



MEMORANDUM

Date: June 22, 2022

BKF Job Number: 20160074

Deliver To: Serena Ip, Project Manager
MidPen Housing Corp.

From: Alejandro Cabrera, Project Engineer
BKF Engineers

Subject: Cypress Point Hydromodification Management (HM)

Existing Conditions

The existing site is approximately 11 acres in Moss Beach, California and bordered by Carlos Street to the west, Lincoln Street to the east, 16th Street to the North and Sierra Street to the south. The site is relatively undeveloped and consists of several concrete slab-on-grade building foundations, native vegetation, unpaved service roads and water and electrical infrastructure.

The existing site slopes range from 10% to 50% with the high point on the east side of the property and the low point at the northwest corner. There is no existing storm drain, sanitary sewer or known gas infrastructure on the property. Storm water runoff is assumed to percolate on site and excess runoff surface flows towards Carlos Street and 16th Street, ultimately discharging to Montara Creek within the James V. Fitzgerald Area of Specific Biological Significance (ASBS) watershed area.

Project Description

The project proposes to construct 71 units of affordable housing on roughly 5 acres of the site. New improvements will include town homes and flats, a community building, at-grade parking and access roads, an entry road connection to Carlos Street, an emergency vehicle access road connecting to Lincoln Street, a pedestrian pathways and new pervious landscaping.

Since the existing site does not currently connect directly to the public storm drain system, the project proposes a new connection to the existing storm drain main on Carlos Street, which ultimately outfalls to Montara Creek. Proposed storm drain infrastructure for the project will consist of storm drain lines approximately ranging from 12-inch to 21-inch diameter, inlets at low points throughout the hardscape and landscape areas, manholes at junction areas, building downspout connections, cleanouts and bio-retention infrastructure designed to comply with the development's dual C.3 requirements of stormwater treatment and Hydromodification Management (HM) requirements.

Hydromodification Management Requirement

As required by the Municipal Regional Permit (MRP) and the authority given to the Clean Water Program San Mateo, Projects creating one or more acres of impervious area in non-exempt regions of the County are required to attenuate runoff associated with the increase in runoff. This project is required to implement HM, see Attachment A: HM Applicability Worksheet and Attachment B: Hydromodification Applicability Map. The goal of the HM program is to control the post-project flow to match pre-project



runoff flow rate and duration from 10 percent of the pre-project 2-year peak flow up to the pre-project 10-year peak flow. The Bay Area Hydrology Model (BAHM) program is used to analyze the Project's flows as prescribed in the MRP. The project anticipates utilizing bio-retention areas as the main best management practice (BMP) treatment strategy for MRP and HM compliance. Stormwater attenuation will be achieved in the bio-retention areas by modifying the overflow riser structures and adding orifices to subdrain connections, thereby adding the storage and flow control necessary to meet HM.

HM Model

The project consists of one Point of Compliance (POC) for HM evaluation. The POC is consistent with the pre-project runoff drainage pattern where stormwater is directed to one discharge location at Montara Creek. The Pre-project tributary area land usage, including off-site run-on, is 10 acres pervious and 1 acres impervious. The post-project tributary area is broken into four watersheds: three draining toward the bioretention areas and another that bypasses the bioretention area and follows existing drainage patterns. Cumulatively the post-project land use will be 3.3 acres impervious and 7.7 acres pervious.

Preliminary modeling results, included as Attachment C, which are a direct output from the BAHM program show full compliance with the projects HM requirements. Peak flows are attenuated between the flow ranges of 0.42 to 10.08 cfs, 10% of the 2-yr up to the 10-yr storm.

HM Facilities

The size and number of orifices and riser heights were determined by the iterative BAHM modeling process to control the outflow of site runoff to match pre-construction rates. Design parameters for the risers and orifices (i.e. heights, orifice diameter, and number of orifices) were entered into the BAHM modeling program and the output was reviewed to confirm that the post-construction rate of runoff complied with pre-construction rates. This iterative process continued until the results were satisfactory.

HM occurs within the following treatment BMP facilities:

BMP #1

- 12-inch diameter riser 6-inches above the bioretention area flowline
- 3:1 Side slopes
- 18" Bioretention Soil Mix Layer above 12-inch Class 2 Permeable with 6-inch sub-drain
- 2.5-inch diameter chock down orifice on the 6-inch subdrain outfall terminus

BMP #2

- 12-inch diameter riser 12-inches above the bioretention area flowline
- 3:1 Side slopes
- 18" Bioretention Soil Mix Layer above 12-inch Class 2 Permeable with 6-inch sub-drain
- 2.25-inch diameter chock down orifice on the 6-inch subdrain outfall terminus



BMP #3

- 12-inch diameter riser 6-inches above the bioretention area flowline
- 3:1 Side slopes
- 18" Bioretention Soil Mix Layer above 12-inch Class 2 Permeable with 6-inch sub-drain
- No orifice on 6-inch subdrain



Hydromodification Management (HM) Applicability Worksheet

(To be completed by municipal staff, for projects that create and/or replace 43,560 sq. ft. or more of impervious surface. Definitions of terms in bold text are included on Page 2)

1. Date of Application: 06/21/22 Type of application: parcel/tentative/vesting/tract map
 site development review building permit
2. Project Location or Address: Carlos and Sierra Street, Moss Beach, CA
3. Project Name (if applicable): _____
4. Applicant's Name: MP Moss Beach Associates, LP
 Owner Contractor Engineer/Architect Builder/Developer
5. Applicant's Phone: (650)-356-2900 7a. Fax: _____ 7b. Email: sip@midpen-housing.org
6. Parcel/Tract No.: _____ 8a. Lot No.: _____ 8b. APN # 037-022-070
7. Total Lot (or Parcel/Tract) Area in Sq.Ft: 480,197
8. Total amount of Impervious Surface Created and/or Replaced (obtain from the completed Impervious Surface Form): 142,258 sq. ft. *If the amount is less than 1 acre (43,560 sq. ft.), HM requirements do not apply, and this form is not needed.*
9. Is the project located in an area subject to the hydromodification management (HM) standard? See HM Control Areas map at www.flowstobay.org/bs_new_development.php.

Check one:

- Yes. *Skip to Question 11.*
- No. *Attach map, indicating project location. Skip to Question 12 and check 12a.*
- Further analysis required. *Continue to Question 10.*

10. If the following condition is met, the project is considered exempt from the HM standard.

Check if condition is met:

An engineer or qualified environmental professional has determined that runoff from the project flows only through a hardened channel or enclosed pipe along its entire length before emptying into a waterway in the exempt area. *(Attach signed statement by qualified professional. Skip to Question 12 and check 12a.)*

11. Does the project replace existing impervious surface (such as a building, parking lot, roadway, etc.) and is the total impervious area NOT increased from the pre-project condition?
 Yes. *The project is NOT required to incorporate HM measures. Go to Question 12 and check 12a.*
 No. *The project IS required to incorporate HM measures. Go Question 12, and check 12b.*

Summary of Requirements

12. Is the project... **Yes (check one):**
- 12a. Exempt from HM requirements?
- 12b. Subject to HM requirements? *Project is subject to requirements in Provision C.3.g and Attachment E of the Municipal Regional Stormwater Permit, available for download at: www.flowstobay.org/ms_municipalities.php.*

Glossary of Terms

for the Hydromodification Management (HM) Applicability Worksheet

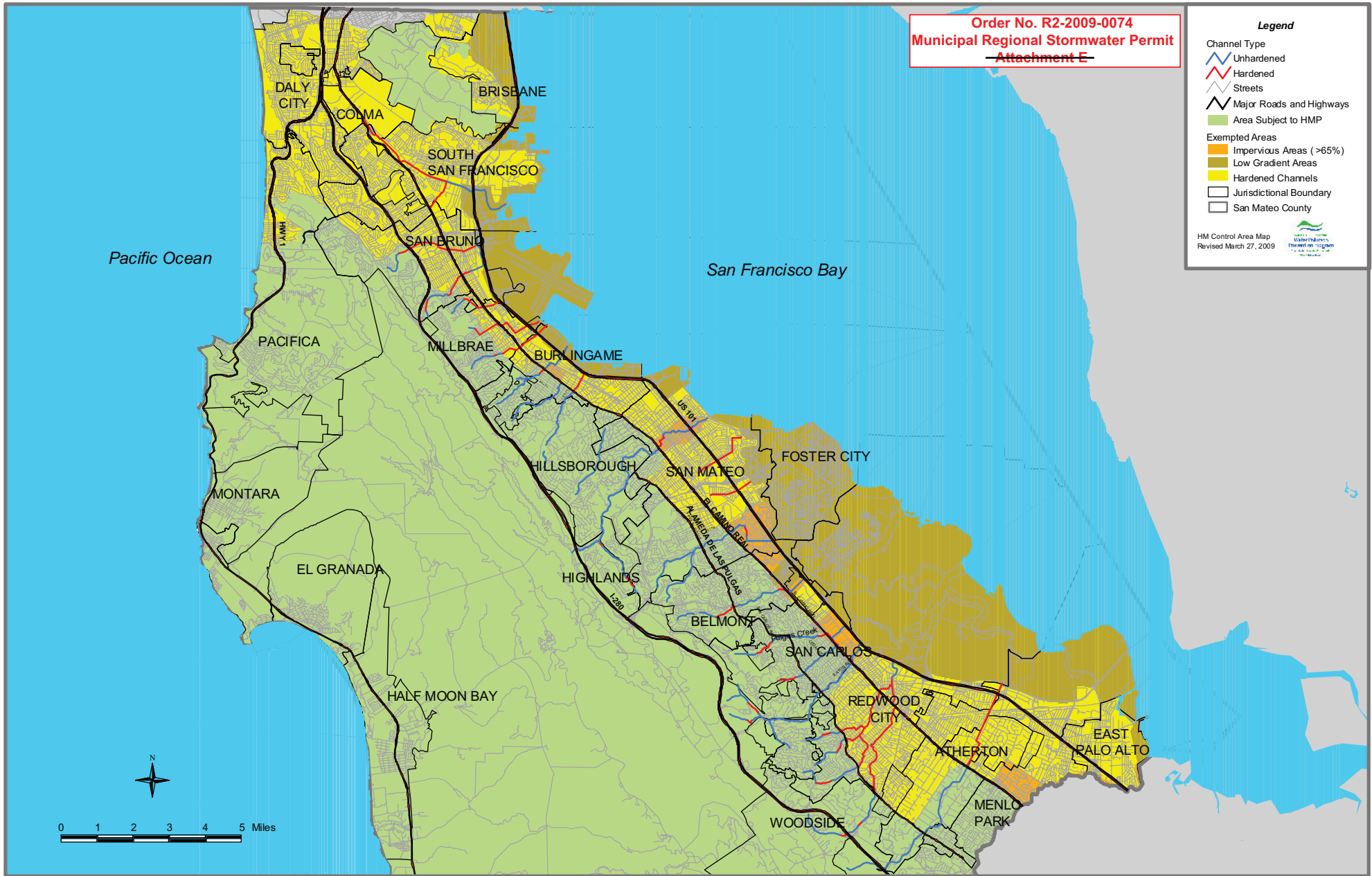
Hydromodification - The modification of a stream's hydrograph, caused in general by increases in flows and durations that result when land is developed (e.g., made more impervious). The effects of hydromodification include, but are not limited to, increased bed and bank erosion, loss of habitat, increased sediment transport and deposition, and increased flooding.

Hydromodification management control area - The areas of HM applicability in San Mateo County as shown in the HM map included in the Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit ("Municipal Regional Permit" or "MRP"). The map may be downloaded at www.flowstobay.org/bs_new_development.php.

Impervious surface - A surface covering or pavement of a developed parcel of land that prevents the land's natural ability to absorb and infiltrate rainfall/stormwater. Impervious surfaces include, but are not limited to, roof tops; walkways; patios; driveways; parking lots; storage areas; impervious concrete and asphalt; and any other continuous watertight pavement or covering. Landscaped soil and pervious pavement, including pavers with pervious openings and seams, underlain with pervious soil or pervious storage material, such as a gravel layer sufficient to hold at least the MRP Provision C.3.d volume of rainfall runoff are not impervious surfaces. Open, uncovered retention/detention facilities shall not be considered as impervious surfaces for purposes of determining whether a project is a Regulated Project under MRP Provisions C.3.b. and C.3.g. Open, uncovered retention/detention facilities shall be considered impervious surfaces for purposes of runoff modeling and meeting the Hydromodification Standard.

Municipal Regional Stormwater NPDES Permit - The San Francisco Bay Regional Water Quality Control Board's Order R2-2009-0074 issuing Waste Discharge Requirements and National Pollutant Discharge Elimination System (NPDES) Permit No. CAS612008, for the discharge of stormwater runoff from the municipal separate storm sewer systems (MS4s) of more than 70 municipalities in the San Francisco Bay Area, including the 21 municipalities within San Mateo County. The MRP may be downloaded at www.flowstobay.org/ms_municipalities.php.

ATTACHMENT B: HYDROMODIFICATION APPLICABILITY MAP



ATTACHMENT C

BAHM2013
PROJECT REPORT

**BAHM2013
PROJECT REPORT**

Project Name: Cypress_Point
Site Name: Cypress Point
Site Address:
City :
Report Date: 6/17/2022
Gage : San Francisco
Data Start : 1959/10/01
Data End : 1997/09/30
Precip Scale: 1.96
Version Date: 2021/05/25

Low Flow Threshold for POC 1 : 10 Percent of the 2 Year

High Flow Threshold for POC 1: 10 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C D,Grass,Mod(5-10%)	10
Pervious Total	10
<u>Impervious Land Use</u>	<u>acre</u>
Roads,Flat(0-5%)	1.02
Impervious Total	1.02
Basin Total	11.02

Element Flows To:

Surface	Interflow	Groundwater
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MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C D,Grass,Mod(5-10%)	1.05
Pervious Total	1.05
<u>Impervious Land Use</u>	<u>acre</u>
Roads,Flat(0-5%)	1.47
Impervious Total	1.47
Basin Total	2.52

Element Flows To:		
Surface	Interflow	Groundwater
Surface retention 1	Surface retention 1	

Name : Basin 2
 Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C D,Grass,Mod(5-10%)	.78
Pervious Total	0.78
<u>Impervious Land Use</u>	<u>acre</u>
Roads,Flat(0-5%)	1.68
Impervious Total	1.68
Basin Total	2.46

Element Flows To:		
Surface	Interflow	Groundwater
Surface retention 2	Surface retention 2	

Name : Basin 3
 Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C D,Grass,Mod(5-10%)	.07
Pervious Total	0.07

<u>Impervious Land Use</u>	<u>acre</u>
Roads,Flat(0-5%)	0.11
Impervious Total	0.11
Basin Total	0.18

Element Flows To:		
Surface	Interflow	Groundwater
Surface retention 3	Surface retention 3	

Name : Basin 4
 Bypass: Yes

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C D,Grass,Mod(5-10%)	5.51
Pervious Total	5.51

<u>Impervious Land Use</u>	<u>acre</u>
Roads,Flat(0-5%)	0.27
Impervious Total	0.27
Basin Total	5.78

Element Flows To:		
Surface	Interflow	Groundwater

Name : Bioretention 1
 Bottom Length: 107.50 ft.
 Bottom Width: 20.00 ft.
 Material thickness of first layer: 1.5
 Material type for first layer: BAHM 5
 Material thickness of second layer: 1
 Material type for second layer: GRAVEL
 Material thickness of third layer: 0
 Material type for third layer: GRAVEL
Underdrain used
 Underdrain Diameter (feet): 0.5
 Orifice Diameter (in.): 2.5
 Offset (in.): 0
 Flow Through Underdrain (ac-ft.): 129.134
 Total Outflow (ac-ft.): 147.681

Percent Through Underdrain: 87.44

Discharge Structure

Riser Height: 0.5 ft.

Riser Diameter: 12 in.

Element Flows To:

Outlet 1

Outlet 2

Bioretention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0984	0.0000	0.0000	0.0000
0.0385	0.0984	0.0007	0.0000	0.0000
0.0769	0.0976	0.0015	0.0000	0.0000
0.1154	0.0968	0.0022	0.0000	0.0000
0.1538	0.0959	0.0030	0.0000	0.0000
0.1923	0.0951	0.0037	0.0000	0.0000
0.2308	0.0943	0.0045	0.0000	0.0000
0.2692	0.0935	0.0053	0.0000	0.0000
0.3077	0.0926	0.0061	0.0000	0.0000
0.3462	0.0918	0.0069	0.0000	0.0000
0.3846	0.0910	0.0077	0.0000	0.0000
0.4231	0.0902	0.0085	0.0112	0.0000
0.4615	0.0894	0.0094	0.0131	0.0000
0.5000	0.0886	0.0102	0.0153	0.0000
0.5385	0.0878	0.0111	0.0179	0.0000
0.5769	0.0870	0.0120	0.0208	0.0000
0.6154	0.0862	0.0128	0.0240	0.0000
0.6538	0.0854	0.0137	0.0276	0.0000
0.6923	0.0846	0.0146	0.0311	0.0000
0.7308	0.0838	0.0155	0.0359	0.0000
0.7692	0.0830	0.0164	0.0383	0.0000
0.8077	0.0822	0.0174	0.0394	0.0000
0.8462	0.0814	0.0183	0.0462	0.0000
0.8846	0.0807	0.0193	0.0514	0.0000
0.9231	0.0799	0.0202	0.0520	0.0000
0.9615	0.0791	0.0212	0.0573	0.0000
1.0000	0.0783	0.0222	0.0620	0.0000
1.0385	0.0776	0.0232	0.0665	0.0000
1.0769	0.0768	0.0242	0.0706	0.0000
1.1154	0.0760	0.0252	0.0744	0.0000
1.1538	0.0753	0.0262	0.0745	0.0000
1.1923	0.0745	0.0273	0.0782	0.0000
1.2308	0.0737	0.0283	0.0817	0.0000
1.2692	0.0730	0.0294	0.0851	0.0000
1.3077	0.0722	0.0305	0.0884	0.0000
1.3462	0.0715	0.0316	0.0915	0.0000
1.3846	0.0707	0.0326	0.0945	0.0000
1.4231	0.0700	0.0338	0.0974	0.0000
1.4615	0.0692	0.0349	0.1003	0.0000
1.5000	0.0685	0.0361	0.1031	0.0000
1.5385	0.0677	0.0373	0.1057	0.0000
1.5769	0.0670	0.0386	0.1084	0.0000
1.6154	0.0663	0.0399	0.1109	0.0000

1.6538	0.0655	0.0411	0.1134	0.0000
1.6923	0.0648	0.0424	0.1159	0.0000
1.7308	0.0641	0.0437	0.1183	0.0000
1.7692	0.0634	0.0451	0.1206	0.0000
1.8077	0.0626	0.0464	0.1229	0.0000
1.8462	0.0619	0.0477	0.1252	0.0000
1.8846	0.0612	0.0491	0.1274	0.0000
1.9231	0.0605	0.0505	0.1296	0.0000
1.9615	0.0598	0.0519	0.1317	0.0000
2.0000	0.0591	0.0532	0.1338	0.0000
2.0385	0.0583	0.0547	0.1359	0.0000
2.0769	0.0576	0.0561	0.1380	0.0000
2.1154	0.0569	0.0575	0.1400	0.0000
2.1538	0.0562	0.0590	0.1420	0.0000
2.1923	0.0555	0.0604	0.1439	0.0000
2.2308	0.0548	0.0619	0.1459	0.0000
2.2692	0.0541	0.0634	0.1478	0.0000
2.3077	0.0535	0.0649	0.1516	0.0000
2.3462	0.0528	0.0664	0.1552	0.0000
2.3846	0.0521	0.0679	0.1589	0.0000
2.4231	0.0514	0.0694	0.1624	0.0000
2.4615	0.0507	0.0710	0.1660	0.0000
2.5000	0.0500	0.0726	0.1712	0.0000
2.5000	0.0494	0.0726	0.1712	0.0000

Surface retention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
2.5000	0.0984	0.0726	0.0000	0.2488	0.0000
2.5385	0.0993	0.0764	0.0000	0.2488	0.0000
2.5769	0.1001	0.0802	0.0000	0.2616	0.0000
2.6154	0.1009	0.0841	0.0000	0.2680	0.0000
2.6538	0.1018	0.0880	0.0000	0.2744	0.0000
2.6923	0.1026	0.0919	0.0000	0.2807	0.0000
2.7308	0.1035	0.0959	0.0000	0.2871	0.0000
2.7692	0.1043	0.0999	0.0000	0.2935	0.0000
2.8077	0.1052	0.1039	0.0000	0.2999	0.0000
2.8462	0.1060	0.1079	0.0000	0.3063	0.0000
2.8846	0.1069	0.1120	0.0000	0.3126	0.0000
2.9231	0.1078	0.1162	0.0000	0.3190	0.0000
2.9615	0.1086	0.1203	0.0000	0.3254	0.0000
3.0000	0.1095	0.1245	0.0000	0.3318	0.0000
3.0385	0.1103	0.1287	0.0800	0.3382	0.0000
3.0769	0.1112	0.1330	0.2257	0.3446	0.0000
3.1154	0.1121	0.1373	0.4122	0.3509	0.0000
3.1538	0.1130	0.1416	0.6273	0.3573	0.0000
3.1923	0.1138	0.1460	0.8600	0.3637	0.0000
3.2308	0.1147	0.1504	1.0991	0.3701	0.0000
3.2692	0.1156	0.1548	1.3333	0.3765	0.0000
3.3077	0.1165	0.1593	1.5516	0.3828	0.0000
3.3462	0.1174	0.1638	1.7445	0.3892	0.0000
3.3846	0.1183	0.1683	1.9054	0.3956	0.0000
3.4231	0.1192	0.1729	2.0318	0.4020	0.0000
3.4615	0.1201	0.1775	2.1274	0.4084	0.0000
3.5000	0.1209	0.1821	2.2033	0.4147	0.0000

Name : Surface retention 1

Element Flows To:
 Outlet 1 Outlet 2
 Bioretention 1

Name : Bioretention 2
 Bottom Length: 97.50 ft.
 Bottom Width: 20.00 ft.
 Material thickness of first layer: 1.5
 Material type for first layer: BAHM 5
 Material thickness of second layer: 1
 Material type for second layer: GRAVEL
 Material thickness of third layer: 0
 Material type for third layer: GRAVEL
Underdrain used
 Underdrain Diameter (feet): 0.5
 Orifice Diameter (in.): 2.25
 Offset (in.): 0
 Flow Through Underdrain (ac-ft.): 134.329
 Total Outflow (ac-ft.): 147.55
 Percent Through Underdrain: 91.04
Discharge Structure
 Riser Height: 1 ft.
 Riser Diameter: 12 in.

Element Flows To:
 Outlet 1 Outlet 2

Bioretention 2 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0904	0.0000	0.0000	0.0000
0.0440	0.0896	0.0008	0.0000	0.0000
0.0879	0.0887	0.0015	0.0000	0.0000
0.1319	0.0878	0.0023	0.0000	0.0000
0.1758	0.0870	0.0031	0.0000	0.0000
0.2198	0.0861	0.0039	0.0000	0.0000
0.2637	0.0852	0.0047	0.0000	0.0000
0.3077	0.0843	0.0055	0.0000	0.0000
0.3516	0.0835	0.0064	0.0000	0.0000
0.3956	0.0826	0.0072	0.0000	0.0000
0.4396	0.0817	0.0081	0.0104	0.0000
0.4835	0.0809	0.0090	0.0124	0.0000
0.5275	0.0800	0.0098	0.0149	0.0000
0.5714	0.0792	0.0107	0.0177	0.0000
0.6154	0.0783	0.0117	0.0209	0.0000
0.6593	0.0775	0.0126	0.0246	0.0000
0.7033	0.0766	0.0135	0.0286	0.0000
0.7473	0.0758	0.0145	0.0292	0.0000
0.7912	0.0749	0.0154	0.0359	0.0000
0.8352	0.0741	0.0164	0.0409	0.0000
0.8791	0.0733	0.0174	0.0415	0.0000

0.9231	0.0724	0.0184	0.0464	0.0000
0.9670	0.0716	0.0194	0.0508	0.0000
1.0110	0.0708	0.0204	0.0548	0.0000
1.0549	0.0700	0.0215	0.0586	0.0000
1.0989	0.0692	0.0225	0.0621	0.0000
1.1429	0.0684	0.0236	0.0654	0.0000
1.1868	0.0675	0.0247	0.0686	0.0000
1.2308	0.0667	0.0258	0.0716	0.0000
1.2747	0.0659	0.0269	0.0745	0.0000
1.3187	0.0651	0.0280	0.0772	0.0000
1.3626	0.0643	0.0292	0.0799	0.0000
1.4066	0.0635	0.0303	0.0825	0.0000
1.4505	0.0628	0.0315	0.0850	0.0000
1.4945	0.0620	0.0326	0.0875	0.0000
1.5385	0.0612	0.0339	0.0898	0.0000
1.5824	0.0604	0.0353	0.0922	0.0000
1.6264	0.0596	0.0366	0.0944	0.0000
1.6703	0.0589	0.0379	0.0966	0.0000
1.7143	0.0581	0.0393	0.0988	0.0000
1.7582	0.0573	0.0407	0.1009	0.0000
1.8022	0.0566	0.0421	0.1029	0.0000
1.8462	0.0558	0.0435	0.1050	0.0000
1.8901	0.0550	0.0449	0.1069	0.0000
1.9341	0.0543	0.0463	0.1089	0.0000
1.9780	0.0535	0.0478	0.1108	0.0000
2.0220	0.0528	0.0492	0.1127	0.0000
2.0659	0.0520	0.0507	0.1145	0.0000
2.1099	0.0513	0.0522	0.1164	0.0000
2.1538	0.0506	0.0537	0.1182	0.0000
2.1978	0.0498	0.0553	0.1199	0.0000
2.2418	0.0491	0.0568	0.1217	0.0000
2.2857	0.0484	0.0584	0.1234	0.0000
2.3297	0.0476	0.0599	0.1251	0.0000
2.3736	0.0469	0.0615	0.1281	0.0000
2.4176	0.0462	0.0632	0.1314	0.0000
2.4615	0.0455	0.0648	0.1347	0.0000
2.5000	0.0448	0.0662	0.1387	0.0000

Surface retention 2 Hydraulic Table

<u>Stage(feet)</u>	<u>Area(ac.)</u>	<u>Volume(ac-ft.)</u>	<u>Discharge(cfs)</u>	<u>To Amended(cfs)</u>	<u>Wetted Surface</u>
2.5000	0.0904	0.0662	0.0000	0.2257	0.0000
2.5440	0.0913	0.0702	0.0000	0.2257	0.0000
2.5879	0.0922	0.0742	0.0000	0.2389	0.0000
2.6319	0.0931	0.0783	0.0000	0.2455	0.0000
2.6758	0.0940	0.0824	0.0000	0.2521	0.0000
2.7198	0.0949	0.0866	0.0000	0.2588	0.0000
2.7637	0.0958	0.0908	0.0000	0.2654	0.0000
2.8077	0.0967	0.0950	0.0000	0.2720	0.0000
2.8516	0.0976	0.0993	0.0000	0.2786	0.0000
2.8956	0.0986	0.1036	0.0000	0.2852	0.0000
2.9396	0.0995	0.1079	0.0000	0.2918	0.0000
2.9835	0.1004	0.1123	0.0000	0.2984	0.0000
3.0275	0.1013	0.1168	0.0000	0.3051	0.0000
3.0714	0.1023	0.1212	0.0000	0.3117	0.0000
3.1154	0.1032	0.1258	0.0000	0.3183	0.0000
3.1593	0.1041	0.1303	0.0000	0.3249	0.0000
3.2033	0.1051	0.1349	0.0000	0.3315	0.0000

3.2473	0.1060	0.1395	0.0000	0.3381	0.0000
3.2912	0.1070	0.1442	0.0000	0.3447	0.0000
3.3352	0.1079	0.1490	0.0000	0.3514	0.0000
3.3791	0.1089	0.1537	0.0000	0.3580	0.0000
3.4231	0.1099	0.1585	0.0000	0.3646	0.0000
3.4670	0.1108	0.1634	0.0000	0.3712	0.0000
3.5110	0.1118	0.1683	0.0122	0.3778	0.0000
3.5549	0.1127	0.1732	0.1365	0.3844	0.0000
3.5989	0.1137	0.1782	0.3281	0.3910	0.0000
3.6429	0.1147	0.1832	0.5635	0.3977	0.0000
3.6868	0.1157	0.1883	0.8261	0.4043	0.0000
3.7308	0.1166	0.1934	1.0991	0.4109	0.0000
3.7747	0.1176	0.1985	1.3657	0.4175	0.0000
3.8187	0.1186	0.2037	1.6096	0.4241	0.0000
3.8626	0.1196	0.2089	1.8176	0.4307	0.0000
3.9066	0.1206	0.2142	1.9818	0.4373	0.0000
3.9505	0.1216	0.2195	2.1028	0.4439	0.0000
3.9945	0.1226	0.2249	2.1930	0.4506	0.0000
4.0000	0.1227	0.2256	2.3112	0.4514	0.0000

Name : Surface retention 2

Element Flows To:

Outlet 1 Outlet 2
 Bioretention 2

Name : Bioretention 3

Bottom Length: 20.00 ft.

Bottom Width: 10.00 ft.

Material thickness of first layer: 1.5

Material type for first layer: BAHM 5

Material thickness of second layer: 1

Material type for second layer: GRAVEL

Material thickness of third layer: 0

Material type for third layer: GRAVEL

Underdrain used

Underdrain Diameter (feet): 0.5

Orifice Diameter (in.): 6

Offset (in.): 0

Flow Through Underdrain (ac-ft.): 8.735

Total Outflow (ac-ft.): 8.816

Percent Through Underdrain: 99.08

Discharge Structure

Riser Height: 0.5 ft.

Riser Diameter: 12 in.

Element Flows To:

Outlet 1 Outlet 2

Bioretention 3 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0201	0.0000	0.0000	0.0000
0.0385	0.0201	0.0001	0.0000	0.0000
0.0769	0.0198	0.0001	0.0000	0.0000
0.1154	0.0195	0.0002	0.0000	0.0000
0.1538	0.0191	0.0003	0.0000	0.0000
0.1923	0.0188	0.0004	0.0000	0.0000
0.2308	0.0185	0.0004	0.0000	0.0000
0.2692	0.0182	0.0005	0.0000	0.0000
0.3077	0.0179	0.0006	0.0000	0.0000
0.3462	0.0176	0.0007	0.0000	0.0000
0.3846	0.0173	0.0008	0.0000	0.0000
0.4231	0.0170	0.0009	0.0000	0.0000
0.4615	0.0167	0.0010	0.0000	0.0000
0.5000	0.0164	0.0011	0.0000	0.0000
0.5385	0.0162	0.0012	0.0000	0.0000
0.5769	0.0159	0.0013	0.0000	0.0000
0.6154	0.0156	0.0014	0.0000	0.0000
0.6538	0.0153	0.0015	0.0000	0.0000
0.6923	0.0150	0.0016	0.0000	0.0000
0.7308	0.0148	0.0017	0.0000	0.0000
0.7692	0.0145	0.0019	0.0000	0.0000
0.8077	0.0142	0.0020	0.0000	0.0000
0.8462	0.0140	0.0021	0.0000	0.0000
0.8846	0.0137	0.0022	0.0000	0.0000
0.9231	0.0134	0.0024	0.0000	0.0000
0.9615	0.0132	0.0025	0.0000	0.0000
1.0000	0.0129	0.0026	0.0000	0.0000
1.0385	0.0126	0.0028	0.0000	0.0000
1.0769	0.0124	0.0029	0.0000	0.0000
1.1154	0.0121	0.0031	0.0000	0.0000
1.1538	0.0119	0.0032	0.0000	0.0000
1.1923	0.0117	0.0034	0.0000	0.0000
1.2308	0.0114	0.0035	0.0000	0.0000
1.2692	0.0112	0.0037	0.0000	0.0000
1.3077	0.0109	0.0039	0.0000	0.0000
1.3462	0.0107	0.0040	0.0000	0.0000
1.3846	0.0105	0.0042	0.0000	0.0000
1.4231	0.0102	0.0044	0.0000	0.0000
1.4615	0.0100	0.0046	0.0000	0.0000
1.5000	0.0098	0.0048	0.0000	0.0000
1.5385	0.0096	0.0050	0.0000	0.0000
1.5769	0.0093	0.0052	0.0000	0.0000
1.6154	0.0091	0.0054	0.0000	0.0000
1.6538	0.0089	0.0056	0.0000	0.0000
1.6923	0.0087	0.0058	0.0000	0.0000
1.7308	0.0085	0.0060	0.0000	0.0000
1.7692	0.0083	0.0063	0.0000	0.0000
1.8077	0.0081	0.0065	0.0000	0.0000
1.8462	0.0078	0.0067	0.0000	0.0000
1.8846	0.0076	0.0070	0.0000	0.0000
1.9231	0.0074	0.0072	0.0000	0.0000
1.9615	0.0073	0.0075	0.0000	0.0000
2.0000	0.0071	0.0077	0.0000	0.0000
2.0385	0.0069	0.0080	0.0000	0.0000
2.0769	0.0067	0.0083	0.0000	0.0000
2.1154	0.0065	0.0085	0.0000	0.0000

2.1538	0.0063	0.0088	0.0000	0.0000
2.1923	0.0061	0.0091	0.0000	0.0000
2.2308	0.0059	0.0094	0.0000	0.0000
2.2692	0.0058	0.0097	0.0000	0.0000
2.3077	0.0056	0.0099	0.0000	0.0000
2.3462	0.0054	0.0102	0.0000	0.0000
2.3846	0.0052	0.0106	0.0000	0.0000
2.4231	0.0051	0.0109	0.0000	0.0000
2.4615	0.0049	0.0112	0.0000	0.0000
2.5000	0.0048	0.0115	0.0000	0.0000
2.5000	0.0046	0.0115	0.0000	0.0000

Surface retention 3 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
2.5000	0.0201	0.0115	0.0000	0.0231	0.0000
2.5385	0.0204	0.0123	0.0000	0.0231	0.0000
2.5769	0.0207	0.0131	0.0000	0.0243	0.0000
2.6154	0.0211	0.0139	0.0000	0.0249	0.0000
2.6538	0.0214	0.0147	0.0000	0.0255	0.0000
2.6923	0.0217	0.0155	0.0000	0.0261	0.0000
2.7308	0.0220	0.0163	0.0000	0.0267	0.0000
2.7692	0.0224	0.0172	0.0000	0.0273	0.0000
2.8077	0.0227	0.0181	0.0000	0.0279	0.0000
2.8462	0.0230	0.0189	0.0000	0.0285	0.0000
2.8846	0.0234	0.0198	0.0000	0.0291	0.0000
2.9231	0.0237	0.0207	0.0010	0.0297	0.0000
2.9615	0.0241	0.0217	0.0012	0.0303	0.0000
3.0000	0.0244	0.0226	0.0014	0.0309	0.0000
3.0385	0.0248	0.0235	0.0017	0.0315	0.0000
3.0769	0.0251	0.0245	0.0019	0.0321	0.0000
3.1154	0.0255	0.0255	0.0022	0.0326	0.0000
3.1538	0.0258	0.0265	0.0026	0.0332	0.0000
3.1923	0.0262	0.0275	0.0029	0.0338	0.0000
3.2308	0.0266	0.0285	0.0033	0.0344	0.0000
3.2692	0.0269	0.0295	0.0038	0.0350	0.0000
3.3077	0.0273	0.0306	0.0043	0.0356	0.0000
3.3462	0.0277	0.0316	0.0048	0.0362	0.0000
3.3846	0.0280	0.0327	0.0053	0.0368	0.0000
3.4231	0.0284	0.0338	0.0059	0.0374	0.0000
3.4615	0.0288	0.0349	0.0059	0.0380	0.0000
3.5000	0.0292	0.0360	0.0066	0.0386	0.0000

Name : Surface retention 3

Element Flows To:

Outlet 1 **Outlet 2**
 Bioretention 3

ANALYSIS RESULTS

Predeveloped Landuse Totals for POC #1
Total Pervious Area:10
Total Impervious Area:1.02

Mitigated Landuse Totals for POC #1
Total Pervious Area:7.41
Total Impervious Area:3.53

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	4.287961
5 year	7.963582
10 year	10.0864
25 year	13.294433

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	3.733322
5 year	7.284808
10 year	8.541908
25 year	12.084646

Annual Peaks for Predeveloped and Mitigated. POC #1

<u>Year</u>	<u>Predeveloped</u>	<u>Mitigated</u>
1960	3.638	2.469
1961	3.355	2.580
1962	6.200	4.720
1963	4.206	2.980
1964	3.800	3.646
1965	3.558	2.212
1966	3.262	2.913
1967	4.920	4.669
1968	6.697	5.214
1969	7.585	5.710
1970	10.084	9.925
1971	7.105	5.262
1972	2.761	1.650
1973	6.443	6.309
1974	3.740	3.285
1975	4.123	3.215
1976	0.318	0.375
1977	3.185	2.089
1978	3.337	2.284
1979	4.128	4.125
1980	4.168	3.351
1981	1.954	3.343
1982	7.388	7.228
1983	20.896	17.121
1984	4.919	4.757
1985	5.858	3.825
1986	10.308	8.427
1987	4.408	4.197
1988	9.750	7.544
1989	4.941	3.845

1990	4.335	3.595
1991	2.503	1.693
1992	10.121	8.401
1993	6.921	6.689
1994	4.243	2.767
1995	9.869	10.106
1996	2.506	1.753
1997	9.695	7.763

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	20.8955	17.1212
2	10.3083	10.1060
3	10.1212	9.9250
4	10.0835	8.4267
5	9.8695	8.4013
6	9.7502	7.7633
7	9.6950	7.5443
8	7.5848	7.2280
9	7.3884	6.6893
10	7.1050	6.3092
11	6.9210	5.7096
12	6.6968	5.2625
13	6.4430	5.2142
14	6.2000	4.7572
15	5.8576	4.7203
16	4.9409	4.6685
17	4.9196	4.1968
18	4.9190	4.1246
19	4.4083	3.8449
20	4.3353	3.8248
21	4.2430	3.6464
22	4.2058	3.5952
23	4.1680	3.3510
24	4.1281	3.3435
25	4.1231	3.2853
26	3.8002	3.2148
27	3.7402	2.9799
28	3.6382	2.9129
29	3.5581	2.7673
30	3.3550	2.5797
31	3.3367	2.4686
32	3.2620	2.2837
33	3.1850	2.2121
34	2.7609	2.0891
35	2.5058	1.7532
36	2.5028	1.6931
37	1.9543	1.6504
38	0.3184	0.3751

POC #1

The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.4288	2782	3016	108	Pass
0.5263	2384	2355	98	Pass
0.6239	2090	1897	90	Pass
0.7215	1852	1537	82	Pass
0.8190	1658	1250	75	Pass
0.9166	1462	1038	70	Pass
1.0141	1275	893	70	Pass
1.1117	1117	774	69	Pass
1.2092	986	668	67	Pass
1.3068	889	576	64	Pass
1.4043	804	505	62	Pass
1.5019	718	438	61	Pass
1.5994	656	395	60	Pass
1.6970	586	349	59	Pass
1.7945	533	315	59	Pass
1.8921	491	282	57	Pass
1.9896	441	256	58	Pass
2.0872	399	226	56	Pass
2.1847	351	204	58	Pass
2.2823	318	185	58	Pass
2.3798	286	161	56	Pass
2.4774	263	144	54	Pass
2.5749	229	135	58	Pass
2.6725	209	121	57	Pass
2.7700	185	109	58	Pass
2.8676	171	97	56	Pass
2.9651	154	90	58	Pass
3.0627	138	85	61	Pass
3.1602	129	79	61	Pass
3.2578	119	75	63	Pass
3.3553	109	69	63	Pass
3.4529	101	65	64	Pass
3.5504	91	62	68	Pass
3.6480	84	58	69	Pass
3.7455	78	53	67	Pass
3.8431	72	50	69	Pass
3.9407	71	45	63	Pass
4.0382	66	44	66	Pass
4.1358	60	41	68	Pass
4.2333	56	37	66	Pass
4.3309	51	36	70	Pass
4.4284	47	36	76	Pass
4.5260	44	33	75	Pass
4.6235	42	33	78	Pass
4.7211	39	28	71	Pass
4.8186	38	27	71	Pass
4.9162	36	27	75	Pass
5.0137	33	27	81	Pass
5.1113	32	26	81	Pass
5.2088	29	25	86	Pass
5.3064	29	22	75	Pass
5.4039	28	20	71	Pass
5.5015	26	20	76	Pass
5.5990	26	19	73	Pass
5.6966	25	19	76	Pass
5.7941	24	17	70	Pass

5.8917	23	17	73	Pass
5.9892	23	17	73	Pass
6.0868	23	17	73	Pass
6.1843	23	17	73	Pass
6.2819	22	16	72	Pass
6.3794	20	14	70	Pass
6.4770	17	13	76	Pass
6.5745	15	13	86	Pass
6.6721	15	12	80	Pass
6.7696	14	11	78	Pass
6.8672	14	11	78	Pass
6.9648	13	11	84	Pass
7.0623	13	10	76	Pass
7.1599	12	10	83	Pass
7.2574	12	9	75	Pass
7.3550	12	9	75	Pass
7.4525	11	9	81	Pass
7.5501	10	8	80	Pass
7.6476	9	8	88	Pass
7.7452	9	8	88	Pass
7.8427	9	7	77	Pass
7.9403	9	7	77	Pass
8.0378	9	7	77	Pass
8.1354	9	7	77	Pass
8.2329	9	7	77	Pass
8.3305	9	7	77	Pass
8.4280	9	5	55	Pass
8.5256	9	5	55	Pass
8.6231	9	4	44	Pass
8.7207	9	4	44	Pass
8.8182	9	4	44	Pass
8.9158	8	4	50	Pass
9.0133	8	4	50	Pass
9.1109	8	3	37	Pass
9.2084	8	3	37	Pass
9.3060	8	3	37	Pass
9.4035	8	3	37	Pass
9.5011	8	3	37	Pass
9.5986	8	3	37	Pass
9.6962	7	3	42	Pass
9.7937	6	3	50	Pass
9.8913	5	3	60	Pass
9.9888	5	2	40	Pass
10.0864	5	2	40	Pass

Drawdown Time Results

Perlnd and Implnd Changes

No changes have been made.

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