Received by Email
4/27/2023

Kindred Hydro

April 19, 2023

Project: Harbor Grove Development Hydrologic Impacts Assessment
Location: 9110 53rd Ave West, Mukilteo, WA
Job#: SEA-23-1

Sea Pac Homes
120 SW Everett Mall Way Suite #100
Everett, WA 98204
Attn: Glen Belew

Dear Mr. Belew:

I am pleased to submit this letter report providing the results of my hydrologic impacts assessment for the Harbor Grove Development (the Site) at 9110 53rd Ave West in Mukilteo, WA. This project will result in a 7-lot single-family lots on 2.43 acres. The City of Mukilteo has requested this assessment to comply with Section 15.16(C.2.b.i.[b]) of the Mukilteo Municipal Code and "shall include an adequate description of the hydrology of the site, conclusions and recommendations regarding the effect of hydrologic conditions on the proposed development and options and recommendations covering the carrying capabilities of the sites to be developed." The City is primarily concerned with the potential for the development to increase water flow into residential lots west of the Site. Slope stability is not a concern for this site, particularly given the plans to build a retaining structure on the west side of the property.

Background

Existing site conditions are shown on the survey in Figure 1. The Site has a total area of 2.43 acres. There is an abandoned house and garage on the property. There is no formal drainage system on the property, although there is a ditch along the eastern side of the property along 53rd Avenue West.

The proposed development plan is provided in Figure 2. The proposed development plan includes seven single-family residential lots, roads, stormwater drainage, and a detention vault. The site would be graded relatively flat and a retaining wall would be constructed on the west side of the property. A portion of the site (0.19 acres) in the northeast corner of the site would be left unchanged and preserved as native growth.

All of the captured stormwater runoff will be directed to a detention vault beneath the road and equipped with flow control to meet the stormwater detention requirements before leaving the site. Flow from the detention vault will be piped south and west to the existing stormwater system at the intersection of 92nd Street Southwest and Hargreaves place and eventually discharges to Smuggler's Gulch Creek west of the site. The west side of the site at the base of the retaining wall will not gravity drain to the detention vault. Therefore, any drainage from the base of the wall will be captured and pumped to a structure at the top of the wall where it can gravity drain to the detention vault. Public comments have expressed concern regarding maintenance and operation of the pump.

A wetlands survey conducted by Wetland Resources (May 6, 2021) did not identify any wetlands.

Topography, Geology, and Hydrogeology

Regional topography near the site is shown in Figure 3. As shown on this figure, the site is located on a topographic high with Smuggler's Gulch Creek ravine located north and west of the site. Based on City of Mukilteo mapping, the northern ravine drains into the western ravine. The more refined site topography provided on Figure 1 indicates that elevations across the site range from ranging from 410 ft above mean sea level (AMSL) in the center of the site to 378 ft AMSL in the southwest corner of the property. Figure 1 shows the location of the topographic divide that runs north-south through the property. The western portion of the property slopes to the west and the eastern portion of the property generally slopes to the southeast. There is a closed basin (i.e., a bowl where standing water could collect) near the eastern boundary of the site. Although there is no evidence of surface runoff, any surface runoff from the west basin would flow to the west and any surface runoff from the east basin would flow to the southeast. Groundwater flow may not follow the land contours, and it is likely that groundwater flows towards Smuggler's Gulch Creek located north and west of the site.

Earth Solutions NW, LLC conducted a geotechnical study for the Site dated July 30, 2021. This study included eight test pits to depths of 4 to 13 ft and determined that the site was underlain by dense glacial till. The upper 1-4 feet was a combination of topsoil, fill, and weathered glacial till that is generally relatively permeable and well drained. The underlying unweathered glacial till is usually relatively impermeable and perched water often occurs above and within unweathered glacial till. No perched groundwater was detected during excavation of the test pits in June of 2021.

Cobalt Geosciences, LLC conducted a groundwater evaluation dated March 14, 2022. This study included two test pits excavated in early March 2022 to a depth of 14 feet. These explorations encountered 4 to 8 feet of weathered glacial till over unweathered glacial till. No perched groundwater was encountered in either test pit, even though the explorations were conducted at the end of the wet season. Based on these observations, they concluded that saturated groundwater is unlikely to occur above an elevation of 375 feet AMSL. The footing drains for the proposed retaining wall on the west side of the property, with an elevation of 376 feet AMSL and less than 2 ft below existing grade, are unlikely to intercept significant groundwater. In a letter dated August 4, 2022, Earth Solutions NW, LLC estimated that less than 0.5 gpm would be collected in the retaining wall drain during the peak wet season.

Site Visit

I conducted a site visit on March 8, 2022, to observe conditions at and near the Site. The Site surrounded by single-family homes on the north, west, and south sides, and by 53rd Avenue West on the east side. Currently, the Site is lightly forested along with a variety of shrubbery, ferns, and other low vegetation. Portions of the site were disturbed in places, likely due to traversing the site with a trackhoe during the geotechnical investigations. There is no evidence of ponding, surface runoff, or erosion on the site. The ditch along 53rd Avenue West was vegetated with no evidence of erosion.

Surface Water Changes Associated with Development

Hydrologic conditions at a site are determined by a variety of factors, including precipitation, topography, vegetation, soils, and groundwater flux beneath the site. Precipitation that falls on a site is distributed into four boxes: evapotranspiration back into the atmosphere, surface runoff, horizontal interflow within near-surface soils (when perching conditions are present), and deep infiltration to groundwater. Development of a site changes how precipitation is partitioned into these boxes and mitigation is generally required to mitigate hydrologic changes that may increase flooding and erosion or adversely impact streams, wetlands, and associated fish and wildlife habitat.

As documented in the Storm Drainage Plan dated April 19, 2023 and shown on Figure 2, Blueline had developed a stormwater management plan that will convey almost all the surface water from the site into a detention vault that will include flow control measures to restrict peak flows from the site. The Storm Drainage Plan includes WWHM hydrologic modeling to demonstrate that these measures will achieve stormwater permit requirements. In compliance with the stormwater permit, Blueline compared surface runoff from a completely forested pre-developed site (plus the neighboring lot) and the developed site with the detention vault and the flow control. These results are summarized in Table 1 and illustrate that the mitigated surface flows from the site are less than the forested flows from the site. Therefore, in terms of impacts to Smuggler’s Gulch Creek (the receiving water body) development of the site will reduce peak flows and erosion.

Although consistent with permit requirements, the Blueline modeling does not directly address the potential hydrologic impacts to properties downhill of the Site. As shown on Figure 1, the eastern portion of the site drains east and into the ditch that flows north along 53rd Avenue West. Water from the east basin does not flow into the properties west of the site on Hargreaves Place. The western portion of the site does drain towards the west and any surface water runoff would flow into the properties along Hargreaves Place (shown on Figure 3). Furthermore, consistent with permit requirements, Blueline modeled 100% forested pre-development conditions, while the site has been developed with a single-family home and is not 100% forested with open areas and low-lying vegetation more similar to pasture. Runoff from pasture is generally higher than runoff from forests.

In order to support this hydrologic assessment, additional hydrologic modeling was conducted to estimate surface water flows towards the Hargreaves properties under existing conditions. The modeling was conducted using the WWHM model and assumed 1.24 acres of either pasture or forest on glacial till soil (type C). As shown on Figure 1, the west basin includes a small area of impervious surface (the house and a portion of the garage). However, the runoff from these structure discharges to the ground and these surfaces were treated as pervious surface for simplicity. As provided in Table 1, surface discharge from the west basin towards the Hargreaves properties ranged from 0.024 cfs to 0.1 cfs depending on the return period and the vegetation cover (forest or pasture). WWHM results are provided in Attachment A.

As shown on Figure 2, most of the developed site will gravity drain to the detention vault and then to the piped stormwater drainage system that discharges directly to Smuggler's Gulch Creek. However, the area associated with the retaining wall on the west side of the property will be captured at the base of the wall and pumped up to the gravity drainage system at the top of the wall. As long as the pump is functioning, any surface water runoff in this area will not flow towards the Hargreaves properties. However, in the unlikely event that the pump was to fail, it is useful to estimate the surface water runoff from this area. As shown on Figure 2, the retaining wall area is 0.24 acres. WWHM hydrologic modeling was conducted for this area assuming grass vegetation and glacial till soils. (runoff from grass is higher than pasture which is higher than forested). The WWHM output file is provided in Attachment B and the results are summarized in Table 1. As shown in the table, surface discharge from the retaining wall area would range from 0.009 cfs to 0.056 cfs. These flows are significantly less (between 20 percent and 70 percent than existing surface flows towards the Hargreaves properties from the west basin. Therefore, development of the site will reduce surface flow towards the Hargreaves properties with or without the pump at the base of the retaining wall.

Table 1: Surface Discharge Estimates (in cubic feet/second) based on Hydrologic Modeling

Return Period	Entire Site 100% Forested[a]	Entire Site Developed with Flow Control[a]	Existing West Basin (Forest/Pasture)	Retaining Wall area w/o pump
2 year	0.07	0.032	0.024/0.031	0.009
5 year	0.10	0.044	0.037/0.048	0.016
10 year	0.12	0.054	0.045/0.060	0.022
25 year	0.16	0.068	0.055/0.076	0.034
50 year	0.19	0.080	0.063/0.089	0.044
100 year	0.22	0.094	0.070/0.10	0.056

[a] Based on WWHM modeling provided in the Storm Drainage Report dated April 11, 2023.

Groundwater Changes Associated with Site Development

Public comments have expressed concern that site development will increase groundwater recharge and increase the potential for groundwater seepage downhill of the site. The WWHM hydrologic model is designed to predict surface water flows and does not provide estimates of groundwater recharge. Bidlake and Payne (2001)[1] provide an excellent analysis of hydrologic processes in the Puget Sound basin and equations to estimate groundwater recharge based on soil, vegetation, and site development. The equations relevant to this analysis are provided in Table 2. As shown in Table 2, assuming an annual rainfall of 40 inches, development of a glacial till site reduces the groundwater recharge from an estimate of 11.2 inches to 5.6 inches per year. Therefore, site development is likely to reduce the potential for groundwater seepage down gradient of the site.

Table 2: Estimates of Groundwater Recharge (based on Bidlake and Payne (2001)

Soil and land-cover group	Equation (R = Recharge and P = Precipitation)	Recharge (in.) when P = 40 in.
Forest and non-forest vegetation on soils formed on glacial till	R = 0.388P -4.27	11.2
Developed or urban land with any soil type	R = 0.l94P- 2.13	5.6

[1] Bidlake, W.R. and Payne, K.L., 2001, Estimating Recharge to Ground Water from Precipitation at Naval Submarine Base Bangor and Vicinity, Kitsap County, Washington, U.S. Geologic Survey, Water-Resources Investigation Report 01-4110.

Conclusions

The proposed development plan includes seven single-family residential lots, roads, stormwater drainage, and a detention vault. The site would be graded relatively flat and a retaining wall would be constructed on the west side of the property. A portion of the site (0.19 acres) in the northeast corner of the site would be left unchanged and preserved as native growth. The City of Mukilteo has requested a hydrologic assessment to comply with Section 15.16.0S0(C.2.b.i.[b]) of the Mukilteo Municipal Code. The City is primarily concerned with the potential for the development to increase water flow into residential lots west of the Site.

After development, all of the captured stormwater runoff will be directed to a detention vault beneath the road and equipped with flow control to meet the stormwater detention requirements before leaving the site. Flow from the detention vault will be piped south and west to the existing stormwater system at the intersection of 92nd Street Southwest and Hargreaves place and eventually discharges to Smuggler's Gulch Creek west of the site. The west side of the site at the base of the retaining wall will not gravity drain to the detention vault. Therefore, any drainage from the base of the wall will be captured and pumped to a structure at the top of the wall where it can gravity drain to the detention vault.

The site is located on a topographic high with Smuggler's Gulch Creek ravine located north and west of the site. The western portion of the property slopes to the west and the eastern portion of the property generally slopes to the southeast. Although there is no evidence of surface runoff, any surface runoff from the west basin would flow to the west and any surface runoff from the east basin would flow to the southeast.

Geotechnical explorations have identified that that site is underlain by glacial till and no groundwater was observed in any of the explorations, including two deep test pits conducted in March of 2022. Based on these observations, footing drains for the proposed retaining wall on the west side of the property are unlikely to intercept groundwater. However, groundwater conditions can vary depending on precipitation and soil conditions and it is possible that the footing drains will capture groundwater during periods of high precipitation.

Based on hydrologic modeling presented in the Storm Drainage Report, the stormwater controls proposed for the site will reduce peak flows in Smuggler's Gulch Creek. Hydrologic modeling presented in this report indicates that development of the site will reduce surface discharge towards the Hargreaves properties by 20-70 percent, even without the pump at the base of the retaining wall. Based on methods developed by Bidlake and Payne (2001) development of the site will also reduce groundwater recharge at the site by approximately 50 percent. These analyses indicate that development of the site should reduce the water flow into and beneath the Hargrove properties west of the site.

Limitations and Closure

Work for this project was performed and this report prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities at the time the work was performed. It is intended for the exclusive use of Sea Pac Homes for specific application to the referenced matter. No other warranty, expressed or implied, is made.

I am pleased to provide this letter report. If you have any questions or concerns, please contact the undersigned.

Sincerely,

J. Scott Kindred, PE, LHG
President
Kindred Hydro, Inc.
Date: April 19, 2023

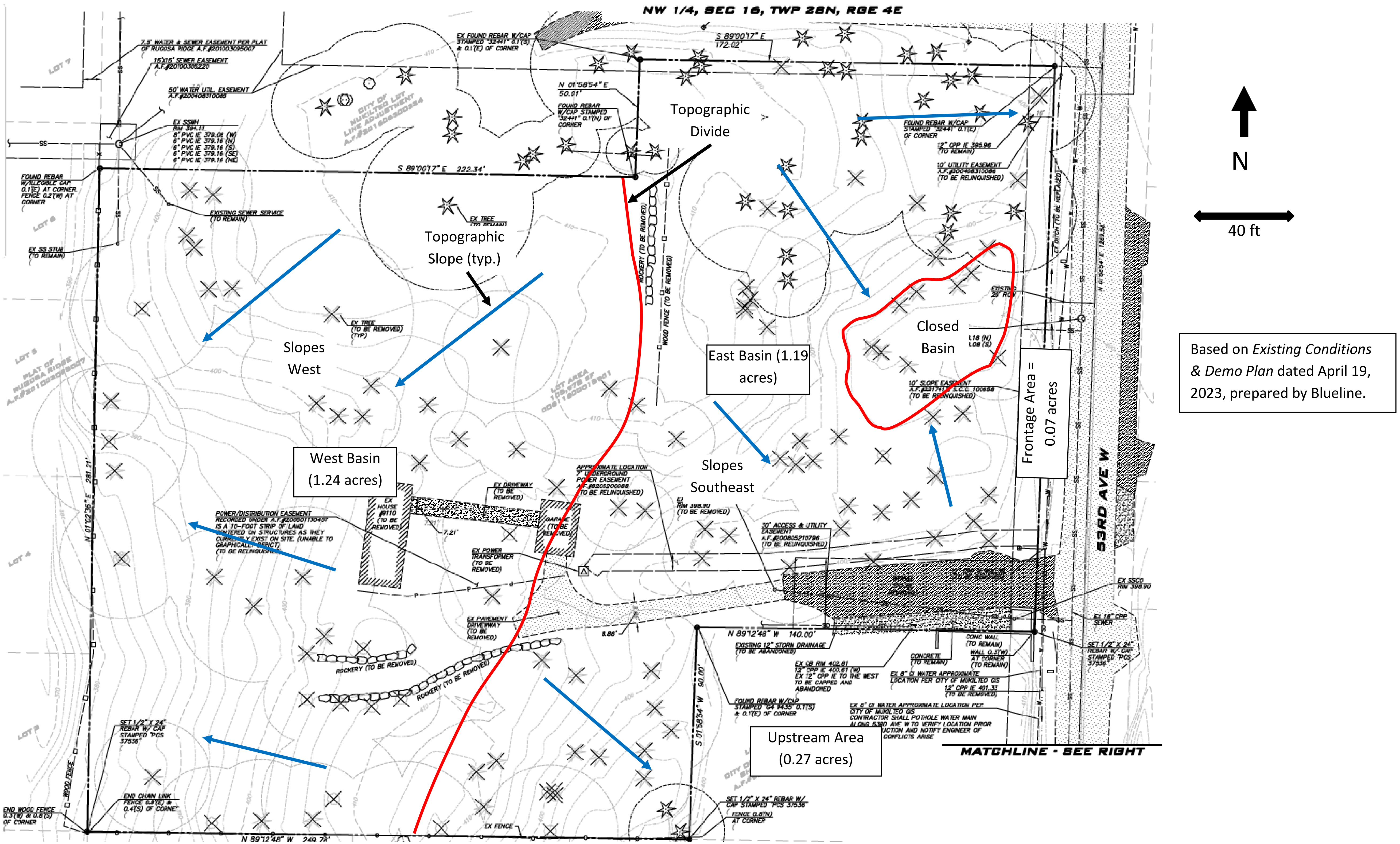

Figure 1: Existing Conditions

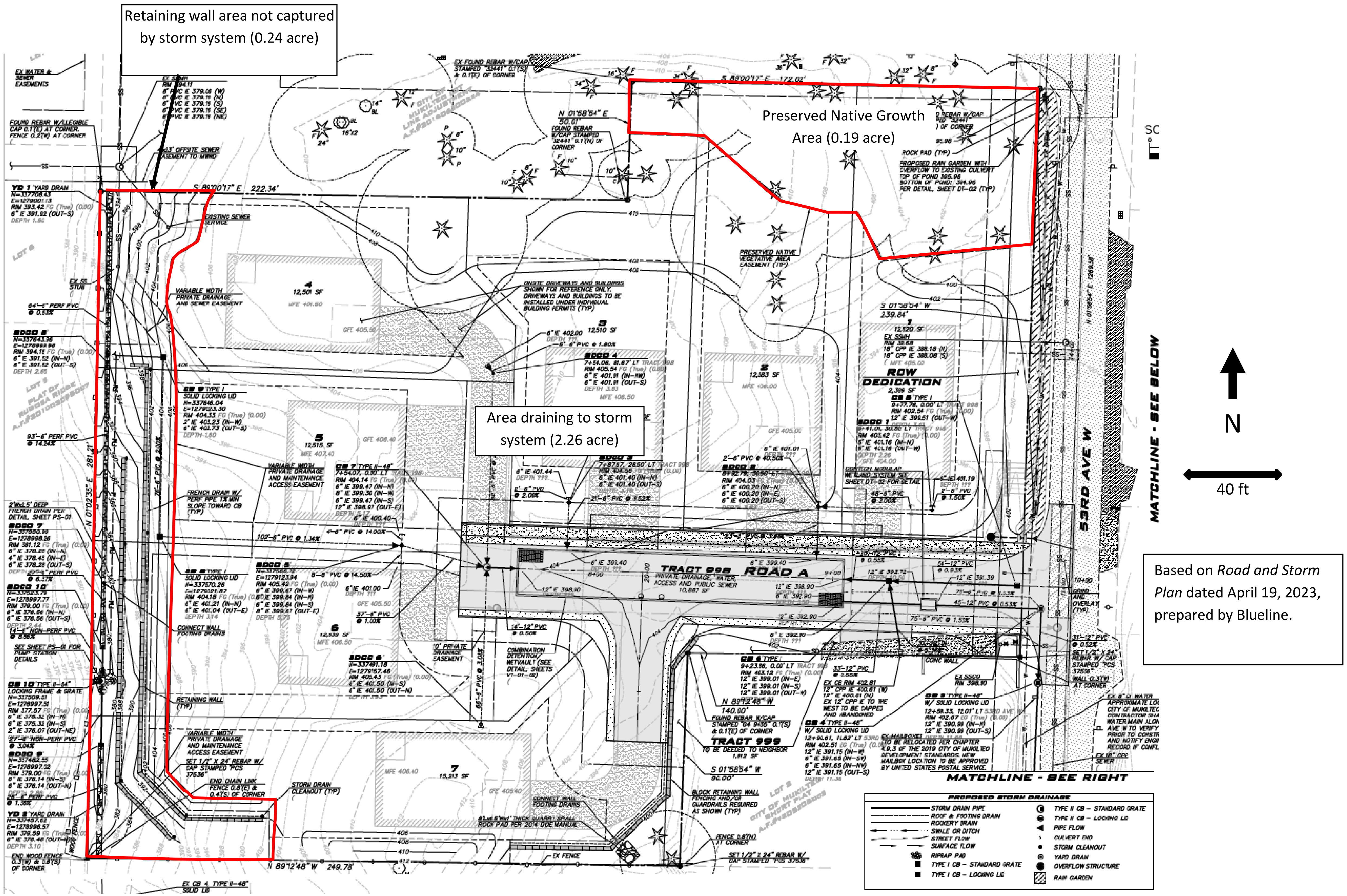

Figure 2: Site Plan Showing Grading and Stormwater Plan

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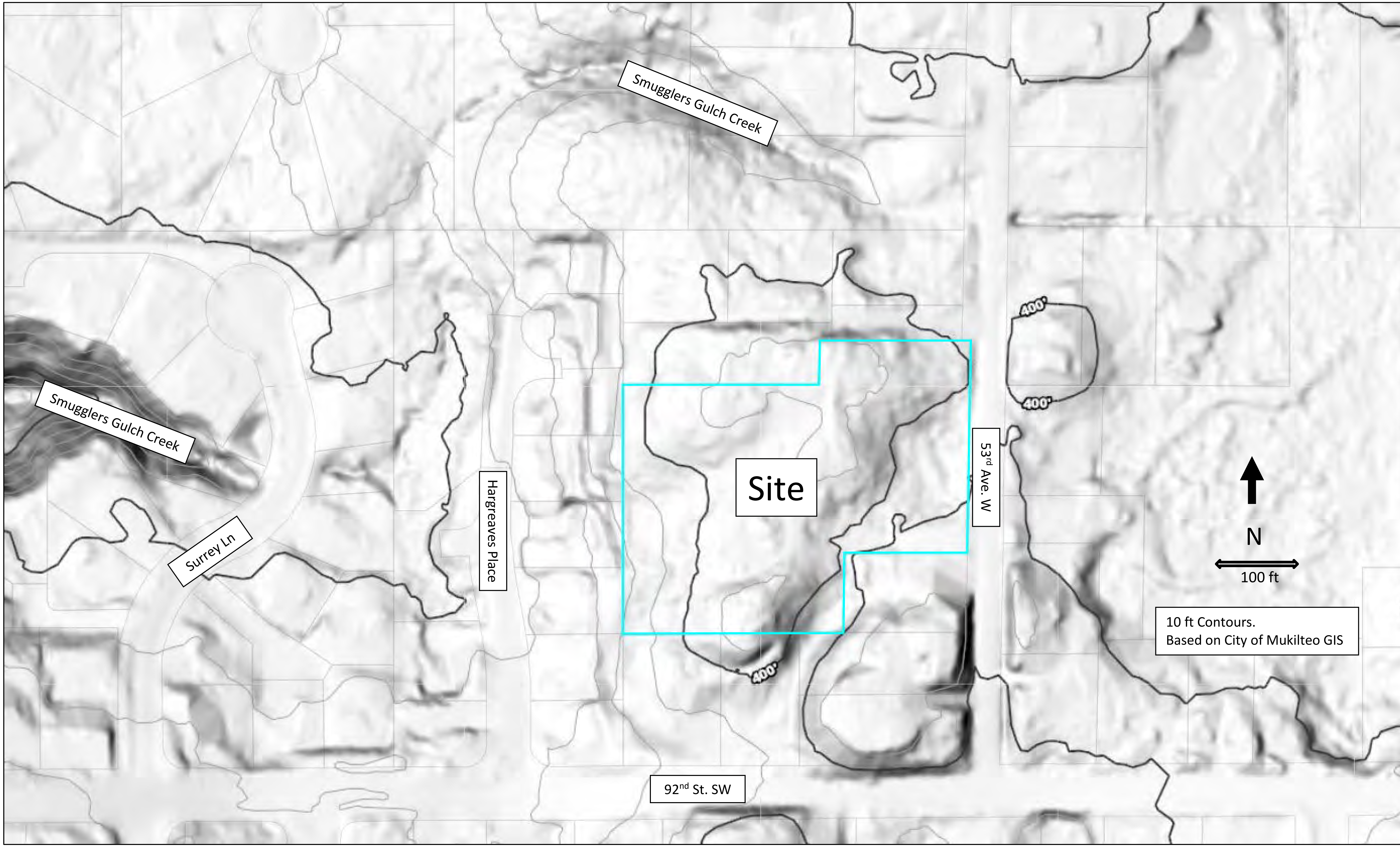

Figure 3: Regional Topography

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Attachment A: WWHM Hydrologic Modeling of West Basin

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Harbor Grove West Basin
Site Name:	Harbor Grove
Site Address:	9018 53rd Ave W
City:	Mukilteo
Report Date:	3/10/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.800
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Steep	1.24
Pervious Total	1.24
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.24

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

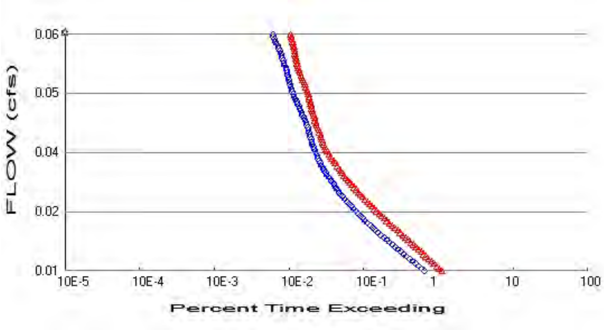
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Steep	1.24
Pervious Total	1.24
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.24

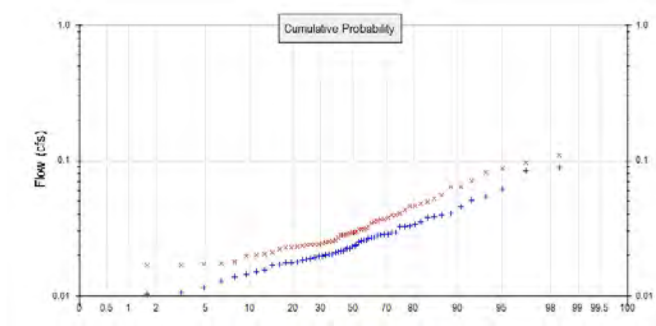
Element Flows To:

Surface	Interflow	Groundwater

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.24
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.24
Total Impervious Area: 0

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.024468
5 year	0.036908
10 year	0.045117
25 year	0.055318
50 year	0.062752
100 year	0.070031

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.031193
5 year	0.047551
10 year	0.059554
25 year	0.075981
50 year	0.089104
100 year	0.102971

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.010	0.020
1950	0.032	0.036
1951	0.021	0.028
1952	0.020	0.024
1953	0.017	0.020
1954	0.045	0.088
1955	0.040	0.046
1956	0.033	0.038
1957	0.038	0.043
1958	0.029	0.036

1959	0.028	0.034
1960	0.026	0.031
1961	0.026	0.031
1962	0.019	0.024
1963	0.026	0.037
1964	0.025	0.031
1965	0.021	0.027
1966	0.013	0.017
1967	0.035	0.039
1968	0.039	0.046
1969	0.018	0.070
1970	0.018	0.023
1971	0.028	0.037
1972	0.028	0.033
1973	0.017	0.023
1974	0.028	0.050
1975	0.018	0.023
1976	0.020	0.022
1977	0.011	0.018
1978	0.019	0.025
1979	0.033	0.052
1980	0.024	0.029
1981	0.020	0.024
1982	0.027	0.030
1983	0.027	0.048
1984	0.022	0.028
1985	0.034	0.040
1986	0.083	0.097
1987	0.029	0.039
1988	0.020	0.024
1989	0.018	0.023
1990	0.023	0.028
1991	0.025	0.029
1992	0.020	0.025
1993	0.014	0.017
1994	0.010	0.017
1995	0.023	0.029
1996	0.054	0.064
1997	0.089	0.110
1998	0.014	0.021
1999	0.022	0.026
2000	0.015	0.017
2001	0.003	0.006
2002	0.022	0.028
2003	0.015	0.020
2004	0.021	0.032
2005	0.021	0.025
2006	0.051	0.064
2007	0.040	0.055
2008	0.061	0.081
2009	0.019	0.024

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0892	0.1101
2	0.0832	0.0965
3	0.0611	0.0879

4	0.0536	0.0814
5	0.0509	0.0703
6	0.0454	0.0644
7	0.0405	0.0639
8	0.0398	0.0555
9	0.0386	0.0521
10	0.0376	0.0497
11	0.0351	0.0479
12	0.0336	0.0464
13	0.0329	0.0462
14	0.0326	0.0430
15	0.0324	0.0404
16	0.0294	0.0395
17	0.0291	0.0394
18	0.0285	0.0379
19	0.0284	0.0369
20	0.0283	0.0367
21	0.0282	0.0360
22	0.0271	0.0355
23	0.0269	0.0342
24	0.0264	0.0326
25	0.0259	0.0316
26	0.0257	0.0309
27	0.0253	0.0308
28	0.0250	0.0308
29	0.0237	0.0295
30	0.0234	0.0294
31	0.0230	0.0292
32	0.0223	0.0289
33	0.0223	0.0284
34	0.0220	0.0283
35	0.0215	0.0281
36	0.0214	0.0280
37	0.0212	0.0270
38	0.0207	0.0259
39	0.0204	0.0253
40	0.0202	0.0249
41	0.0200	0.0247
42	0.0198	0.0244
43	0.0197	0.0242
44	0.0192	0.0242
45	0.0190	0.0239
46	0.0187	0.0236
47	0.0183	0.0233
48	0.0178	0.0231
49	0.0177	0.0228
50	0.0175	0.0228
51	0.0170	0.0222
52	0.0169	0.0210
53	0.0154	0.0202
54	0.0150	0.0201
55	0.0144	0.0196
56	0.0139	0.0179
57	0.0129	0.0173
58	0.0115	0.0172
59	0.0105	0.0168
60	0.0103	0.0168
61	0.0033	0.0059

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0122	13881	23891	172	Fail
0.0127	12690	21966	173	Fail
0.0133	11586	20146	173	Fail
0.0138	10587	18572	175	Fail
0.0143	9625	17182	178	Fail
0.0148	8787	15862	180	Fail
0.0153	8029	14649	182	Fail
0.0158	7360	13560	184	Fail
0.0163	6731	12545	186	Fail
0.0168	6171	11559	187	Fail
0.0173	5668	10675	188	Fail
0.0178	5191	9862	189	Fail
0.0184	4763	9095	190	Fail
0.0189	4365	8376	191	Fail
0.0194	3991	7747	194	Fail
0.0199	3640	7146	196	Fail
0.0204	3315	6583	198	Fail
0.0209	3050	6072	199	Fail
0.0214	2821	5591	198	Fail
0.0219	2633	5144	195	Fail
0.0224	2413	4735	196	Fail
0.0229	2224	4363	196	Fail
0.0235	2079	4013	193	Fail
0.0240	1942	3717	191	Fail
0.0245	1825	3459	189	Fail
0.0250	1705	3191	187	Fail
0.0255	1581	2969	187	Fail
0.0260	1478	2766	187	Fail
0.0265	1372	2577	187	Fail
0.0270	1268	2391	188	Fail
0.0275	1191	2224	186	Fail
0.0281	1112	2072	186	Fail
0.0286	1038	1932	186	Fail
0.0291	985	1819	184	Fail
0.0296	944	1694	179	Fail
0.0301	901	1594	176	Fail
0.0306	860	1487	172	Fail
0.0311	816	1391	170	Fail
0.0316	773	1320	170	Fail
0.0321	741	1232	166	Fail
0.0326	695	1163	167	Fail
0.0332	663	1097	165	Fail
0.0337	632	1043	165	Fail
0.0342	608	999	164	Fail
0.0347	581	945	162	Fail
0.0352	560	892	159	Fail
0.0357	543	849	156	Fail
0.0362	525	798	152	Fail
0.0367	511	766	149	Fail
0.0372	497	732	147	Fail
0.0377	481	699	145	Fail
0.0383	464	670	144	Fail
0.0388	455	646	141	Fail
0.0393	443	624	140	Fail

0.0398	430	603	140	Fail
0.0403	420	590	140	Fail
0.0408	412	577	140	Fail
0.0413	401	564	140	Fail
0.0418	395	547	138	Fail
0.0423	387	535	138	Fail
0.0429	380	519	136	Fail
0.0434	371	502	135	Fail
0.0439	364	491	134	Fail
0.0444	350	479	136	Fail
0.0449	338	471	139	Fail
0.0454	325	460	141	Fail
0.0459	316	450	142	Fail
0.0464	305	442	144	Fail
0.0469	295	434	147	Fail
0.0474	289	427	147	Fail
0.0480	275	419	152	Fail
0.0485	269	411	152	Fail
0.0490	262	403	153	Fail
0.0495	249	398	159	Fail
0.0500	244	387	158	Fail
0.0505	237	379	159	Fail
0.0510	232	372	160	Fail
0.0515	224	358	159	Fail
0.0520	220	351	159	Fail
0.0525	217	341	157	Fail
0.0531	211	327	154	Fail
0.0536	208	320	153	Fail
0.0541	204	308	150	Fail
0.0546	202	297	147	Fail
0.0551	197	291	147	Fail
0.0556	194	285	146	Fail
0.0561	187	280	149	Fail
0.0566	183	277	151	Fail
0.0571	177	268	151	Fail
0.0576	173	265	153	Fail
0.0582	169	260	153	Fail
0.0587	167	256	153	Fail
0.0592	163	254	155	Fail
0.0597	155	250	161	Fail
0.0602	153	249	162	Fail
0.0607	145	243	167	Fail
0.0612	139	240	172	Fail
0.0617	136	235	172	Fail
0.0622	132	229	173	Fail
0.0628	131	225	171	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.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

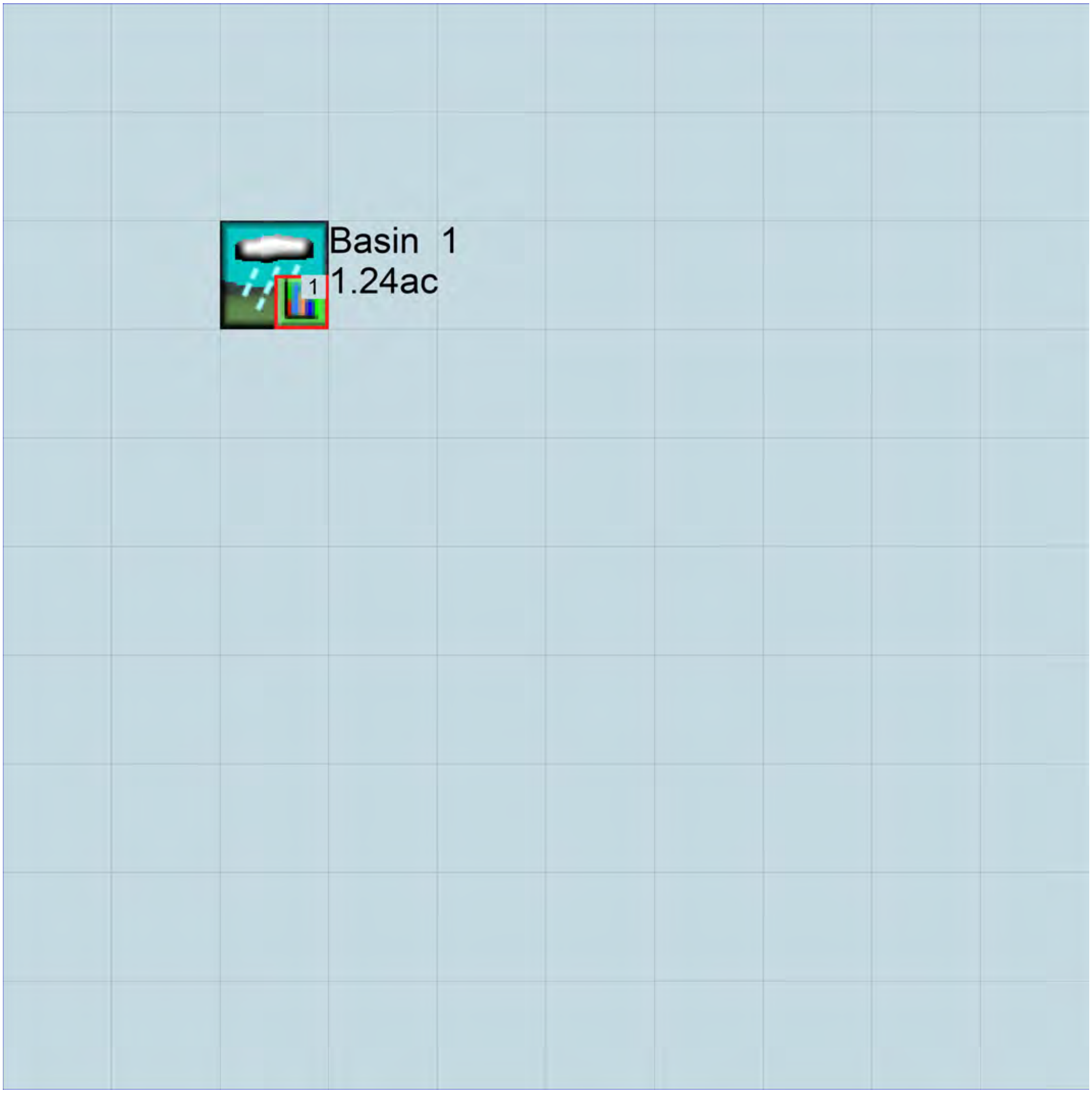
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

Disclaimer

Legal Notice

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Olympia, WA. 98501
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Local (360)943-0304

www.clearcreeksolutions.com

Attachment B: WWHM Hydrologic Modeling of Retaining Wall Area

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Harbor Grove Model Retaining Area
Site Name:	Harbor Grove
Site Address:	9018 53rd Ave W
City:	Mukilteo
Report Date:	3/10/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.800
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.24
Pervious Total	0.24
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.24

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

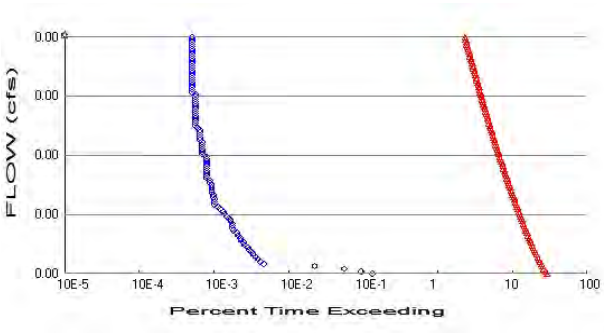
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.24
Pervious Total	0.24
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.24

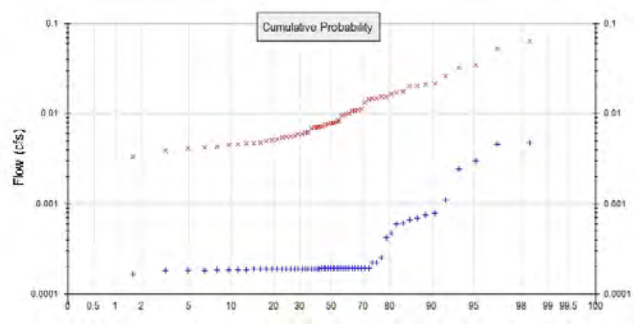
Element Flows To:

Surface	Interflow	Groundwater

Analysis Results

POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.24
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.24
Total Impervious Area: 0

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000248
5 year	0.000526
10 year	0.000831
25 year	0.001425
50 year	0.00208
100 year	0.002982

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.008595
5 year	0.015925
10 year	0.022587
25 year	0.033485
50 year	0.043692
100 year	0.05595

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.000	0.011
1950	0.000	0.013
1951	0.000	0.008
1952	0.000	0.008
1953	0.000	0.007
1954	0.001	0.034
1955	0.001	0.016
1956	0.000	0.008
1957	0.000	0.017
1958	0.000	0.021

1959	0.000	0.007
1960	0.000	0.007
1961	0.001	0.064
1962	0.000	0.008
1963	0.000	0.022
1964	0.001	0.011
1965	0.000	0.005
1966	0.000	0.003
1967	0.000	0.008
1968	0.000	0.009
1969	0.000	0.053
1970	0.000	0.006
1971	0.001	0.011
1972	0.000	0.016
1973	0.000	0.008
1974	0.000	0.018
1975	0.000	0.011
1976	0.000	0.006
1977	0.000	0.004
1978	0.000	0.005
1979	0.000	0.026
1980	0.000	0.010
1981	0.000	0.005
1982	0.000	0.007
1983	0.000	0.015
1984	0.000	0.006
1985	0.001	0.010
1986	0.002	0.020
1987	0.001	0.008
1988	0.000	0.005
1989	0.000	0.010
1990	0.000	0.006
1991	0.000	0.005
1992	0.000	0.007
1993	0.000	0.004
1994	0.000	0.005
1995	0.000	0.006
1996	0.003	0.015
1997	0.005	0.032
1998	0.000	0.004
1999	0.000	0.005
2000	0.000	0.006
2001	0.000	0.001
2002	0.000	0.006
2003	0.000	0.004
2004	0.000	0.007
2005	0.000	0.005
2006	0.005	0.020
2007	0.000	0.015
2008	0.000	0.015
2009	0.000	0.005

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0048	0.0643
2	0.0046	0.0534
3	0.0030	0.0344

4	0.0024	0.0324
5	0.0011	0.0264
6	0.0008	0.0218
7	0.0008	0.0214
8	0.0007	0.0205
9	0.0007	0.0203
10	0.0006	0.0177
11	0.0006	0.0171
12	0.0005	0.0164
13	0.0004	0.0155
14	0.0003	0.0154
15	0.0002	0.0147
16	0.0002	0.0147
17	0.0002	0.0146
18	0.0002	0.0133
19	0.0002	0.0112
20	0.0002	0.0109
21	0.0002	0.0108
22	0.0002	0.0108
23	0.0002	0.0101
24	0.0002	0.0099
25	0.0002	0.0096
26	0.0002	0.0094
27	0.0002	0.0083
28	0.0002	0.0082
29	0.0002	0.0080
30	0.0002	0.0078
31	0.0002	0.0077
32	0.0002	0.0077
33	0.0002	0.0077
34	0.0002	0.0073
35	0.0002	0.0073
36	0.0002	0.0072
37	0.0002	0.0070
38	0.0002	0.0070
39	0.0002	0.0069
40	0.0002	0.0062
41	0.0002	0.0062
42	0.0002	0.0060
43	0.0002	0.0059
44	0.0002	0.0057
45	0.0002	0.0055
46	0.0002	0.0055
47	0.0002	0.0054
48	0.0002	0.0052
49	0.0002	0.0052
50	0.0002	0.0050
51	0.0002	0.0048
52	0.0002	0.0047
53	0.0002	0.0047
54	0.0002	0.0046
55	0.0002	0.0045
56	0.0002	0.0043
57	0.0002	0.0042
58	0.0002	0.0041
59	0.0002	0.0039
60	0.0002	0.0033
61	0.0002	0.0015

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0001	2868	626906	21858	Fail
0.0001	2002	597603	29850	Fail
0.0002	1202	570225	47439	Fail
0.0002	478	545628	114148	Fail
0.0002	100	523384	523384	Fail
0.0002	90	503920	559911	Fail
0.0002	83	484670	583939	Fail
0.0003	78	466918	598612	Fail
0.0003	72	450448	625622	Fail
0.0003	68	435690	640720	Fail
0.0003	64	420932	657706	Fail
0.0003	61	407243	667611	Fail
0.0004	55	394409	717107	Fail
0.0004	53	382432	721569	Fail
0.0004	49	370454	756028	Fail
0.0004	48	359118	748162	Fail
0.0004	45	348424	774275	Fail
0.0005	43	338585	787406	Fail
0.0005	39	328532	842389	Fail
0.0005	38	319121	839792	Fail
0.0005	38	309924	815589	Fail
0.0005	38	301582	793636	Fail
0.0006	36	293027	813963	Fail
0.0006	34	284899	837938	Fail
0.0006	32	276771	864909	Fail
0.0006	30	269713	899043	Fail
0.0006	29	262227	904231	Fail
0.0007	26	255168	981415	Fail
0.0007	24	248110	1033791	Fail
0.0007	22	241693	1098604	Fail
0.0007	22	235277	1069440	Fail
0.0007	22	229074	1041245	Fail
0.0008	21	222871	1061290	Fail
0.0008	21	217096	1033790	Fail
0.0008	20	211664	1058320	Fail
0.0008	20	206188	1030940	Fail
0.0008	20	200862	1004309	Fail
0.0009	20	195729	978645	Fail
0.0009	19	191023	1005384	Fail
0.0009	19	186168	979831	Fail
0.0009	17	181463	1067429	Fail
0.0009	17	176885	1040500	Fail
0.0010	17	172650	1015588	Fail
0.0010	17	168373	990429	Fail
0.0010	17	164159	965641	Fail
0.0010	17	160074	941611	Fail
0.0010	17	156352	919717	Fail
0.0011	17	152524	897200	Fail
0.0011	17	148823	875429	Fail
0.0011	17	145209	854170	Fail
0.0011	15	141872	945813	Fail
0.0011	15	138450	923000	Fail
0.0012	15	135156	901040	Fail
0.0012	15	131883	879220	Fail

0.0012	15	128868	859120	Fail
0.0012	15	125809	838726	Fail
0.0012	14	122857	877550	Fail
0.0013	14	119991	857078	Fail
0.0013	14	117382	838442	Fail
0.0013	14	114751	819650	Fail
0.0013	14	112141	801007	Fail
0.0013	13	109618	843215	Fail
0.0013	12	107372	894766	Fail
0.0014	12	105019	875158	Fail
0.0014	12	102730	856083	Fail
0.0014	12	100527	837725	Fail
0.0014	12	98367	819725	Fail
0.0014	12	96357	802975	Fail
0.0015	12	94303	785858	Fail
0.0015	12	92271	768925	Fail
0.0015	12	90346	752883	Fail
0.0015	12	88464	737200	Fail
0.0015	12	86603	721691	Fail
0.0016	12	84742	706183	Fail
0.0016	12	83010	691750	Fail
0.0016	12	81384	678200	Fail
0.0016	11	79695	724500	Fail
0.0016	11	78048	709527	Fail
0.0017	11	76444	694945	Fail
0.0017	11	75011	681918	Fail
0.0017	11	73513	668300	Fail
0.0017	11	71995	654500	Fail
0.0017	11	70519	641081	Fail
0.0018	11	69150	628636	Fail
0.0018	11	67760	616000	Fail
0.0018	11	66305	602772	Fail
0.0018	11	64936	590327	Fail
0.0018	11	63653	578663	Fail
0.0019	11	62327	566609	Fail
0.0019	11	61022	554745	Fail
0.0019	11	59739	543081	Fail
0.0019	11	58541	532190	Fail
0.0019	11	57322	521109	Fail
0.0020	11	56124	510218	Fail
0.0020	11	54926	499327	Fail
0.0020	11	53857	489609	Fail
0.0020	11	52745	479500	Fail
0.0020	11	51675	469772	Fail
0.0021	11	50649	460445	Fail
0.0021	11	49643	451300	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.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

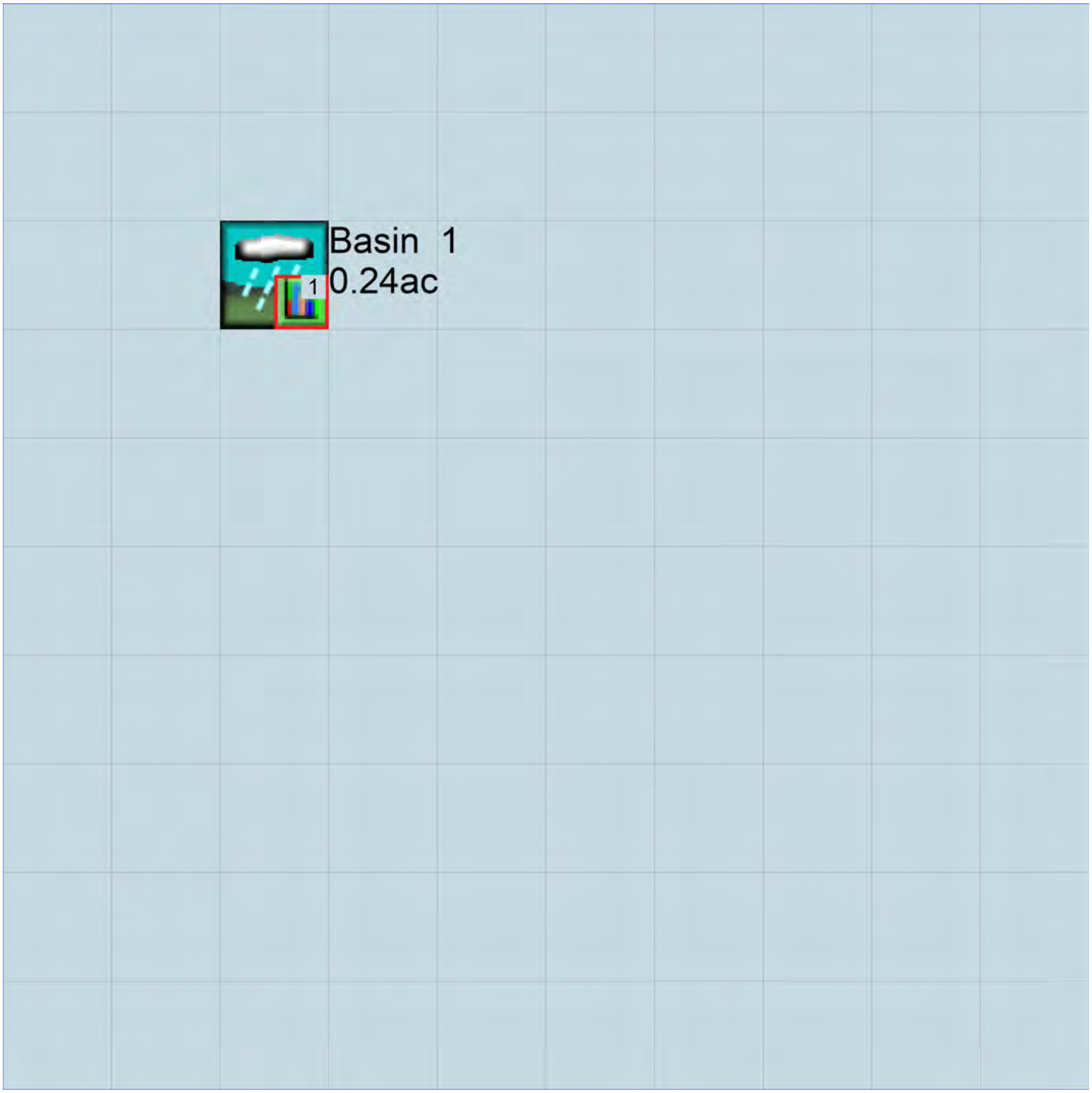
PERLND Changes

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   Harbor Grove Model Retaining Area.wdm
MESSU      25   PreHarbor Grove Model Retaining Area.MES
           27   PreHarbor Grove Model Retaining Area.L61
           28   PreHarbor Grove Model Retaining Area.L62
           30   POCHarbor Grove Model Retaining Area1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       7
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         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           ***
    7      A/B, 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 ***
    7         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  *********
    7         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 ***
    7         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
    7             0         5       0.8       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    7             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7            0.1       0.5      0.25         0       0.7      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
    7             0         0         0         0         3         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#   ***
Basin  1***
PERLND   7                        0.24     COPY   501     12
PERLND   7                        0.24     COPY   501     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



<-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    0.8            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.8            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
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   Harbor Grove Model Retaining Area.wdm
MESSU      25   MitHarbor Grove Model Retaining Area.MES
           27   MitHarbor Grove Model Retaining Area.L61
           28   MitHarbor Grove Model Retaining Area.L62
           30   POCHarbor Grove Model Retaining Area1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         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           ***
   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 ***
   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  *********
   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 ***
   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
   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
   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 ***
   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
   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           ***
  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#   ***
Basin  1***
PERLND  16                        0.24     COPY   501     12
PERLND  16                        0.24     COPY   501     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



<-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    0.8            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.8            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
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
```

Disclaimer

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