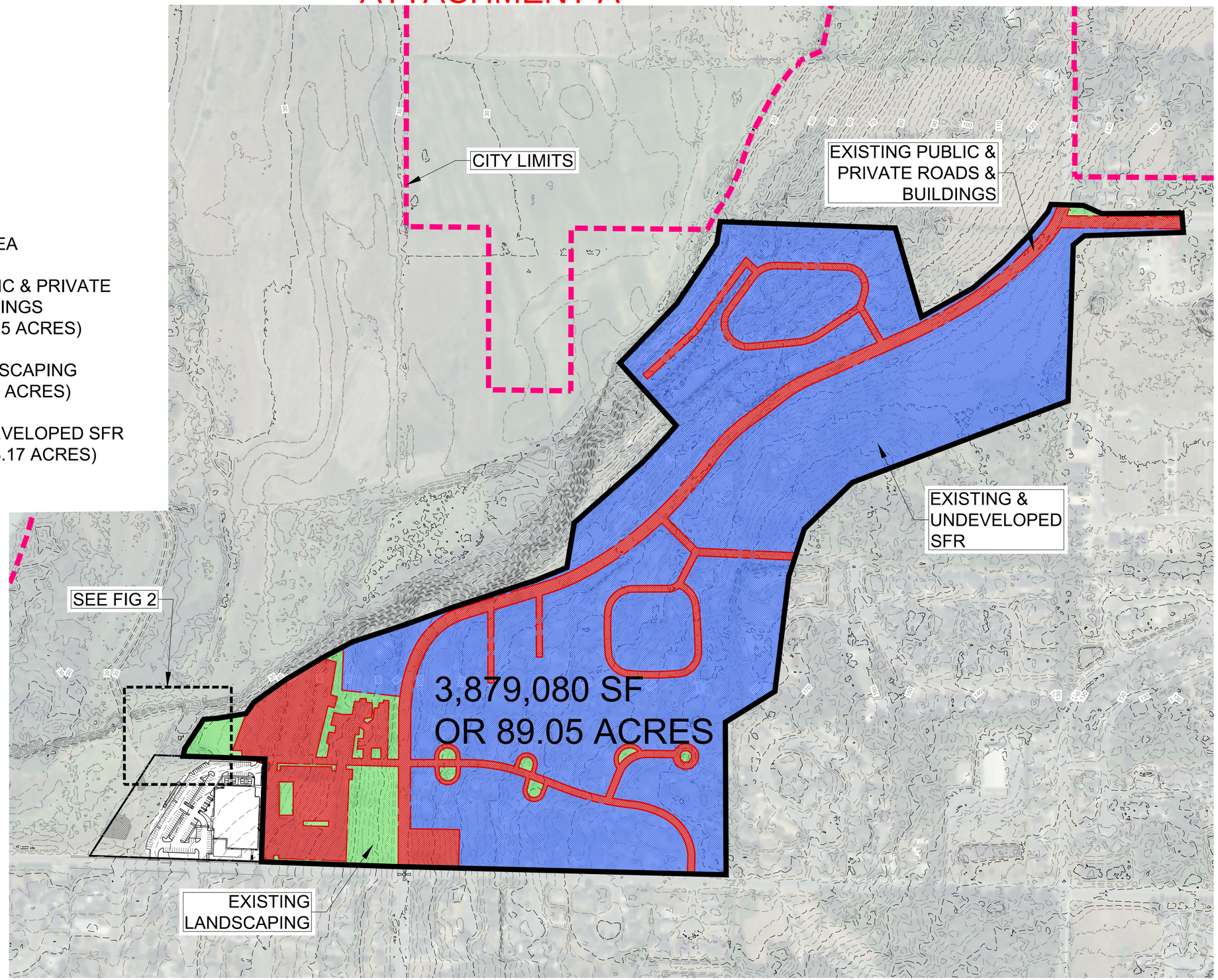
N

200 0 200 400

SCALE IN FEET

LEGEND:

- CITY LIMITS
- TRIBUTARY AREA
- EXISTING PUBLIC & PRIVATE ROADS & BUILDINGS 725,127 SF (16.65 ACRES)
- EXISTING LANDSCAPING 185,766 SF (4.26 ACRES)
- EXISTING UNDEVELOPED SFR 2,969,671 SF (68.17 ACRES)



No.	DATE	BY	REVISION

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WA 98155
P: 206.523.0024
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DCG civil structural

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DANILO S. OCHOA — STATE OF WASHINGTON — 45870 — REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS. DCG CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, & ALL OTHER EX FEATURES & CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN &/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT DCG PRIOR TO CONSTRUCTION.

OWNER: YMCA VALLEY FAMILY YMCA
215 EAST FULTON STREET
MOUNT VERNON, WA 98273

PROJECT: 1901 HOAG ROAD
MOUNT VERNON, WA 98273
TRIBUTARY AREAS MAP

PROJ. MANAGER:	DO
DESIGNED BY:	NMD
DRAWN BY:	NMD
CHECKED BY:	DO
SCALE:	AS NOTED
DATE: 8/21/2017	REV. A
SHEET 1 OF 3	

SHEET NUMBER

FIG1

CAD FILE NUMBER: P:\CLIENTS\YMCA SKAGIT\NEW YMCA MV FACILITY\DWG\GISXR_GIS_17_YMCA.DWG
LAST MODIFIED BY: DSAARENAS - SAVE DATE: 8/21/2017 12:13 PM - SHEET SET: #### - ORIGINAL SHEET SIZE: ANSI FULL BLEED D (34.00 X 22.00 INCHES)
AUTOCAD VERSION: CIVIL 3D 2015

ATTACHMENT B

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	20170817 YMCA Drainage Basin_REV2
Site Name:	
Site Address:	
City:	
Report Date:	8/21/2017
Gage:	Burlington
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2017/04/14
Version:	4.2.13

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year
Low Flow Threshold for POC4:	50 Percent of the 2 Year
High Flow Threshold for POC4:	50 Year

Landuse Basin Data

Predeveloped Land Use

Drainage Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	89.05
Pervious Total	89.05
Impervious Land Use	acre
Impervious Total	0
Basin Total	89.05

Element Flows To:

Surface	Interflow	Groundwater

YMCA Parcel

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	5.29
Pervious Total	5.29
Impervious Land Use	acre
Impervious Total	0
Basin Total	5.29

Element Flows To:

Surface	Interflow	Groundwater

Final Drainage Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	94.34
Pervious Total	94.34
Impervious Land Use	acre
Impervious Total	0
Basin Total	94.34

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Drainage Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	48.75
Pervious Total	48.75
Impervious Land Use	acre
ROADS FLAT	16.44
ROOF TOPS FLAT	23.86
Impervious Total	40.3
Basin Total	89.05

Element Flows To:

Surface	Interflow	Groundwater

YMCA Parcel

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	2.404
Pervious Total	2.404
Impervious Land Use	acre
ROADS FLAT	0.165
ROOF TOPS FLAT	0.968
SIDEWALKS FLAT	0.223
PARKING FLAT	1.53
Impervious Total	2.886
Basin Total	5.29

Element Flows To:

Surface	Interflow	Groundwater

Final Drainage Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	48.75
C, Lawn, Flat	2.404
Pervious Total	51.154
Impervious Land Use	acre
ROADS FLAT	16.605
ROOF TOPS FLAT	24.828
SIDEWALKS FLAT	0.223
PARKING FLAT	1.53
Impervious Total	43.186
Basin Total	94.34

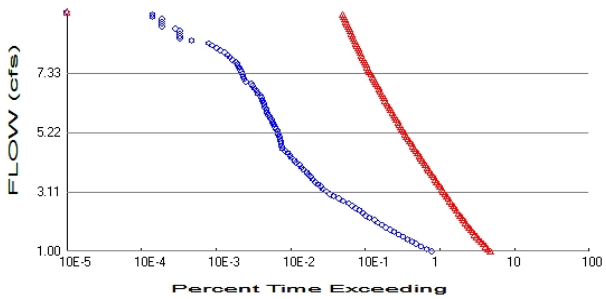
Element Flows To:

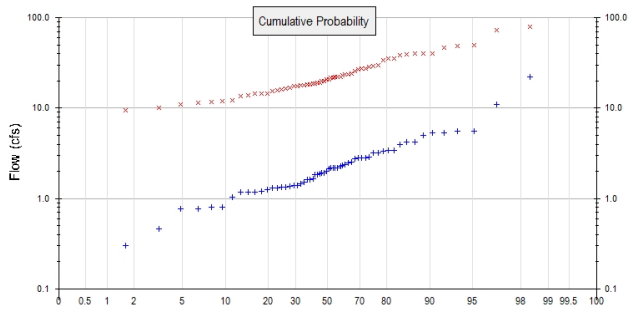
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 89.05
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 48.75
Total Impervious Area: 40.3

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	1.998779
5 year	3.775721
10 year	5.264934
25 year	7.50539
50 year	9.437198
100 year	11.596192

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	21.156656
5 year	32.250023
10 year	40.952686
25 year	53.60083
50 year	64.293375
100 year	76.135445

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	5.567	39.522
1950	3.205	14.601
1951	5.549	35.197
1952	2.500	35.167
1953	2.266	39.893
1954	2.810	18.203
1955	1.831	13.787
1956	1.400	9.511
1957	2.783	40.101
1958	1.906	15.959

1959	2.790	17.918
1960	1.995	24.385
1961	1.364	14.570
1962	0.299	21.899
1963	1.383	16.732
1964	1.334	15.295
1965	2.549	49.846
1966	1.305	18.326
1967	1.645	28.699
1968	3.406	30.073
1969	1.179	17.432
1970	0.762	38.537
1971	3.346	23.617
1972	1.607	11.794
1973	1.882	23.196
1974	3.177	18.781
1975	10.934	46.216
1976	1.240	48.454
1977	1.443	16.542
1978	2.194	27.658
1979	1.180	18.931
1980	2.796	25.963
1981	1.618	17.829
1982	3.935	19.996
1983	2.344	19.216
1984	5.286	22.364
1985	0.797	20.733
1986	2.387	13.657
1987	2.175	12.317
1988	4.231	40.373
1989	1.035	18.615
1990	2.904	22.063
1991	4.178	29.482
1992	1.928	19.959
1993	1.856	10.059
1994	0.463	11.860
1995	0.763	10.912
1996	5.277	33.883
1997	22.344	73.523
1998	2.187	17.422
1999	1.190	9.144
2000	0.798	23.891
2001	0.235	15.713
2002	1.524	11.546
2003	1.180	14.610
2004	2.136	78.816
2005	1.320	22.296
2006	3.433	27.370
2007	2.196	21.717
2008	5.050	20.600
2009	1.332	26.780

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	22.3444	78.8158
2	10.9339	73.5230
3	5.5674	49.8463

4	5.5490	48.4537
5	5.2860	46.2163
6	5.2775	40.3727
7	5.0499	40.1008
8	4.2311	39.8925
9	4.1779	39.5219
10	3.9352	38.5368
11	3.4328	35.1965
12	3.4059	35.1674
13	3.3458	33.8827
14	3.2045	30.0725
15	3.1770	29.4824
16	2.9041	28.6992
17	2.8099	27.6575
18	2.7965	27.3704
19	2.7903	26.7797
20	2.7834	25.9625
21	2.5494	24.3852
22	2.4999	23.8905
23	2.3875	23.6167
24	2.3437	23.1961
25	2.2662	22.3637
26	2.1956	22.2964
27	2.1939	22.0629
28	2.1875	21.8985
29	2.1748	21.7171
30	2.1363	20.7333
31	1.9949	20.6004
32	1.9278	19.9962
33	1.9061	19.9589
34	1.8824	19.2156
35	1.8561	18.9305
36	1.8313	18.7813
37	1.6446	18.6150
38	1.6182	18.3259
39	1.6070	18.2029
40	1.5242	17.9178
41	1.4427	17.8290
42	1.4004	17.4318
43	1.3830	17.4219
44	1.3644	16.7317
45	1.3338	16.5423
46	1.3318	15.9588
47	1.3202	15.7132
48	1.3053	15.2947
49	1.2403	14.6102
50	1.1898	14.6007
51	1.1800	14.5699
52	1.1800	13.7874
53	1.1792	13.6572
54	1.0354	12.3169
55	0.7977	11.8595
56	0.7967	11.7942
57	0.7630	11.5461
58	0.7617	10.9119
59	0.4628	10.0587
60	0.2987	9.5114
61	0.2354	9.1436

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.9994	16566	100870	608	Fail
1.0846	14052	93533	665	Fail
1.1699	11941	86988	728	Fail
1.2551	10284	81085	788	Fail
1.3403	9009	75759	840	Fail
1.4255	7856	71011	903	Fail
1.5108	6821	66690	977	Fail
1.5960	5957	62733	1053	Fail
1.6812	5197	59097	1137	Fail
1.7665	4558	55718	1222	Fail
1.8517	4034	52552	1302	Fail
1.9369	3557	49622	1395	Fail
2.0222	3142	46820	1490	Fail
2.1074	2804	44318	1580	Fail
2.1926	2415	41965	1737	Fail
2.2778	2154	39762	1845	Fail
2.3631	1974	37602	1904	Fail
2.4483	1780	35634	2001	Fail
2.5335	1590	33901	2132	Fail
2.6188	1427	32190	2255	Fail
2.7040	1268	30586	2412	Fail
2.7892	1081	29046	2686	Fail
2.8745	935	27613	2953	Fail
2.9597	808	26223	3245	Fail
3.0449	713	24961	3500	Fail
3.1301	646	23763	3678	Fail
3.2154	579	22565	3897	Fail
3.3006	536	21474	4006	Fail
3.3858	498	20396	4095	Fail
3.4711	457	19376	4239	Fail
3.5563	425	18401	4329	Fail
3.6415	394	17522	4447	Fail
3.7268	370	16666	4504	Fail
3.8120	350	15858	4530	Fail
3.8972	318	15088	4744	Fail
3.9825	300	14354	4784	Fail
4.0677	281	13672	4865	Fail
4.1529	254	13026	5128	Fail
4.2381	239	12371	5176	Fail
4.3234	221	11779	5329	Fail
4.4086	209	11244	5379	Fail
4.4938	195	10679	5476	Fail
4.5791	181	10153	5609	Fail
4.6643	165	9663	5856	Fail
4.7495	161	9216	5724	Fail
4.8348	158	8772	5551	Fail
4.9200	156	8352	5353	Fail
5.0052	154	7980	5181	Fail
5.0904	149	7619	5113	Fail
5.1757	145	7270	5013	Fail
5.2609	143	6943	4855	Fail
5.3461	136	6620	4867	Fail
5.4314	130	6318	4860	Fail
5.5166	127	6079	4786	Fail

5.6018	121	5824	4813	Fail
5.6871	119	5565	4676	Fail
5.7723	112	5313	4743	Fail
5.8575	106	5108	4818	Fail
5.9428	103	4896	4753	Fail
6.0280	101	4684	4637	Fail
6.1132	96	4481	4667	Fail
6.1984	94	4286	4559	Fail
6.2837	92	4119	4477	Fail
6.3689	90	3953	4392	Fail
6.4541	86	3790	4406	Fail
6.5394	83	3630	4373	Fail
6.6246	77	3499	4544	Fail
6.7098	74	3379	4566	Fail
6.7951	70	3249	4641	Fail
6.8803	66	3110	4712	Fail
6.9655	63	2990	4746	Fail
7.0507	54	2877	5327	Fail
7.1360	51	2751	5394	Fail
7.2212	49	2648	5404	Fail
7.3064	48	2532	5275	Fail
7.3917	46	2438	5300	Fail
7.4769	45	2355	5233	Fail
7.5621	43	2274	5288	Fail
7.6474	41	2188	5336	Fail
7.7326	39	2111	5412	Fail
7.8178	35	2021	5774	Fail
7.9031	33	1951	5912	Fail
7.9883	31	1890	6096	Fail
8.0735	28	1819	6496	Fail
8.1587	24	1767	7362	Fail
8.2440	22	1721	7822	Fail
8.3292	19	1660	8736	Fail
8.4144	17	1592	9364	Fail
8.4997	10	1535	15350	Fail
8.5849	7	1488	21257	Fail
8.6701	7	1425	20357	Fail
8.7554	7	1389	19842	Fail
8.8406	7	1341	19157	Fail
8.9258	6	1301	21683	Fail
9.0110	4	1256	31400	Fail
9.0963	4	1210	30250	Fail
9.1815	4	1167	29175	Fail
9.2667	4	1133	28325	Fail
9.3520	3	1097	36566	Fail
9.4372	3	1065	35500	Fail

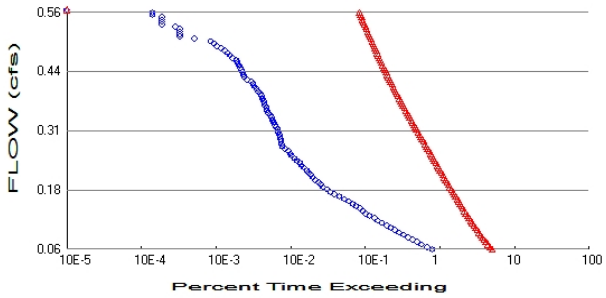
The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

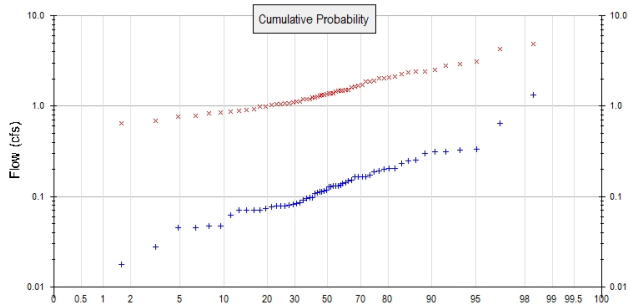
Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

POC 2





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 5.29
Total Impervious Area: 0

Mitigated Landuse Totals for POC #2
Total Pervious Area: 2.404
Total Impervious Area: 2.886

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	**Flow(cfs)**
2 year	0.118737
5 year	0.224296
10 year	0.312762
25 year	0.445856
50 year	0.560614
100 year	0.688869

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	**Flow(cfs)**
2 year	1.376104
5 year	2.028255
10 year	2.526938
25 year	3.237091
50 year	3.826883
100 year	4.471017

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	**Predeveloped**	**Mitigated**
1949	0.331	2.354
1950	0.190	0.983
1951	0.330	2.074
1952	0.149	2.146
1953	0.135	2.416
1954	0.167	1.044
1955	0.109	0.927
1956	0.083	0.652
1957	0.165	2.400
1958	0.113	0.987
1959	0.166	1.134

1960	0.119	1.499
1961	0.081	0.916
1962	0.018	1.489
1963	0.082	1.079
1964	0.079	1.065
1965	0.151	3.105
1966	0.078	1.209
1967	0.098	2.029
1968	0.202	1.873
1969	0.070	1.073
1970	0.045	2.279
1971	0.199	1.454
1972	0.095	0.790
1973	0.112	1.520
1974	0.189	1.199
1975	0.650	2.802
1976	0.074	2.936
1977	0.086	1.092
1978	0.130	1.897
1979	0.070	1.258
1980	0.166	1.626
1981	0.096	1.268
1982	0.234	1.322
1983	0.139	1.202
1984	0.314	1.384
1985	0.047	1.484
1986	0.142	0.888
1987	0.129	0.877
1988	0.251	2.505
1989	0.062	1.293
1990	0.173	1.402
1991	0.248	1.882
1992	0.115	1.402
1993	0.110	0.684
1994	0.027	0.848
1995	0.045	0.758
1996	0.314	2.018
1997	1.327	4.309
1998	0.130	1.242
1999	0.071	0.628
2000	0.047	1.704
2001	0.014	1.120
2002	0.091	0.826
2003	0.070	1.040
2004	0.127	4.872
2005	0.078	1.471
2006	0.204	1.652
2007	0.130	1.365
2008	0.300	1.317
2009	0.079	1.679

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated
1	1.3274	4.8719
2	0.6495	4.3092
3	0.3307	3.1048
4	0.3296	2.9358

5	0.3140	2.8019
6	0.3135	2.5048
7	0.3000	2.4159
8	0.2513	2.3999
9	0.2482	2.3537
10	0.2338	2.2791
11	0.2039	2.1461
12	0.2023	2.0743
13	0.1988	2.0294
14	0.1904	2.0176
15	0.1887	1.8971
16	0.1725	1.8822
17	0.1669	1.8730
18	0.1661	1.7042
19	0.1658	1.6787
20	0.1653	1.6518
21	0.1514	1.6264
22	0.1485	1.5204
23	0.1418	1.4987
24	0.1392	1.4887
25	0.1346	1.4837
26	0.1304	1.4708
27	0.1303	1.4543
28	0.1299	1.4025
29	0.1292	1.4019
30	0.1269	1.3845
31	0.1185	1.3646
32	0.1145	1.3220
33	0.1132	1.3173
34	0.1118	1.2930
35	0.1103	1.2681
36	0.1088	1.2575
37	0.0977	1.2424
38	0.0961	1.2086
39	0.0955	1.2024
40	0.0905	1.1993
41	0.0857	1.1345
42	0.0832	1.1204
43	0.0822	1.0922
44	0.0811	1.0792
45	0.0792	1.0733
46	0.0791	1.0646
47	0.0784	1.0439
48	0.0775	1.0403
49	0.0737	0.9872
50	0.0707	0.9828
51	0.0701	0.9274
52	0.0701	0.9162
53	0.0701	0.8881
54	0.0615	0.8765
55	0.0474	0.8484
56	0.0473	0.8264
57	0.0453	0.7904
58	0.0453	0.7576
59	0.0275	0.6840
60	0.0177	0.6517
61	0.0140	0.6280

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0594	16765	107051	638	Fail
0.0644	14228	100228	704	Fail
0.0695	12117	94047	776	Fail
0.0746	10451	88592	847	Fail
0.0796	9157	83587	912	Fail
0.0847	7999	78925	986	Fail
0.0897	6962	74818	1074	Fail
0.0948	6087	70968	1165	Fail
0.0999	5313	67396	1268	Fail
0.1049	4661	64059	1374	Fail
0.1100	4128	61001	1477	Fail
0.1151	3557	57557	1618	Fail
0.1201	3153	54905	1741	Fail
0.1252	2815	52317	1858	Fail
0.1303	2436	49900	2048	Fail
0.1353	2162	47590	2201	Fail
0.1404	1981	45473	2295	Fail
0.1454	1791	43419	2424	Fail
0.1505	1611	41516	2577	Fail
0.1556	1440	39633	2752	Fail
0.1606	1285	37922	2951	Fail
0.1657	1104	36211	3279	Fail
0.1708	955	34671	3630	Fail
0.1758	824	33217	4031	Fail
0.1809	727	31827	4377	Fail
0.1859	657	30458	4635	Fail
0.1910	579	28918	4994	Fail
0.1961	536	27763	5179	Fail
0.2011	499	26565	5323	Fail
0.2062	457	25431	5564	Fail
0.2113	426	24362	5718	Fail
0.2163	396	23378	5903	Fail
0.2214	373	22437	6015	Fail
0.2265	352	21496	6106	Fail
0.2315	322	20604	6398	Fail
0.2366	303	19733	6512	Fail
0.2416	285	18906	6633	Fail
0.2467	256	18091	7066	Fail
0.2518	241	17342	7195	Fail
0.2568	221	16640	7529	Fail
0.2619	212	15969	7532	Fail
0.2670	198	15319	7736	Fail
0.2720	181	14572	8050	Fail
0.2771	165	14020	8496	Fail
0.2821	161	13419	8334	Fail
0.2872	158	12874	8148	Fail
0.2923	156	12337	7908	Fail
0.2973	154	11792	7657	Fail
0.3024	150	11306	7537	Fail
0.3075	145	10814	7457	Fail
0.3125	143	10389	7265	Fail
0.3176	137	9948	7261	Fail
0.3226	131	9544	7285	Fail
0.3277	127	9165	7216	Fail

0.3328	122	8793	7207	Fail
0.3378	119	8440	7092	Fail
0.3429	113	8106	7173	Fail
0.3480	106	7790	7349	Fail
0.3530	103	7439	7222	Fail
0.3581	101	7146	7075	Fail
0.3632	96	6847	7132	Fail
0.3682	94	6594	7014	Fail
0.3733	92	6365	6918	Fail
0.3783	90	6115	6794	Fail
0.3834	86	5850	6802	Fail
0.3885	83	5632	6785	Fail
0.3935	78	5416	6943	Fail
0.3986	74	5242	7083	Fail
0.4037	70	5043	7204	Fail
0.4087	67	4872	7271	Fail
0.4138	64	4691	7329	Fail
0.4188	55	4528	8232	Fail
0.4239	51	4363	8554	Fail
0.4290	50	4214	8428	Fail
0.4340	48	4062	8462	Fail
0.4391	46	3916	8513	Fail
0.4442	45	3771	8380	Fail
0.4492	43	3634	8451	Fail
0.4543	41	3518	8580	Fail
0.4594	40	3392	8480	Fail
0.4644	35	3283	9380	Fail
0.4695	33	3172	9612	Fail
0.4745	31	3082	9941	Fail
0.4796	28	2984	10657	Fail
0.4847	25	2896	11584	Fail
0.4897	22	2810	12772	Fail
0.4948	20	2729	13645	Fail
0.4999	18	2633	14627	Fail
0.5049	11	2530	23000	Fail
0.5100	7	2455	35071	Fail
0.5150	7	2368	33828	Fail
0.5201	7	2304	32914	Fail
0.5252	7	2212	31600	Fail
0.5302	6	2152	35866	Fail
0.5353	4	2072	51800	Fail
0.5404	4	2002	50050	Fail
0.5454	4	1947	48675	Fail
0.5505	4	1903	47575	Fail
0.5556	3	1849	61633	Fail
0.5606	3	1789	59633	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

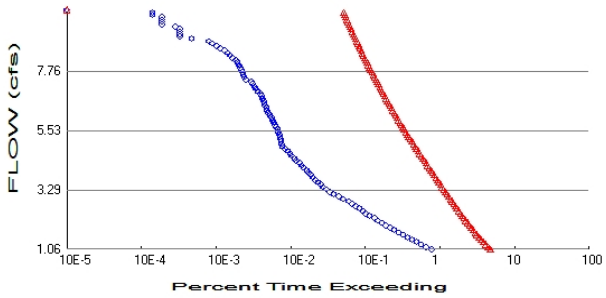
Water Quality BMP Flow and Volume for POC #2

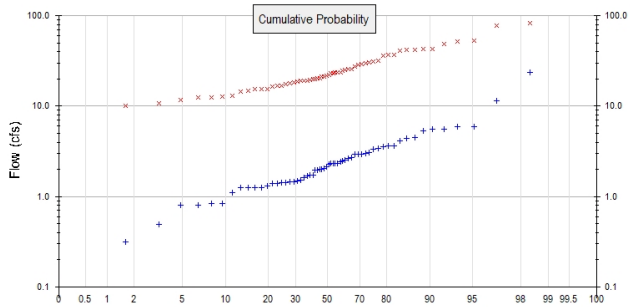
On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

POC 3

POC #3 was not reported because POC must exist in both scenarios and both scenarios must have been run.

POC 4





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #4
Total Pervious Area: 94.34
Total Impervious Area: 0

Mitigated Landuse Totals for POC #4
Total Pervious Area: 51.154
Total Impervious Area: 43.186

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #4

Return Period	**Flow(cfs)**
2 year	2.117516
5 year	4.000015
10 year	5.577693
25 year	7.95124
50 year	9.997804
100 year	12.285049

Flow Frequency Return Periods for Mitigated. POC #4

Return Period	**Flow(cfs)**
2 year	22.53178
5 year	34.274562
10 year	43.47209
25 year	56.822564
50 year	68.096434
100 year	80.571504

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #4

Year	**Predeveloped**	**Mitigated**
1949	5.898	41.876
1950	3.395	15.584
1951	5.879	37.271
1952	2.648	37.314
1953	2.401	42.308
1954	2.977	19.247
1955	1.940	14.715
1956	1.484	10.163
1957	2.949	42.501
1958	2.019	16.946
1959	2.956	19.052

1960	2.113	25.884
1961	1.445	15.486
1962	0.316	23.387
1963	1.465	17.811
1964	1.413	16.359
1965	2.701	52.951
1966	1.383	19.534
1967	1.742	30.729
1968	3.608	31.946
1969	1.249	18.505
1970	0.807	40.803
1971	3.545	25.071
1972	1.702	12.585
1973	1.994	24.717
1974	3.366	19.981
1975	11.583	49.018
1976	1.314	51.389
1977	1.528	17.634
1978	2.324	29.555
1979	1.250	20.188
1980	2.963	27.589
1981	1.714	19.097
1982	4.169	21.318
1983	2.483	20.418
1984	5.600	23.748
1985	0.844	22.217
1986	2.529	14.533
1987	2.304	13.127
1988	4.482	42.878
1989	1.097	19.908
1990	3.077	23.465
1991	4.426	31.365
1992	2.042	21.361
1993	1.966	10.743
1994	0.490	12.708
1995	0.808	11.670
1996	5.591	35.900
1997	23.672	77.762
1998	2.317	18.664
1999	1.261	9.772
2000	0.845	25.595
2001	0.249	16.834
2002	1.615	12.373
2003	1.250	15.609
2004	2.263	83.688
2005	1.399	23.767
2006	3.637	29.022
2007	2.326	23.082
2008	5.350	21.918
2009	1.411	28.458

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #4

Rank	Predeveloped	Mitigated
1	23.6717	83.6877
2	11.5834	77.7616
3	5.8981	52.9511
4	5.8787	51.3894

5	5.6000	49.0182
6	5.5910	42.8775
7	5.3499	42.5006
8	4.4824	42.3084
9	4.4260	41.8756
10	4.1690	40.8027
11	3.6367	37.3135
12	3.6082	37.2708
13	3.5445	35.9003
14	3.3949	31.9455
15	3.3657	31.3646
16	3.0766	30.7285
17	2.9769	29.5546
18	2.9626	29.0222
19	2.9561	28.4584
20	2.9487	27.5889
21	2.7009	25.8839
22	2.6484	25.5947
23	2.5293	25.0710
24	2.4829	24.7165
25	2.4008	23.7671
26	2.3260	23.7482
27	2.3243	23.4654
28	2.3174	23.3872
29	2.3040	23.0817
30	2.2632	22.2169
31	2.1134	21.9177
32	2.0423	21.3608
33	2.0194	21.3182
34	1.9942	20.4181
35	1.9664	20.1880
36	1.9401	19.9805
37	1.7423	19.9080
38	1.7143	19.5344
39	1.7024	19.2468
40	1.6148	19.0971
41	1.5284	19.0522
42	1.4836	18.6643
43	1.4651	18.5050
44	1.4455	17.8109
45	1.4130	17.6344
46	1.4109	16.9460
47	1.3987	16.8337
48	1.3829	16.3593
49	1.3140	15.6086
50	1.2605	15.5835
51	1.2501	15.4861
52	1.2501	14.7149
53	1.2493	14.5334
54	1.0969	13.1268
55	0.8450	12.7078
56	0.8441	12.5845
57	0.8083	12.3725
58	0.8070	11.6695
59	0.4903	10.7427
60	0.3164	10.1631
61	0.2493	9.7716

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
1.0588	16574	101233	610	Fail
1.1491	14040	93918	668	Fail
1.2393	11933	87416	732	Fail
1.3296	10297	81513	791	Fail
1.4199	9015	76230	845	Fail
1.5102	7854	71417	909	Fail
1.6005	6814	67139	985	Fail
1.6908	5961	63225	1060	Fail
1.7811	5195	59525	1145	Fail
1.8714	4558	56188	1232	Fail
1.9617	4034	53001	1313	Fail
2.0520	3557	50050	1407	Fail
2.1423	3142	47312	1505	Fail
2.2326	2804	44788	1597	Fail
2.3229	2417	42414	1754	Fail
2.4132	2150	40211	1870	Fail
2.5035	1975	38051	1926	Fail
2.5937	1782	36083	2024	Fail
2.6840	1589	34308	2159	Fail
2.7743	1425	32597	2287	Fail
2.8646	1267	31014	2447	Fail
2.9549	1081	29474	2726	Fail
3.0452	935	27998	2994	Fail
3.1355	808	26608	3293	Fail
3.2258	712	25303	3553	Fail
3.3161	646	24105	3731	Fail
3.4064	579	22929	3960	Fail
3.4967	536	21817	4070	Fail
3.5870	498	20773	4171	Fail
3.6773	457	19727	4316	Fail
3.7676	425	18749	4411	Fail
3.8579	394	17840	4527	Fail
3.9481	369	16966	4597	Fail
4.0384	350	16151	4614	Fail
4.1287	318	15368	4832	Fail
4.2190	300	14660	4886	Fail
4.3093	281	13937	4959	Fail
4.3996	254	13302	5237	Fail
4.4899	239	12651	5293	Fail
4.5802	221	12038	5447	Fail
4.6705	209	11469	5487	Fail
4.7608	195	10953	5616	Fail
4.8511	181	10397	5744	Fail
4.9414	165	9897	5998	Fail
5.0317	161	9415	5847	Fail
5.1220	158	8983	5685	Fail
5.2123	156	8558	5485	Fail
5.3025	154	8171	5305	Fail
5.3928	149	7790	5228	Fail
5.4831	145	7433	5126	Fail
5.5734	143	7112	4973	Fail
5.6637	136	6806	5004	Fail
5.7540	130	6487	4990	Fail
5.8443	127	6207	4887	Fail

5.9346	121	5970	4933	Fail
6.0249	119	5722	4808	Fail
6.1152	112	5452	4867	Fail
6.2055	106	5232	4935	Fail
6.2958	103	5009	4863	Fail
6.3861	101	4815	4767	Fail
6.4764	96	4596	4787	Fail
6.5667	94	4415	4696	Fail
6.6569	92	4231	4598	Fail
6.7472	90	4062	4513	Fail
6.8375	86	3891	4524	Fail
6.9278	83	3734	4498	Fail
7.0181	77	3587	4658	Fail
7.1084	73	3463	4743	Fail
7.1987	70	3332	4760	Fail
7.2890	66	3204	4854	Fail
7.3793	63	3074	4879	Fail
7.4696	54	2960	5481	Fail
7.5599	51	2840	5568	Fail
7.6502	49	2716	5542	Fail
7.7405	48	2620	5458	Fail
7.8308	46	2505	5445	Fail
7.9211	45	2421	5380	Fail
8.0113	43	2334	5427	Fail
8.1016	41	2259	5509	Fail
8.1919	39	2171	5566	Fail
8.2822	35	2095	5985	Fail
8.3725	33	2006	6078	Fail
8.4628	31	1939	6254	Fail
8.5531	28	1879	6710	Fail
8.6434	24	1810	7541	Fail
8.7337	22	1759	7995	Fail
8.8240	19	1713	9015	Fail
8.9143	17	1656	9741	Fail
9.0046	10	1583	15830	Fail
9.0949	7	1531	21871	Fail
9.1852	7	1482	21171	Fail
9.2755	7	1418	20257	Fail
9.3658	7	1382	19742	Fail
9.4560	6	1336	22266	Fail
9.5463	4	1296	32400	Fail
9.6366	4	1250	31250	Fail
9.7269	4	1212	30300	Fail
9.8172	4	1166	29150	Fail
9.9075	3	1131	37700	Fail
9.9978	3	1094	36466	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #4

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

POC 5

POC #5 was not reported because POC must exist in both scenarios and both scenarios must have been run.

POC 6

POC #6 was not reported because POC must exist in both scenarios and both scenarios must have been run.

POC 7

POC #7 was not reported because POC must exist in both scenarios and both scenarios must have been run.

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

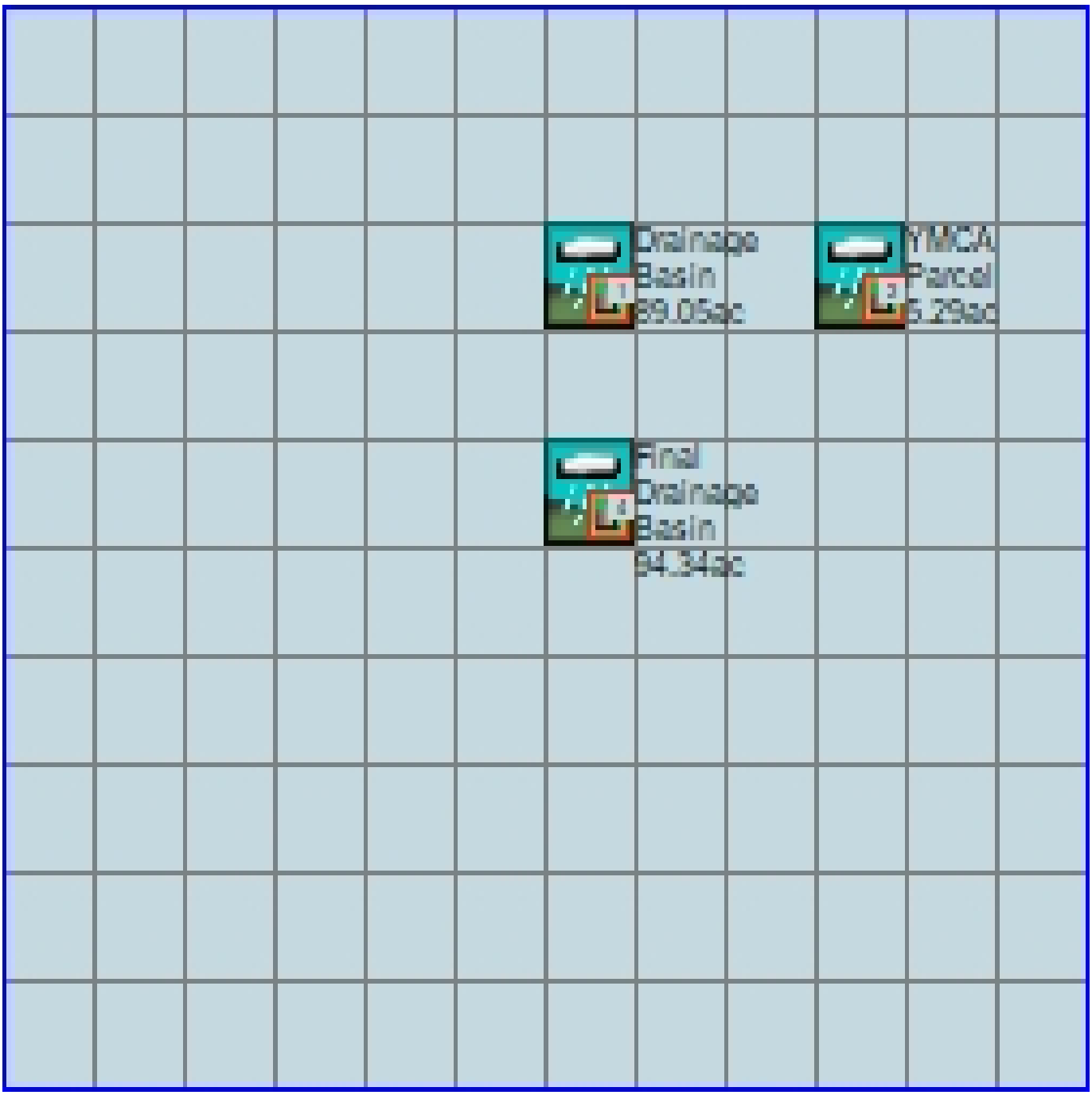
IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                                ***
WDM        26   20170817 YMCA Drainage Basin_REV2.wdm
MESSU      25   Pre20170817 YMCA Drainage Basin_REV2.MES
           27   Pre20170817 YMCA Drainage Basin_REV2.L61
           28   Pre20170817 YMCA Drainage Basin_REV2.L62
           30   POC20170817 YMCA Drainage Basin_REV21.dat
           31   POC20170817 YMCA Drainage Basin_REV22.dat
           33   POC20170817 YMCA Drainage Basin_REV24.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      COPY       501
      COPY       502
      COPY       504
      DISPLY       1
      DISPLY       2
      DISPLY       4
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Drainage Basin              MAX                    1    2   30    9
    2        YMCA Parcel                 MAX                    1    2   31    9
    4        Final Drainage Basin        MAX                    1    2   33    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  502         1    1
  504         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
   11     C, Forest, Mod          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
```

```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   11         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   11             0       4.5      0.08       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   11             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11           0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   11             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2
```

```
  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Drainage Basin***
PERLND  11                       89.05     COPY   501     12
PERLND  11                       89.05     COPY   501     13
YMCA Parcel***
PERLND  11                        5.29     COPY   502     12
PERLND  11                        5.29     COPY   502     13
Final Drainage Basin***
PERLND  11                       94.34     COPY   504     12
PERLND  11                       94.34     COPY   504     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     INPUT  TIMSER 1
COPY   504 OUTPUT MEAN   1 1   48.4        DISPLY   4     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<-----------------><---> User T-series  Engl Metr LKFG            ***
                                        in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
```

```
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    502 FLOW     ENGL      REPL
COPY   504 OUTPUT MEAN   1 1     48.4      WDM    504 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM        26   20170817 YMCA Drainage Basin_REV2.wdm
MESSU      25   Mit20170817 YMCA Drainage Basin_REV2.MES
           27   Mit20170817 YMCA Drainage Basin_REV2.L61
           28   Mit20170817 YMCA Drainage Basin_REV2.L62
           30   POC20170817 YMCA Drainage Basin_REV21.dat
           31   POC20170817 YMCA Drainage Basin_REV22.dat
           33   POC20170817 YMCA Drainage Basin_REV24.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      17
      IMPLND       1
      IMPLND       4
      PERLND      16
      IMPLND       8
      IMPLND      11
      COPY       501
      COPY       502
      COPY       504
      DISPLY       1
      DISPLY       2
      DISPLY       4
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Drainage Basin              MAX                    1    2   30    9
    2        YMCA Parcel                 MAX                    1    2   31    9
    4        Final Drainage Basin        MAX                    1    2   33    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  502         1    1
  504         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
   17     C, Lawn, Mod            1    1    1    1   27    0
```

```
  16     C, Lawn, Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   17         0    0    1    0    0    0    0    0    0    0    0    0
   16         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   17         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   17         0    0    0    0    0    0    0    0    0    0    0
   16         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   17              0       4.5      0.03       400       0.1       0.5     0.996
   16              0       4.5      0.03       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   17              0         0         2         2         0         0         0
   16              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   17            0.1      0.25      0.25         6       0.5      0.25
   16            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   17              0         0         0         0       2.5         1         0
   16              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
   11      PARKING/FLAT           1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
```

```
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
   11         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
   11         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
   11         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
   11            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1             0         0
    4             0         0
    8             0         0
   11             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1             0         0
    4             0         0
    8             0         0
   11             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Drainage Basin***
PERLND  17                      48.75     COPY   501     12
PERLND  17                      48.75     COPY   501     13
IMPLND   1                      16.44     COPY   501     15
IMPLND   4                      23.86     COPY   501     15
YMCA Parcel***
PERLND  16                      2.404     COPY   502     12
PERLND  16                      2.404     COPY   502     13
IMPLND   1                      0.165     COPY   502     15
IMPLND   4                      0.968     COPY   502     15
IMPLND   8                      0.223     COPY   502     15
IMPLND  11                       1.53     COPY   502     15
Final Drainage Basin ***
PERLND  17                      48.75     COPY   504     12
```

```
PERLND  17                      48.75     COPY   504     13
PERLND  16                      2.404     COPY   504     12
PERLND  16                      2.404     COPY   504     13
IMPLND   1                     16.605     COPY   504     15
IMPLND   4                     24.828     COPY   504     15
IMPLND   8                      0.223     COPY   504     15
IMPLND  11                       1.53     COPY   504     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1
COPY   502 OUTPUT MEAN   1 1   48.4        DISPLY   2     INPUT  TIMSER 1
COPY   504 OUTPUT MEAN   1 1   48.4        DISPLY   4     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                       in  out                                ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><-------><-------><-------><-------><-------><------->              ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
```

```
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY     2 OUTPUT MEAN   1 1     48.4      WDM    702 FLOW     ENGL      REPL
COPY   502 OUTPUT MEAN   1 1     48.4      WDM    802 FLOW     ENGL      REPL
COPY     4 OUTPUT MEAN   1 1     48.4      WDM    704 FLOW     ENGL      REPL
COPY   504 OUTPUT MEAN   1 1     48.4      WDM    804 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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ATTACHMENT C

N

20 0 20 40

SCALE IN FEET

No.	DATE	BY	REVISION

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(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

DANILO S. OCHOA — STATE OF WASHINGTON — 45879 — REGISTERED PROFESSIONAL ENGINEER

PRELIMINARY

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS. DCG CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, & ALL OTHER EX FEATURES & CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN &/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT DCG PRIOR TO CONSTRUCTION.

OWNER: YMCA VALLEY FAMILY YMCA
215 EAST FULTON STREET
MOUNT VERNON, WA 98273

PROJECT: 1901 HOAG ROAD
MOUNT VERNON, WA 98273
EXISTING STORMWATER POND PLAN

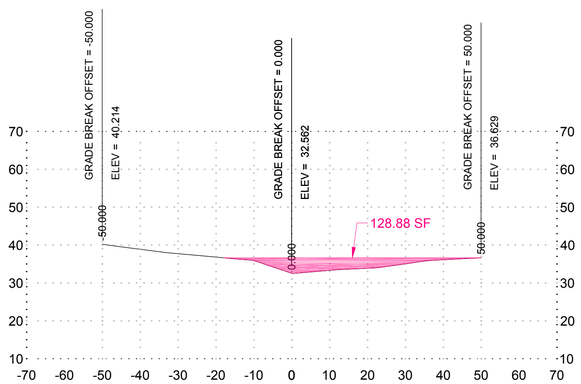
PROJ. MANAGER:	DO
DESIGNED BY:	NMD
DRAWN BY:	NMD
CHECKED BY:	DO
SCALE:	AS NOTED
DATE: 8/21/2017	REV. A
SHEET 2 OF 3	

SHEET NUMBER

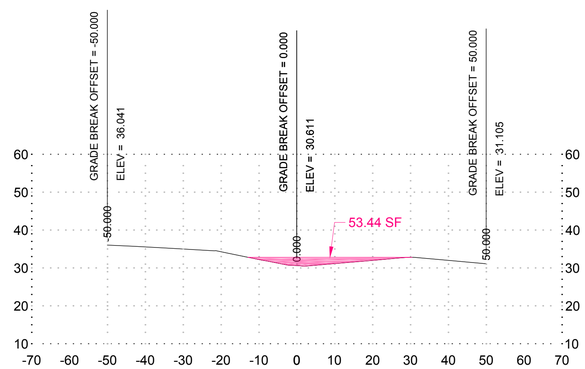
FIG2

CAD FILE NUMBER: P:\CLIENTS\YMCA SKAGIT\NEW YMCA MV FACILITY\CIVIL\GIS\XR_GIS_17_YMCA.DWG
LAST MODIFIED BY: DSAARENAS - SAVE DATE: 8/21/2017 12:13 PM - SHEET SET: #### - ORIGINAL SHEET SIZE: ANSI FULL BLEED D (34.00 X 22.00 INCHES)
AUTOCAD VERSION: CIVIL 3D 2015

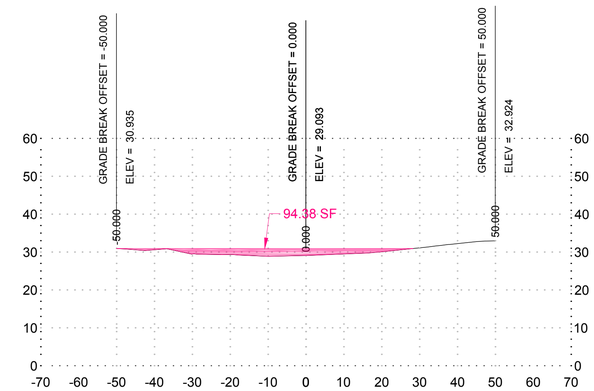
ATTACHMENT D



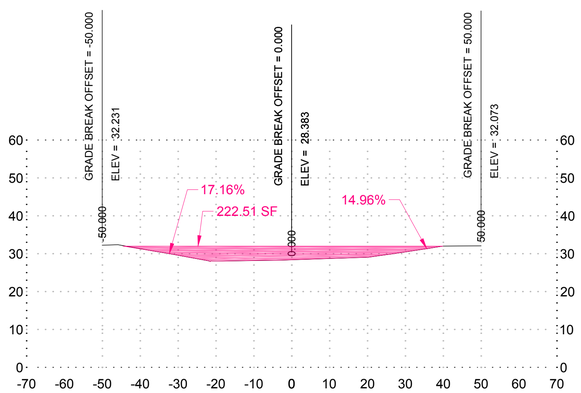
STA 53+00
CROSS SECTION A-A



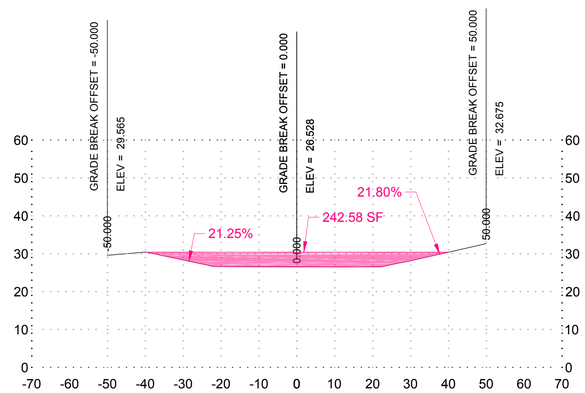
STA 54+00
CROSS SECTION B-B



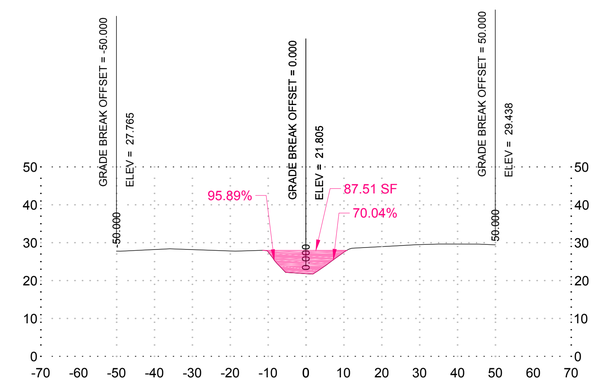
STA 54+50
CROSS SECTION C-C



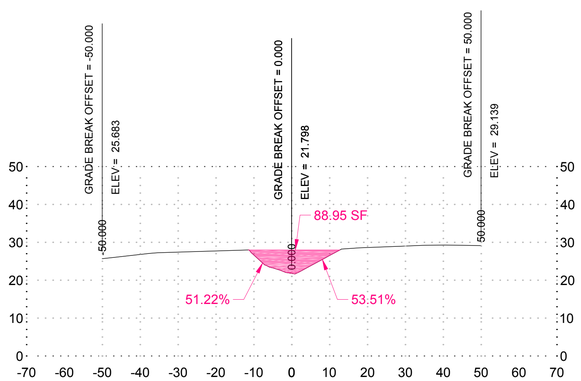
STA 55+00
CROSS SECTION D-D



STA 56+00
CROSS SECTION E-E



STA 56+70
CROSS SECTION F-F



STA 56+80
CROSS SECTION F-F

No.	DATE	BY	REVISION

LEED AP™ — LEED ACCREDITED PROFESSIONAL™ & THE RELATED ACRONYM, & THE LEGACY LEED AP LOGO ARE TRADEMARKS OWNED BY THE U.S. GREEN BUILDING COUNCIL & ARE AWARDED TO INDIVIDUALS WHO PASS THE GREEN BUILDING CERTIFICATION INSTITUTE.

15029 Bothell Way NE
Suite 600
Lake Forest Park
WA 98155
P: 206.523.0024
F: 206.523.1012
www.dcgengr.com
DCG civil structural

CALL 811
2 BUSINESS DAYS
BEFORE YOU DIG
(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

DANILO S. OCHOA — STATE OF WASHINGTON — 45870 — REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY

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OWNER: YMCA VALLEY FAMILY YMCA
215 EAST FULTON STREET
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PROJECT: 1901 HOAG ROAD
MOUNT VERNON, WA 98273
EXISTING STORMWATER POND SECTIONS

PROJ. MANAGER:	DO
DESIGNED BY:	NMD
DRAWN BY:	NMD
CHECKED BY:	DO
SCALE:	AS NOTED
DATE: 8/21/2017	REV. A
SHEET 3 OF 3	

SHEET NUMBER
FIG3

CAD FILE NUMBER: P:\CLIENTS\YMCA SKAGIT\NEW YMCA MV FACILITY\DWG\GISVR_GIS_17_YMCA.DWG
LAST MODIFIED BY: DSAARENAS - SAVE DATE: 8/21/2017 12:13 PM - SHEET SET: #### - ORIGINAL SHEET SIZE: ANSI FULL BLEED D (34.00 X 22.00 INCHES)
AUTOCAD VERSION: CIVIL 3D 2015

ATTACHMENT E

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Aug 17 2017

YMCA Bioswale

Trapezoidal

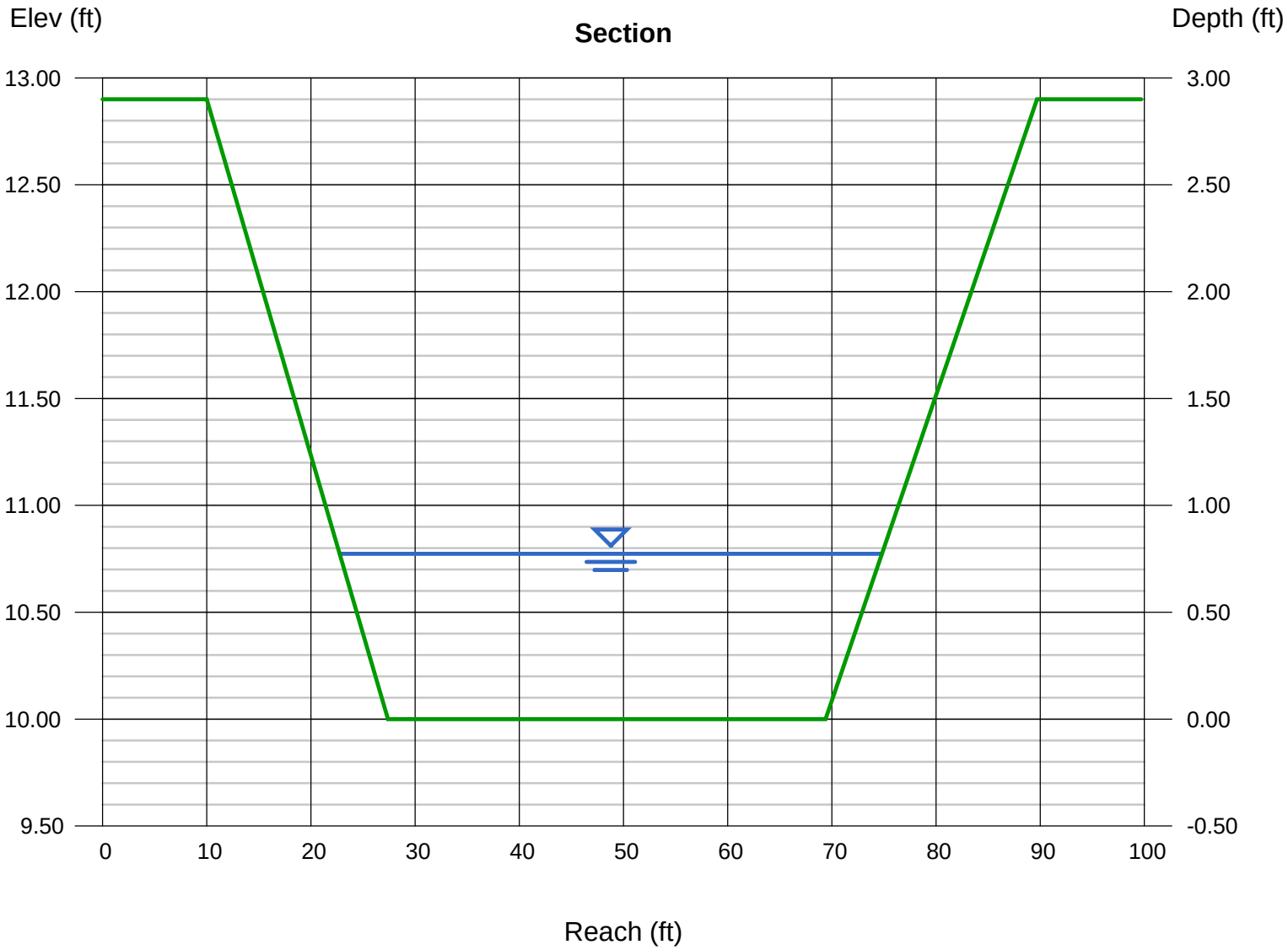
Bottom Width (ft)	=	42.00
Side Slopes (z:1)	=	6.00, 7.00
Total Depth (ft)	=	2.90
Invert Elev (ft)	=	10.00
Slope (%)	=	0.40
N-Value	=	0.030

Calculations

Compute by:		Q vs Depth
No. Increments	=	15

Highlighted

Depth (ft)	=	0.77
Q (cfs)	=	89.56
Area (sqft)	=	36.37
Velocity (ft/s)	=	2.46
Wetted Perim (ft)	=	52.17
Crit Depth, Yc (ft)	=	0.51
Top Width (ft)	=	52.05
EGL (ft)	=	0.87



Depth	Q	Area	Veloc
(ft)	(cfs)	(sqft)	(ft/s)
0.19	8.585	8.363	1.03
0.39	27.56	17.21	1.60
0.58	54.79	26.55	2.06
0.77	89.56	36.37	2.46
0.97	131.5	46.67	2.82
1.16	180.5	57.47	3.14
1.35	236.3	68.74	3.44
1.55	299.1	80.51	3.72
1.74	368.8	92.76	3.98
1.93	445.5	105.5	4.22
2.13	529.1	118.7	4.46
2.32	619.9	132.4	4.68
2.51	717.9	146.6	4.90
2.71	823.2	161.3	5.10
2.90	935.9	176.5	5.30

Wp	Yc	TopWidth	Energy
(ft)	(ft)	(ft)	(ft)
44.54	0.11	44.51	0.21
47.09	0.24	47.03	0.43
49.63	0.37	49.54	0.65
52.17	0.51	52.05	0.87
54.72	0.66	54.57	1.09
57.26	0.80	57.08	1.31
59.80	0.95	59.59	1.54
62.34	1.10	62.11	1.76
64.89	1.26	64.62	1.99
67.43	1.41	67.13	2.21
69.97	1.57	69.65	2.44
72.52	1.73	72.16	2.66
75.06	1.89	74.67	2.89
77.60	2.05	77.19	3.11
80.15	2.21	79.70	3.34

Channel Report

ATTACHMENT F

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Aug 16 2017

<Name>

Trapezoidal

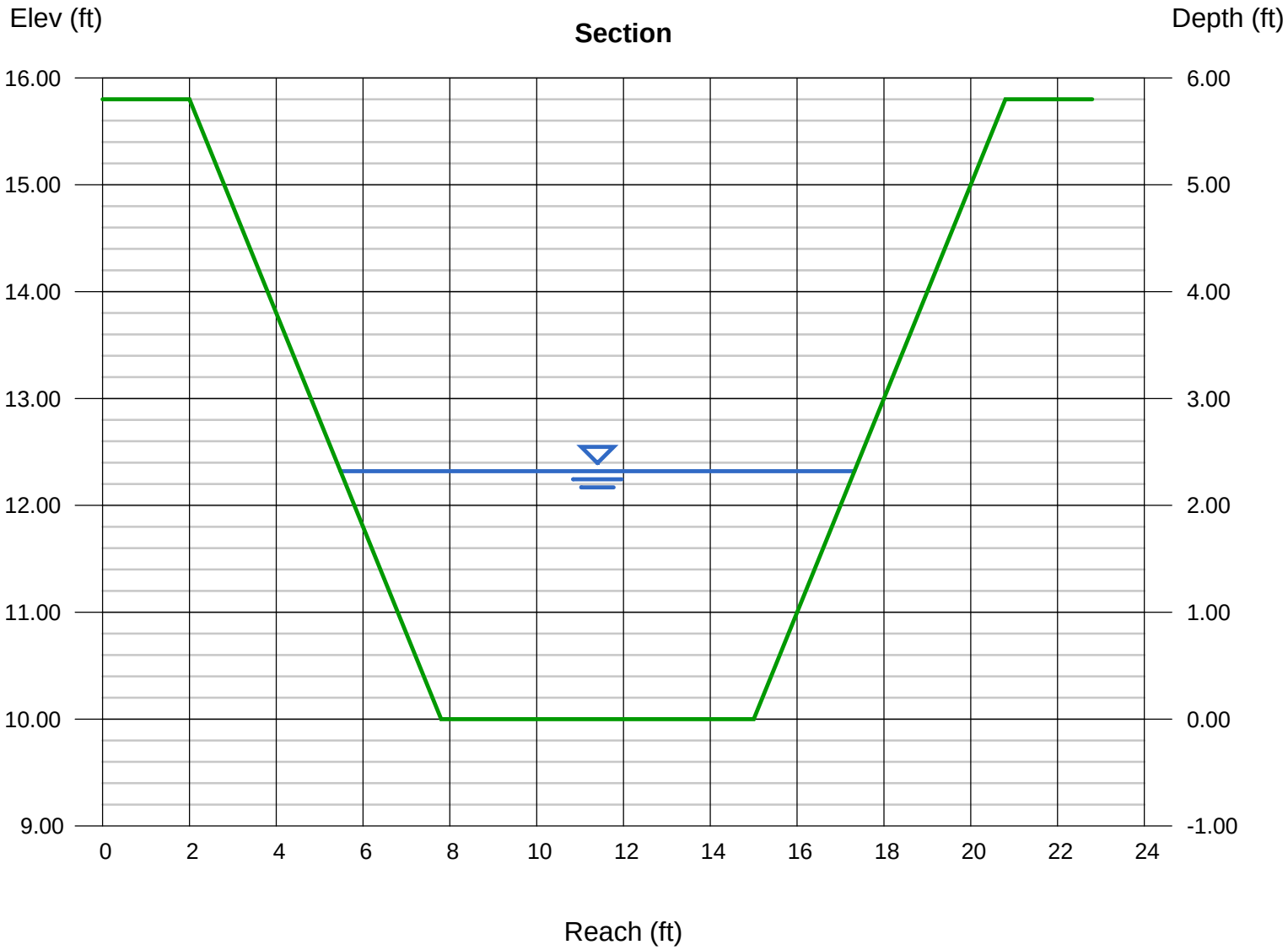
Bottom Width (ft)	=	7.20
Side Slopes (z:1)	=	1.00, 1.00
Total Depth (ft)	=	5.80
Invert Elev (ft)	=	10.00
Slope (%)	=	0.40
N-Value	=	0.030

Calculations

Compute by:		Q vs Depth
No. Increments	=	10

Highlighted

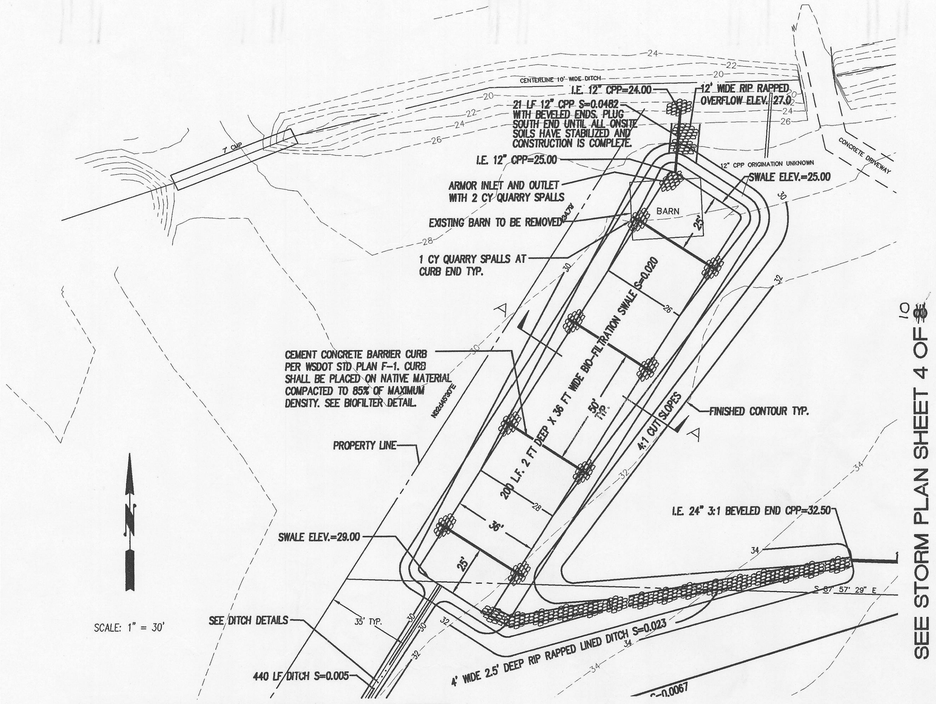
Depth (ft)	=	2.32
Q (cfs)	=	94.86
Area (sqft)	=	22.09
Velocity (ft/s)	=	4.29
Wetted Perim (ft)	=	13.76
Crit Depth, Yc (ft)	=	1.63
Top Width (ft)	=	11.84
EGL (ft)	=	2.61



Depth	Q	Area	Veloc
(ft)	(cfs)	(sqft)	(ft/s)
0.58	9.027	4.512	2.00
1.16	28.85	9.698	2.97
1.74	57.55	15.56	3.70
2.32	94.86	22.09	4.29
2.90	140.9	29.29	4.81
3.48	195.9	37.17	5.27
4.06	260.1	45.72	5.69
4.64	334.1	54.94	6.08
5.22	418.1	64.83	6.45
5.80	512.5	75.40	6.80

Wp	Yc	TopWidth	Energy
(ft)	(ft)	(ft)	(ft)
8.84	0.36	8.36	0.64
10.48	0.77	9.52	1.30
12.12	1.19	10.68	1.95
13.76	1.63	11.84	2.61
15.40	2.07	13.00	3.26
17.04	2.52	14.16	3.91
18.68	2.98	15.32	4.56
20.32	3.44	16.48	5.21
21.96	3.91	17.64	5.87
23.60	4.38	18.80	6.52

ATTACHMENT G



SEE SANITARY SEWER PLAN SHEET 4 FOR CONTINUATION

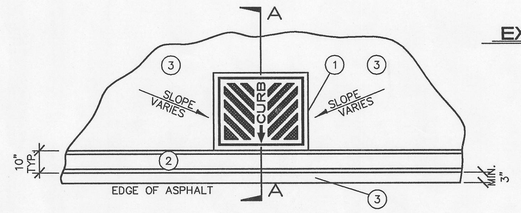
SEE STORM PLAN SHEET 4 OF 10

BIOFILTER SWALE / SEDIMENT POND DETAIL

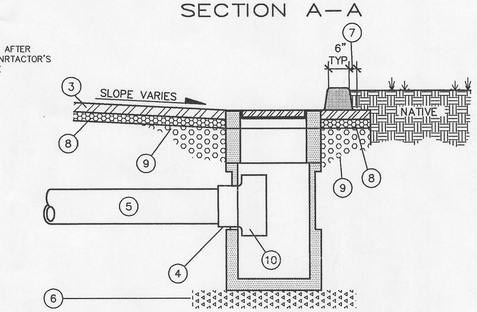
NOT TO SCALE

TYPE 1 CB EXTRUDED CURB

PLAN

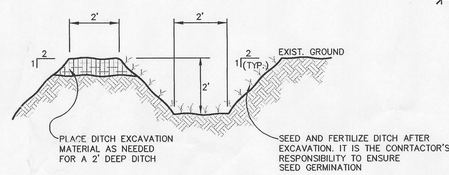


SECTION A–A



EXTRUDED CURB NOTES

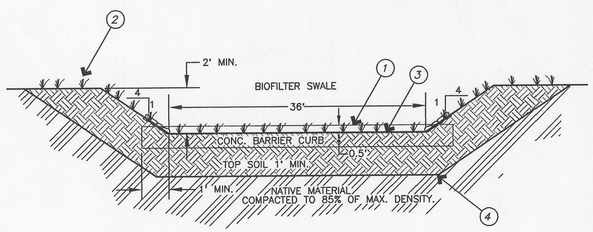
1. TYPE 1 CATCH BASIN.
2. EXTRUDED CURB PER STD PLAN F–2b TYPE 6, ANCHORED TO PROPOSED ASPHALT WITH CONCRETE SLURRY OR EPOXY BOND.
3. ASPHALT COMPACTED TO 95% OF MAX. DENSITY. DEPTH AS PER SECTION DETAIL.
4. FOR PVC PIPE, USE SAND IMPREGNATED BELL FITTING ONLY.
5. PVC OR REINFORCED CONCRETE PIPE. SEE TRENCH DETAIL FOR PROPER BEDDING AND COMPACTION.
6. 6" OF 5/8" COMPACTED CRUSHED ROCK. CRUSHED ROCK SHALL BE SPREAD 1'–0" AROUND OUTSIDE OF BASIN.
7. 3" MIN. TO 6" MAX.
8. CRUSHED SURFACING TOP COURSE COMPACTED TO 95% OF MAX. DENSITY. DEPTH AS PER SECTION DETAIL.
9. GRAVEL BALLAST COMPACTED TO 95% OF MAX. DENSITY. DEPTH AS PER SECTION DETAIL.
10. SEE OIL/WATER SEPARATOR DETAIL ON OUTLET.



NOTE: THE DITCH AND THE ON–SITE BIOFILTRATION SWALE SHALL BE COMPLETED PRIOR TO ANY OTHER ON–SITE CONSTRUCTION

DITCH DETAIL

NOT TO SCALE



GENERAL NOTES:

NOTE–1 CEMENT CONCRETE BARRIER CURB. INSTALLED WITH A LEVEL SLOPE PARALLEL TO PROPOSED CONTOURS

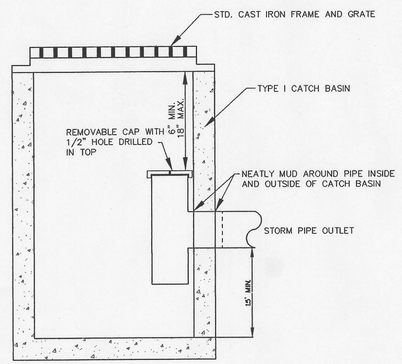
NOTE–2 ALL AREAS DISTURBED FROM CONSTRUCTION SHALL BE RE–SEEDED WITH A LAWN GRASS MIXTURE.

NOTE–3 THE BIO–FILTER SWALE SHALL BE SODDED TO 1 FOOT ABOVE THE EXISTING POND BOTTOM AS SHOWN. THE BIOFILTRATION SWALE SHALL BE RE–SEEDED IF NECESSARY (AT THE DIRECTION OF THE ENGINEER) AS FOLLOWS.
40% REDTOP BENT GRASS
30% RED FESCUE
20% TALL FESCUE
5% PERENNIAL RYE
5% RUSSIAN WILD RYE

NOTE–4 THE BIO FILTER SWALE SHALL BE EXCAVATED TO THE BOTTOM OF THE TOP SOIL LEVEL AND USED AS A SEDIMENT POND UNTIL ALL ONSITE CONSTRUCTION IS COMPLETE AND ALL EXPOSED SOILS HAVE BEEN STABILIZED. IT IS THE CONTRACTORS RESPONSIBILITY TO MAINTAIN THE SEDIMENT POND AND REMOVE EXCESS SILT BUILT UP IN THE POND AFTER EACH RAINFALL. ONCE ALL EXPOSED SOILS ON THIS PROJECT HAVE BEEN STABILIZED, THE CONTRACTOR SHALL CONSTRUCT THE BIOFILTER SWALE AS SHOWN.

SECTION A-A BIOFILTER SWALE

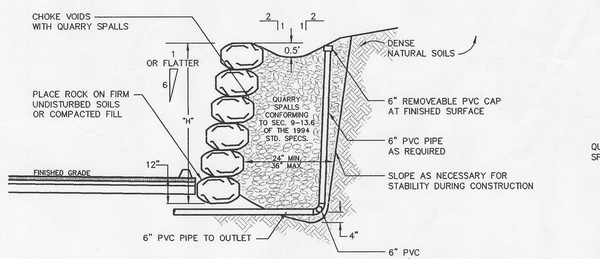
NOT TO SCALE



1. OIL/WATER SEPARATORS SHALL BE INSTALLED ON ALL OUTLET PIPES FROM PROPOSED TYPE 1 AND 1L CATCH BASINS WITHIN THE CHURCH PARKING LOT.
2. TEE AND CAP SHALL BE OF THE SAME SIZE AND MATERIAL AS THE OUTLET PIPE. TEE SHALL BE INSTALLED AGAINST CATCH BASIN WALL.

OIL / WATER SEPARATOR DETAIL

NOT TO SCALE

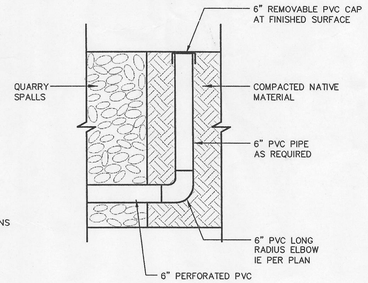


ROCKERIES SHALL BE CONSTRUCTED AS PER ASSOCIATED ROCKERY CONTRACTOR GUIDELINE.

HEIGHT FROM TOP OF ROCKERY	MINIMUM ROCK WIDTH (B) IN FEET
<5	1–1 1/2
5–7	2
7–10	3

ROCKERY DETAIL

NOT TO SCALE



ROCKERY CLEANOUT DETAIL

NOT TO SCALE

PATRICK I. SEVERIN
STATE OF WASHINGTON
32276
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 8/13/ 98

APPROVED FOR CONSTRUCTION
CITY OF MOUNT VERNON — DATE 4-8-97
VOID 1 YEAR AFTER DATE OF APPROVAL

NO.	DATE	REVISIONS	BY	APVD
1	3/17/97	REVISIONS PER THE CITY OF MOUNT VERNON COMMENTS	PLS	PLS

Leonard, Boudinot & Skodje Inc.
PROFESSIONAL ENGINEERS & LAND SURVEYORS
603 South First Street; P.O. Box 1228
Mount Vernon, WA 98273
Tel: 360–336–5751 Fax: 360–336–3981

SHEET DESCRIPTION: STORM PLAN AND DETAILS

SCALE: NTS
DRAWN BY: JENNIFER LANGE
DESIGNED BY: PAT SEVERIN
CHECKED BY: PAT SEVERIN
FIELD BOOK/PAGE: .
DATE: APRIL 1, 1996

SITE PLAN FOR SALEM LUTHERAN CHURCH

DRAWING NO. 93107-7
JOB NO. 94054
SHEET 7 OF 10

D:\93107\93107-7 Tue Mar 18 16:59:18 1997

Skagit County Area, Washington

17—Bow gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2htx
Elevation: 50 to 400 feet
Mean annual precipitation: 20 to 40 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 170 to 220 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Bow and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bow

Setting

Landform: Terraces, hillslopes
Parent material: Volcanic ash, glaciolacustrine deposits, and glacial drift

Typical profile

H1 - 0 to 7 inches: gravelly ashy loam
H2 - 7 to 17 inches: very gravelly ashy loam
H3 - 17 to 31 inches: clay loam
H4 - 31 to 60 inches: silty clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C/D
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: Yes

Minor Components

Bellingham

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Skagit County Area, Washington
Survey Area Data: Version 13, Sep 8, 2016

Skagit County Area, Washington

67—Hoogdal silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2hwp
Elevation: 100 to 300 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hoogdal and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hoogdal

Setting

Landform: Terraces
Parent material: Loess and glaciolucustrine deposits

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 17 inches: silty clay loam
H3 - 17 to 60 inches: silty clay

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 1 to 20 inches to abrupt textural change
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Other vegetative classification: Soils with Moderate Limitations (G002XN602WA)

Hydric soil rating: No

Data Source Information

Soil Survey Area: Skagit County Area, Washington
Survey Area Data: Version 13, Sep 8, 2016

ATTACHMENT I

N

30 15 0 30 60

SCALE IN FEET

KEY NOTES

KEY	DESCRIPTION	DETAIL/ SHEET
1	10'Wx6'Lx12"D ENERGY DISSIPATING RIPRAP PAD	-
2	CONTRACTOR SHALL REPLACE & RESTORE ALL DISTURBED EXISTING LANDSCAPING	-
3	BIOFILTRATION SWALE: W/ 6" PERFORATED PVC UNDERDRAINS: LENGTH: 115 LF TOP WIDTH: 11.00' BOTTOM WIDTH: 5.00' SIDE SLOPES: 3:1 LONGITUDINAL SLOPE: 1.50%	-
4	ROCK CHECK DAM (TYP)	-
5	SITE WALL/ROCKERY MAX HEIGHT: 8.00' MIN HEIGHT: 1.00'	-
6	6" DOWNSPOUT LOCATION TBD (TYP)	-
7	6" DOWNSPOUT TIGHTLINE CONNECTION @ 2.00% MIN SLOPE & 2.00' MIN COVER	-
8	FEMA FLOOD PLAIN LIMIT ELEVATION: 36.70	-
9	6" FOUNDATION, FOOTING & UNDERDRAIN TIGHTLINE CONNECTION @ 2% MIN SLOPE & 2.00' MIN COVER	-
10	8" PLAY AREA DRAIN RIM 47.60 (1' BELOW FG) 8" IE 45.00	-
11	55 LF 8" SD @ 2.00%	-
12	8" PLAY AREA DRAIN RIM 47.75 (1' BELOW FG) 8" IE 43.90	-
13	49 LF 8" SD @ 2.00%	-
14	8" AREA DRAIN RIM 48.75 8" IE 42.92	-
15	249 LF 8" SD @ 2.00%	-
16	8" SDCO RIM 47.19 8" IE 37.94	-
17	35 LF 8" SD @ 2.00%	-
18	12" IE 37.00	-
19	8" AREA DRAIN RIM 48.75 8" IE 43.00	-
20	268 LF 8" SD @ 1.50%	-
21	8" SDCO RIM 47.95 8" IE 38.98	-
22	169 LF 8" SD @ 1.76%	-
23	8" SDCO RIM 48.78 8" IE 37.79	-
24	112 LF 8" SD @ 0.50%	-
25	8" SDCO RIM 48.95 8" IE 37.23	-
26	47 LF 8" SD @ 0.50%	-
27	6" PERFORATED PVC PUMPHOUSE UNDERDRAIN PIPE @ ELEV 38.00, 3 - 6" PIPES 10' O.C.	-
28	6" PERFORATED PVC POOL UNDERDRAIN PIPE, ELEV VARIES, 15 - 6" PIPES 7.5' O.C.	-
29	6" PERIMETER FOOTING/FOUNDATION DRAIN	-

2.74 acres = 0.357 cfs, Assumed existing area going to wetlands

1.95 acres = 0.254 cfs, Assumed existing area not impacted by project

2.74 acres - 1.95 acres = 0.79 acres = 0.103 cfs
Mitigated area could be sent to wetlands.

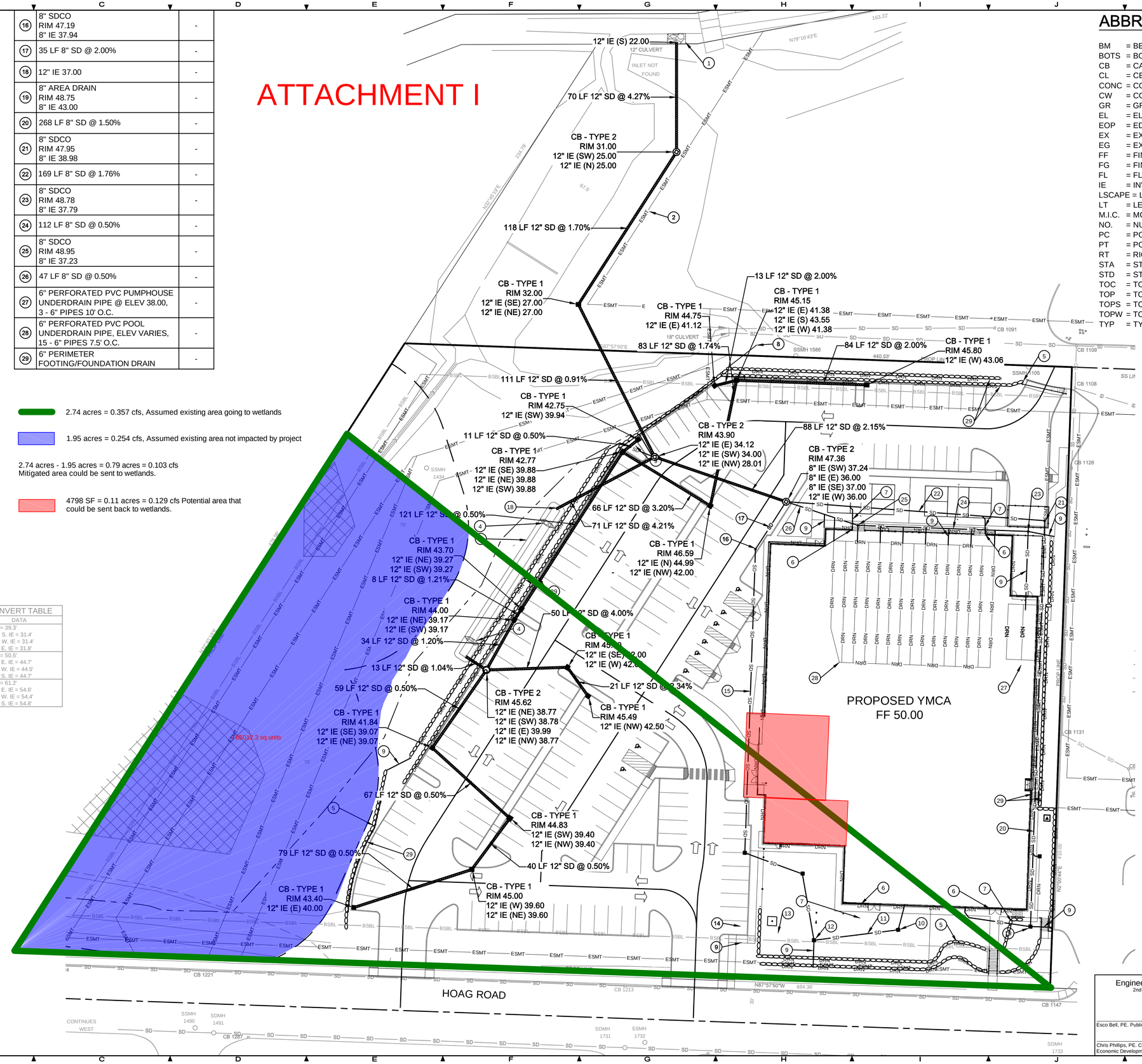
4798 SF = 0.11 acres = 0.129 cfs Potential area that could be sent back to wetlands.

EX SDCB INVERT TABLE

CB	DATA
1002	LID ELV = 64.6' 12" PVC E. IE = 57.6' 12" PVC W. IE = 57.5'
1089	LID ELV = 59.9' 6" PVC N. IE = 57.3'
1090	LID ELV = 56.4' 12" PVC E. IE = 52.3' 12" PVC NW. IE = 52.2' 6" PVC S. IE = 52.9' (E. CONNECTION UNKNOWN)
1091	LID ELV = 42.3' 8" PVC NE IE = 36.5' 8" PVC W. IE = 36.4' (NE CONNECTION UNKNOWN)
1108	LID ELV = 45.6' 12" PVC N. IE = 43.2' 12" PVC E. IE = 43.1' 12" PVC S. IE = 43.2'
1109	LID ELV = 45.2' 18" PVC E. IE = 42.3' 18" PVC W. IE = 42.3' 12" PVC S. IE = 42.7'
1126	LID ELV = 48.4' 12" PVC N. IE = 45.9' 12" PVC S. IE = 46.0'
1131	LID ELV = 54.3' 12" PVC N. IE = 51.3' 12" PVC SE. IE = 51.3'
1147	LID ELV = 60.5' 12" PVC E. IE = 57.1' 12" PVC W. IE = 57.1'
1213	LID ELV = 50.2' 12" PVC E. IE = 46.3' 12" PVC W. IE = 46.3'
1221	LID ELV = 38.9' 12" PVC E. IE = 35.0' 12" PVC W. IE = 35.0'
1228	LID ELV = 35.1' 12" PVC E. IE = 31.5' 12" PVC W. IE = 31.5' 12" PVC N. = CAPPED
1277	LID ELV = 35.0' 8" CMP N. IE = 29.7' 8" CMP S. IE = 30.2' (N. CONNECTION UNKNOWN) (S. CONNECTION UNKNOWN)
1287	LID ELV = 39.9' 8" CMP E. IE = 36.7' (E. CONNECTION UNKNOWN)
1299	LID ELV = 52.4' 8" CMP W. IE = 50.5' (W. CONNECTION UNKNOWN)
1309	LID ELV = 63.1' 8" CMP W. IE = 61.3' (W. CONNECTION UNKNOWN)
1553	LID ELV = 50.0' 12" PVC W. IE = 47.8' 6" PVC E. IE = 48.0' (E. CONNECTION UNKNOWN)

EX SDMH INVERT TABLE

CB	DATA
1491	LID ELV = 39.3' 24" CMP S. IE = 31.4' 24" CMP W. IE = 31.4' 18" CMP E. IE = 31.8'
1731	LID ELV = 50.5' 18" CMP E. IE = 44.7' 18" CMP W. IE = 44.5' 12" CMP S. IE = 44.7'
1733	LID ELV = 61.2' 18" CMP E. IE = 54.6' 18" CMP W. IE = 54.4' 12" CMP S. IE = 54.8'



ABBREVIATIONS:

BM	= BENCHMARK
BOTS	= BOTTOM OF STAIR
CB	= CATCH BASIN
CL	= CENTER LINE
CONC	= CONCRETE
CW	= CONCRETE WALK
GR	= GRADE
EL	= ELEVATION
EOP	= EDGE OF PAVEMENT
EX	= EXISTING
EG	= EXISTING GRADE
FF	= FINISHED FLOOR
FG	= FINISHED GRADE
FL	= FLOWLINE
IE	= INVERT ELEVATION
LSCAPE	= LANDSCAPING
LT	= LEFT
M.I.C.	= MONUMENT IN CASE
NO.	= NUMBER
PC	= POINT OF CURVE
PT	= POINT OF TANGENT
RT	= RIGHT
STA	= STATION
STD	= STANDARD
TOC	= TOP OF CURB
TOP	= TOP OF PAVEMENT
TOPS	= TOP OF STAIR
TOPW	= TOP OF WALL
TYP	= TYPICAL

No.	DATE	BY	REVISION

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215 EAST FULTON STREET
MOUNT VERNON, WA 98273

PROJECT: 1901 HOAG ROAD
MOUNT VERNON, WA 98273
DRAINAGE PLAN

PROJ. MANAGER:	DO
DESIGNED BY:	ND, DO, NA
DRAWN BY:	ND, NA
CHECKED BY:	DO
SCALE:	AS NOTED
DATE: 8/10/2017	REV. A / SHEET OF 15
SHEET NUMBER	C10

Engineering Standards
2nd Edition May 2016

APPROVED BY:

Esco Bell, PE. Public Works Director — Date

Chris Phillips, PE. Community and Economic Development Director — Date

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