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MAKING A "WAY" OUT OF "NO WAY"

Hanson Sisters, LLC

17406 19th Ave NE, Marysville, EA 98271

PN PA 21-023

1st Submittal: May 2023

Stormwater Site Plan Report for English Crossing

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Not for Construction
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Acronyms

The following acronyms and abbreviations may or may not be called out within the body of this report.

- ASTM - American Society for Testing and Materials
- BMPs - Best Management Practices
- CB - Catch Basin
- CAO - Critical Areas Ordinance
- CESCL - Certified Erosion and Sediment Control Lead
- DOE - Department of Ecology
- EDDS - Engineering Design & Development Standards
- FEMA - Federal Emergency Management Agency
- HSPF - Hydrological Simulation Program—Fortran
- LiDAR - Light Detecting And Ranging
- LDA - Land disturbing activity
- LID - Low Impact Development
- LID Manual - DOE 2005 LID Technical Guidance Manual for Puget Sound
- MRs - Minimum Requirements (for Stormwater Management)
- MS4 - Municipal Separate Storm Sewer System
- MSL - Mean Sea Level
- NAVD88 - North American Vertical Datum of 1888
- NGVD29 - National Geodetic Vertical Datum of 1929
- NPDES - National Pollutant Discharge Elimination System
- NRCS - Natural Resources Conservation Service
- NPGIS - Non-Pollutant Generating Impervious Surface
- O&M - Operations and Maintenance
- PGIS - Pollutant Generating Impervious Surface
- PGPS - Pollutant Generating Pervious Surface
- PLSS - Public Land Survey System
- POC - Point of Compliance
- RCW - Revised Code of Washington
- ROW - Right-of-Way
- SCDM-2010 - Snohomish County 2010 Drainage Manual
- SMMWW - DOE 2005 Stormwater Management Manual for Western Washington
- SWPPP - Stormwater Pollution Prevention Plan
- TDA - Threshold Discharge Area
- TESC - Temporary Erosion and Sediment Controls
- USDA - United States Department of Agriculture
- US EPA - United States Environmental Protection Agency
- WSDOT - Washington State Department of Transportation
- WWHM - Western Washington Hydrology Model

Section 1 – Report Summary

1.1 Project Description

Hanson Sister, LLC is proposing the development of 19.52-*acres* of land in Northwest Marysville, WA off of 19th Ave NE. The parcel is currently vacant and vegetated with pasture.

The development of the parcel will result in Condominium Townhomes with 247-Units and drive aisles. Each unit is allocated to accept a maximum of 70% total impervious of roof and driveway with the remaining portion consisting of lawn. Open space areas for both passive and active recreation will be located outside of the proposed lots.

The proposed road access for the development entrance will be from 19th Ave NE at two locations. The development consists of units, driveways, drive aisles, on-site recreation and stormwater facilities.

Per NRCS mappings, type "C/D" Custer fine sandy loam soils are found through the bulk of the site int the east. A band of Norma Taxadjunct loam soils are located in the south portion of the site. An intrusion from the north of Kitsap silt loam also exists. The site is mapped as the Marysville Sand Member-Recession Outwash.

The 2019 DOE Stormwater Management Manual for Western Washington will be used for stormwater management guidance. Stormwater management BMPs and engineered designs are specified in this report.

Stormwater facilities will consist of bioretention facilities.

The entire developable project area is in one natural discharge area with a discharge location. Stormwater BMPs will be employed to mitigate polluted and unpolluted surface water flows.

Summary Stormwater Management

The project qualifies as 'new development' because there are less than 35% of existing impervious areas. The proposed condition of the fully developed site will have more than 5,000sf impervious areas. Per Figure 2.4.1 Vol. 1 of the 2019 SMMWW, all minimum requirements shall apply for this project.

This project triggers MRs 1-9 and is within the City's UGA. The project will choose to adhere to List #2 of MR #5. On-site stormwater BMPs will consist only of BMPT5.13. Feasibility analysis for individual lot BMPs is provided in MR #5 of the report. However, the overall site stormwater management will mirror the requirements and intent of MR #5.

Flow control requirements for the site will be met by detention. The majority of runoff from impervious surfaces and converted surfaces will be detained. A small portion of the site bypasses facilities for detention. The site as a whole meets the flow control threshold requirement matching the fully-forested condition.

Water quality will be met by percolating stormwater through bioretention treatment soils. The bioretention cell mitigates polluted stormwater through physical, chemical, and biological treatment processes.

1.2 Project Data Summary

Existing and proposed project areas are presented for determination of stormwater management requirements based on prescribed thresholds as outlined in the Marysville Municipal Code (MMC 22C) and the 2019 SMMWW Vol-1, Ch-2, Section 2.4 are summarized in the following tables.

Table 1 - Project Parcel Summary

Project Data:	
Applicant	Hanson Sister, LLC
Site Owner	Hanson Sisters, LLC
Project Name	English Crossing
Project T.S.R. Location	Twn 31 N, Rng 5 E, Sec 19, Qtr-SE
Project Address	17406 19th Ave NE, Marysville, EA 98271
Parcel ID(s)	310519-004-012-00
Watershed	Snohomish
Basin	Snohomish
Sub-Basin	Quilceda Creek
WRIA Number	7-Snohomish
Analysis Standard	2019 DOE SMMWW

Table 2 - Project Area Analysis & Activities Summary

Existing Conditions:		
Total Site Area	850,175	sf (19.52 ac)
Existing Impervious Area	0	sf (0.00 ac) 0.0%
Proposed Activity:		
Proposed Activity	Condominium Townhomes	
Total Proposed Disturbance Area	838,082	sf (19.24 ac)
Proposed Grading Area	838,082	sf (19.24 ac)
Proposed New NPGIS Onsite (Roof)	69,567	sf (1.60 ac)
Proposed New PGIS Onsite (Road, Sidewalk & Driveway)	97,843	sf (2.25 ac)
Proposed Replaced Impervious Area	0	sf (0.00 ac)
Native Vegetation convert to Lawn	0	sf (0.00 ac)
Native Vegetation convert to Pasture	0	sf (0.00 ac)
Total New Impervious Area Onsite	468,398	sf (10.75 ac)
Grading is ≤ 2 feet from P/L	No	
Any excavation 4+' at <1:1 slope to P/L	No	
Fill Slopes 4+' and >33% slope	No	

Section 2 - Minimum Requirements

2.1 Assessment of Minimum Requirements and Thresholds

Minimum requirements and thresholds are established by City of Marysville Municipal Code 14.15.050 – Minimum Requirements. Minimum Requirements for new development and Redevelopment are based on a development's disturbance area. Existing and proposed project areas for determination of stormwater management requirements are presented in Table 2.

The existing impervious area is less than 35% so this project qualifies as 'new development'. The proposed condition of the fully developed site will have impervious area in excess of 5,000 sf. This requires construction activities and stormwater management to comply with Minimum Requirements 1 through 9. A full construction SWPPP is also required.

Minimum Requirements per the SWWMM:

MR-1: Prepare Stormwater Site Plan. MMC 14.15.050 (1)

MR-2: Stormwater Pollution Prevention Plan (SWPPP). MMC 14.15.050 (2)

MR-3: Water pollution source control for new development. MMC 14.15.050 (3)

MR-4: Preservation of natural drainage systems and outfalls. MMC 14.15.050 (4)

MR-5: On-site stormwater management. MMC 14.15.050 (5)

MR-6: Runoff treatment. MMC 14.15.050 (6)

MR-7: Flow control requirements. MMC 14.15.050 (7)

MR-8: Detention or treatment in wetlands and wetland buffers. MMC 14.15.050 (8)

MR-9: Inspection, operation and maintenance requirements. MMC 14.15.050 (9)

Each Minimum Requirements is described in the following sections. There are no additional requirements to be met.

2.2 MR #1: Preparation of Stormwater Site Plans

This document is the Stormwater Site Plan Report that addresses the requirements of MR-1. This section presents the portion of the Stormwater Site Plan that includes recommendations, calculations, and procedures required to adhere to Minimum Requirement #1. The evaluation of the existing site conditions follows.

2.2.1 Site Location

The site is located in the SE quarter of Section 19 of Township 31 North, Range 5 East. The street address is 17406 19th Ave NE, Marysville, EA 98271 and the parcel is located to the west of 19th Ave NE. The parcel is also bordered on the west by the Burlington North R.R. See Figure 1 for a vicinity map.

2.2.2 Site Description, Existing Conditions

The project site is 19.52-*acres*. The parcel owned by Hanson Sisters, LLC. The Snohomish County parcel number is 310519-004-012-00. It is zoned Mixed Use and is located in City of Marysville within Snohomish County.

The parcel is vacant. The existing drainage system(s) are undetermined but largely surface runoff to an on-site wetland over the top silt layer. Surface runoff overall flows east.

The majority of the site is pasture.

All maps and figures are presented in the Support Data section of this document.

A vicinity map that shows the site location is shown as Figure 1.

A site map that shows the property lines is shown in Figure 2.

A topographic map that shows the site boundaries, study area boundaries, and the downstream flow-paths is also presented in Figure 3.

2.2.3 Existing Basin Analysis

The project is defined by the development within the subject parcel. Existing project flow paths are shown in Figure 2.

The study area is located in the Quilceda Creek sub-basin of the Snohomish Basin in the Snohomish watershed (WRIA-7-Snohomish), which drains to the Puget Sound.

All existing flow assessment and site related basin delineations were established by tracing analysis of a LIDAR surface model.

2.2.4 Other Information on the Study Area

The site is not in or adjacent to a USEPA Sole Source Aquifer.

The site is not in a well-head protection area.

The site is not in a floodway or floodplain.

2.2.5 Critical Areas

The area off-site to the north has a small area that may be wetland. The potential wetland is Category IV.

2.2.6 Topography

The site and surrounding topography was analyzed using survey topographic points provided by A.S.P.I. A 3D surface model was generated.

The site has some gently sloped areas with a low point around 116 *feet* MSL along the east boundary. The low point is in the location of the agricultural ditch system. The site slopes up from the east to a high point of 118 *feet* along the west property boundary.

Slopes average in the range of 0 to 5 percent for the majority of the developable area. The site has an average slope of 3.66%.

2.2.7 Soils

The majority of the site is situated on Custer fine sandy loam soils, a hydrologic Type-C/D soil per NRCS mapping. Custer fine sandy loam soils have a 0-9 *inch* first layer of fine sandy loam with the remaining profile being sand. Much surface runoff is attributed to the fine sandy loam layer. Infiltration increases significantly with depth within this soil type in the eastern portion of the site. A narrow band of Kitsap silt loam exists in the west and Norma taxadjunct loam in the north portion of the site. Kitsap soils have limited infiltration capacity due to the fine grained nature of the soils.

Detailed physical and chemical properties of these soils are presented in Section 4.1. The NRCS mapping can be seen in Figure 5.

2.2.8 Field Inspection

The site has not been visited recently. All inspection has been conducted via remote sensing.

2.2.9 Upstream Analysis

A relative high point at 128 *feet* MSL is located along west boundary of the site within the Burlington Northern RR ROW. This local high intercepts all upstream flows from flowing onto the site and adjacent upstream site.

2.2.10 Downstream Analysis

The downstream area was established by tracing analysis of a LIDAR surface model and evaluation of various GIS data, aerial imagery, and City of Marysville Drainage Inventory. The development are flows to the northwest.

The development area flows to the east before reaching an agriculture ditch along the eastern boundary of the site. Stormwater crosses 172nd ROW via a 24" ADS culvert and flows south. After travelling around 580 ft, stormwater turns southeast and flows along the east side of the tracks for two miles downstream of the project site before flowing through a 36 *inch* culvert underneath the RR tracks. The culvert leads stormwater to a ditch that parallels Interstate 5. Stormwater eventually meets with Quilceda Creek near 140th St NE & 29th Ave NE.

Figure 3 shows a portion of the downstream flow path.

2.3 MR #2: Stormwater Pollution Prevention Plans (SWPPPs)

MMC 14.15.050 (2) specifies the requirements for development and redevelopment projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters. Volume I, Chapter 2.5.2 of the 2019 SMMWW specifies that all new development and redevelopment implement a Stormwater Pollution Prevention Plans (SWPPP), which is a list of 13 elements that present measures and methods for all permanent and temporary erosion and sediment control (TESC), pollution prevention, inspection/monitoring activities, and recordkeeping required during the proposed construction project.

Based on the MR#2 thresholds, this project generates more than 2,000 *square feet* of impervious area, so a full SWPPP is required. Required elements for the SWPPP:

- SWPPP element 1: Preserve vegetation/mark clearing limits
- SWPPP element 2: Establish construction access
- SWPPP element 3: Control flow rates
- SWPPP element 4: Install sediment controls
- SWPPP element 5: Stabilize soils
- SWPPP Element 6: Protect slopes
- SWPPP Element 7: Protect permanent drain inlets
- SWPPP element 8: Stabilize channels and outlets
- SWPPP element 9: Control pollutants
- SWWP element 10: Control dewatering
- SWPPP element 11: Maintain best management practices
- SWPPP element 12: Manage the project
- SWPPP element 13: Protect On-Site Stormwater Management BMPs for Runoff from Roofs and Other Hard Surfaces

The SWPPP is assembled as a separate document for portability and reproduction purposes. The document is titled "**Stormwater Pollution Prevention Plan for Hanson Sister, LLC**", dated 12 May 2023.

2.4 MR #3: Source Control of Pollution

MMC 14.15.050 (3) specifies the requirements for water pollution source control for new development or redevelopment activities in accordance with Volume IV of the SMMWW. These activities are primarily commercial industrial developments that represent significant pollutant generation potential and the associated source control BMPs are designed to suit those activities.

Per Chapter 2.5.3, MR#3 does not apply to residential development, hence such source controls are not specified for this project.

2.5 MR #4: Preservation of Natural Drainage Systems and Outfalls

MMC 14.15.050 (4) specifies the requirements for preservation of natural drainage systems or outfalls for all new development and redevelopment activities under Minimum Requirement 4 in the 2019 SMMWW.

Natural drainage patterns as they once existed shall be retained. Pre-developed conditions experience a sheet drainage pattern to the site's east property boundary. Stormwater generated onsite reaches the property boundary through infiltration or surface runoff prior to being intercepted by exiting ditches. Existing discharge location shall be maintained.

2.6 MR #5: On-Site Stormwater Management

MMC 14.15.050 (5) specifies requirements for on-site stormwater BMPs. This requirement mandates that on-site stormwater runoff be infiltrated, dispersed, and/or retained to the maximum extent feasible without causing flooding or erosion impacts. Projects triggering Minimum Requirements 1 through 5 must use On-site stormwater management BMPs from List #1 for all surfaces or demonstrate compliance with the LID Performance Standard. Projects triggering Minimum Requirements 1 through 9 must meet the requirements of Table 2.5.1 in Vol. 1 of the 2019 SMMWW. Table 2.5.1 specifies the requirements for new or redevelopment depending on UGA and parcel size to meet the requirements of the LID Performance Standard and/or List #2. List #1 and List #2 specify stormwater BMPs in order of preference. The first BMP determined feasible is required.

This project trigger MR's 1-9. This project is within the City's UGA. This project is required to adhere to the LID Performance Standard or List #2 per Table 2.5.1.

List #1 and #2 contain appropriate BMPs to mitigate a particular developed surface. The surfaces included in the list are Lawn and Landscaped Areas, Roofs, and other hard surfaces (road/driveway/parking).

> Lawn/Landscape is required to utilize BMP T5.13, Post-Construction Soil Quality and Depth.
>
> Roofs are required to employ BMP T5.30 Full Dispersion or Downspout Infiltration, Rain Gardens or Bioretention, BMP T5.10A Downspout Dispersion Systems, or perforated stub-out connections. The first feasible BMP in this list must be used.
>
> Other Hard surfaces (Roads, Driveways, Parking Lots, Etc.) must utilize BMP T5.30 Full Dispersion, BMP T5.15 Permeable Pavement, Bioretention, Sheet Flow Dispersion, or Concentrated Flow Dispersion. The first feasible BMP in this list must be used.

Lawn/landscape will utilize BMP T5.13, Post Construction Soil Quality and Depth.

Roofs will not be able to provide BMP T5.30 Full Dispersion. Full Dispersion requires 100-*foot* flow paths within native areas. The project will not be able to maintain 65% open space.

Individual Lot Infiltration is not feasible based on the low-permeability of native soils. Most roofs will be ultimately routed to bioretention areas for treatment and flow control.

BMP T5.10B Downspout Dispersion will not be utilized as each individual lot lacks the prescriptive flow path length. BMP T5.10C perforated stub out connections are also not feasible due to the close proximity of sewer, water, gas, electricity, and cable utilities on these narrow 40 ft wide lots. Perforated stub outs are also not permitted to be installed beneath driveways.

Onsite stormwater BMPs are infeasible.

Road and Driveway/Parking will be routed to bioretention areas, BMP T7.30. The bioretention cells will treat stormwater through filtering, phytoremediation, and microbial action from within the compost.

Permeable pavement will not be used as the pavement areas are likely to have long-term excessive sediment deposition after construction and homeowner turnover. Permeable pavement

may also be constructed over the top of compacted structural fill that does not exhibit infiltration rates consistent with the requirements for this BMP.

A site plan showing the stormwater management and development can be seen in Figure 4.

2.7 MR #6: Runoff Treatment

Minimum Requirement #6 in MMC 14.15.050 (6) specifies the requirements for providing runoff treatment. The threshold for requiring a treatment BMP is 5,000 *square feet* of PGIS (Pollution Generating Impervious Surface) or a total of more than ¾ of an acre of PGPS (Pollution Generating Pervious Surface).

This project is expected to generate 97,843 *square feet* (2.25 *acres*) of PGIS based on road, sidewalk and driveway areas, therefore treatment facility BMPs are required for this project.

Runoff treatment facility selection is outlined in Vol. I, Ch. 4.2, Step V of the 2019 SMMWW. Step V outlines the treatment facility selection flow chart based on the intended use of a project. Treatment selection is based on if the site is a high-use site, if the downstream receiving waters are phosphorous sensitive, and/or if the site is required to provide enhanced treatment. The definitions of high-use, phosphorous control, and enhanced treatment can be found in Step V in Section 4.2 of the 2019 SMMWW.

The project is not a high use site.

The project is not required to treat for phosphorous.

Enhanced treatment is not required for the project.

Enhanced and Basic treatment is provided through the use of a bioretention facility per Vol. III Section 3.3.12 of the 2019 SMMWW. The bioretention specified will provide enhanced treatment. The bio-cell treats stormwater through the infiltration of stormwater through soils and their ability to absorb pollutants. On-site soils are suitable for use. See Vol III. Section 3.3.12 of the 2019 SMMWW for specific soil design criteria.

The project utilizes bioretention cells for treatment. The bioretention cell mitigates polluted stormwater through physical, chemical and biological treatment processes. The treatment process reduces pollutant loads to downstream receiving waters. Stormwater percolates through compost amended soils and plantings to obtain treatment. The total percolated runoff through each bio-cell's amended soils is well over the 91% total runoff volume treatment requirement. See Section 7.

2.8 MR #7: Flow Control

Minimum Requirement #7 in MMC 14.15.050 (7) specifies the requirements for runoff flow control. The threshold for requiring Minimum Requirement #7 is 5,000 *square feet* of impervious surface. Flow control shall be provided if the project creates more than 10,000 *square feet* of effective impervious area in a threshold discharge area, converts ¾ of an acre or more of native vegetation to lawn, 2.5 *acres* or more native vegetation is converted to pasture, or a combination of impervious and converted pervious surfaces cause a 0.1 *cfs* increase in the 100-*year* flow frequency from a continuous simulation runoff model.

The project exceeds this requirement and is required to provide flow control.

All runoff from impervious surfaces and converted surfaces is preferred to be infiltrated if feasible. Standard flow control requires that stormwater discharges match pre-developed discharge durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow to the 50-year peak flow. The pre-developed condition shall be matched to the fully-forested condition (soils and vegetation) to which the Western Washington Hydrologic Model (WWHM) is calibrated, unless reasonable, historic information is provided that indicates the site was prairie prior to Euro-American settlement. This requirement may also be met by Full dispersion and infiltration. This standard requirement is waived for sites that will reliably infiltrate all the runoff from hard surface and converted vegetation areas.

The project exceeds this requirement and is required to provide flow control.

The site stormwater management practices detention of stormwater generated on site. A small portion of the frontage bypass facilities for detention. These bypasses are not included in the stormwater model. The site as a whole still meets the flow control threshold requirement.

The site stormwater management practices combine traditional detention, infiltration and bio-retention for the remaining surfaces. The project uses bioretention cells to manage and treat all incoming impervious surface generated stormwater (PGIS and NPGIS).

Stormwater generated on site flows to Bioretention Cell A, B, D, E, F, G and H. All bioretention cells release stormwater to an existing ditch within 19th Ave NE ROW.

The combination of bioretention cells meet compliance with flow-control standard of 50% of the 2-year to the 50% predeveloped stormwater flows.

All bioretention cells are comprised of 1.5 *feet* of bioretention soil media. Those cells utilize ponded area with freeboard to allow stormwater to percolate through the amended soils. Percolated stormwater drains to a filter layer, and then to a storage chamber consisting of 0.5 *ft* to 6.0 *ft* of rock. The rock layer is drained through a perforated underdrain.

See Section 7 for bioretention cells, planter bioswales and rooftop modeling parameters.

2.9 MR #8: Wetlands Protection

MMC 14.15.050 (8) specifies requirements for discharge of stormwater in wetlands and wetland buffers as well as discharge of stormwater to a stream. The site discharges to an offsite wetland. Any project that is defined within a contributing Threshold Discharge Area which discharges to a critical wetland, Wetlands Protection per MR#8 must be applied.

Minimum Requirement #8 requires that stormwater discharges to wetlands within a projects TDA shall meet a specified Level of Wetland Protection. There are four Wetland Protection Levels that apply to the TDA: General Protection, Protection from Pollutants, Wetland Hydroperiod protection Method 1, and Method 2.

Both General Protection and Protection from Pollutants wetland protection levels are satisfied with the proper implementation of Minimum Requirement #2 and Minimum Requirement #5 & #6, respectively.

Wetland Hydroperiod Protection Methods require monitoring of wetland discharges to maintain existing wetland input volumes. The wetland input volume is a different analysis than the flow rate control of the Stream Protection Duration requirement of Minimum Requirement #7. Minimum Requirement #8 does take precedence over satisfying Minimum Requirement #7. (See Vol. I, Ch.3, Section 3.4.8 of the SMMWW)

The development does not discharge stormwater to wetlands.

2.10 MR # 9: Operation and Maintenance

Minimum Requirement #9 specified MMC 14.15.050 (9) contains requirements for inspection, operation and maintenance of stormwater facilities and BMPs. Specific maintenance standards and requirements are outlined in Volume V of the 2019 SMMWW. The 2019 SMMWW requires the regular maintenance and inspection of drainage facilities.

For portability and reproduction purposes, the Operations and Maintenance Manual is presented in a separate stand-alone document titled "**Operations and Maintenance Manual for English Crossing"**, dated **12 May 2023.** This document will be provided with the construction plan submittal.

Section 3 - Maps & Figures

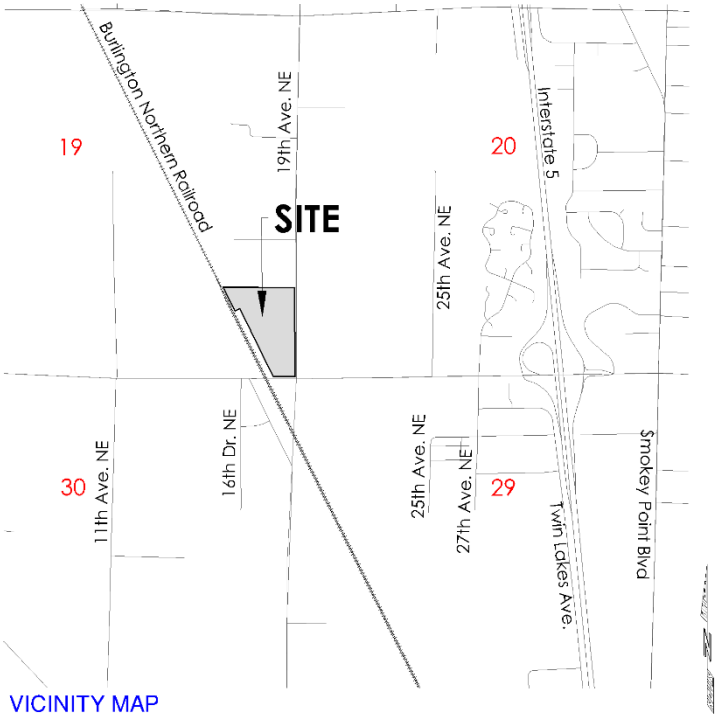


Figure 1 - Vicinity Map

Figure 2 - Existing Conditions (not to scale)

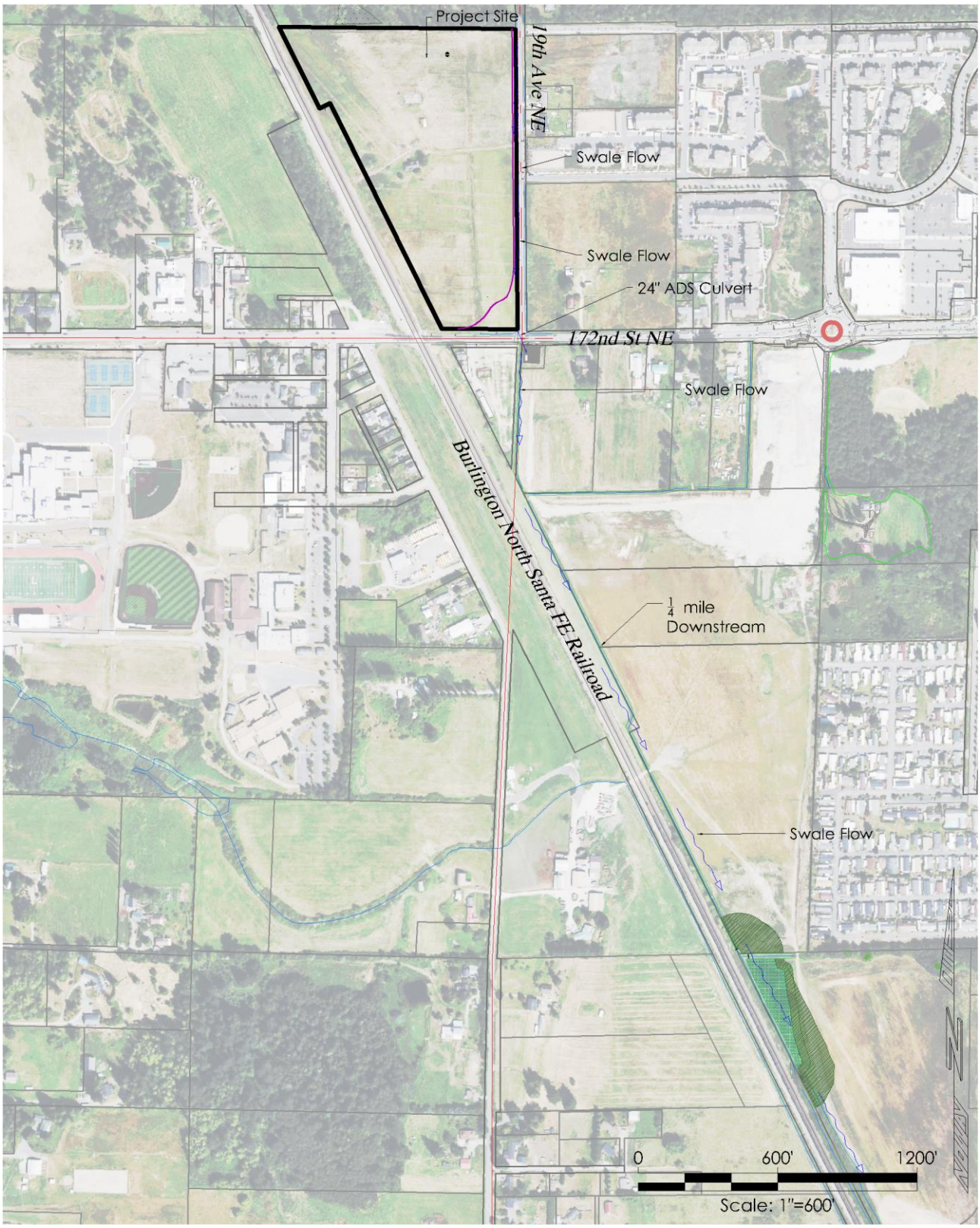


Figure 3 – Downstream Flow Path

Figure 4 - Site Plan

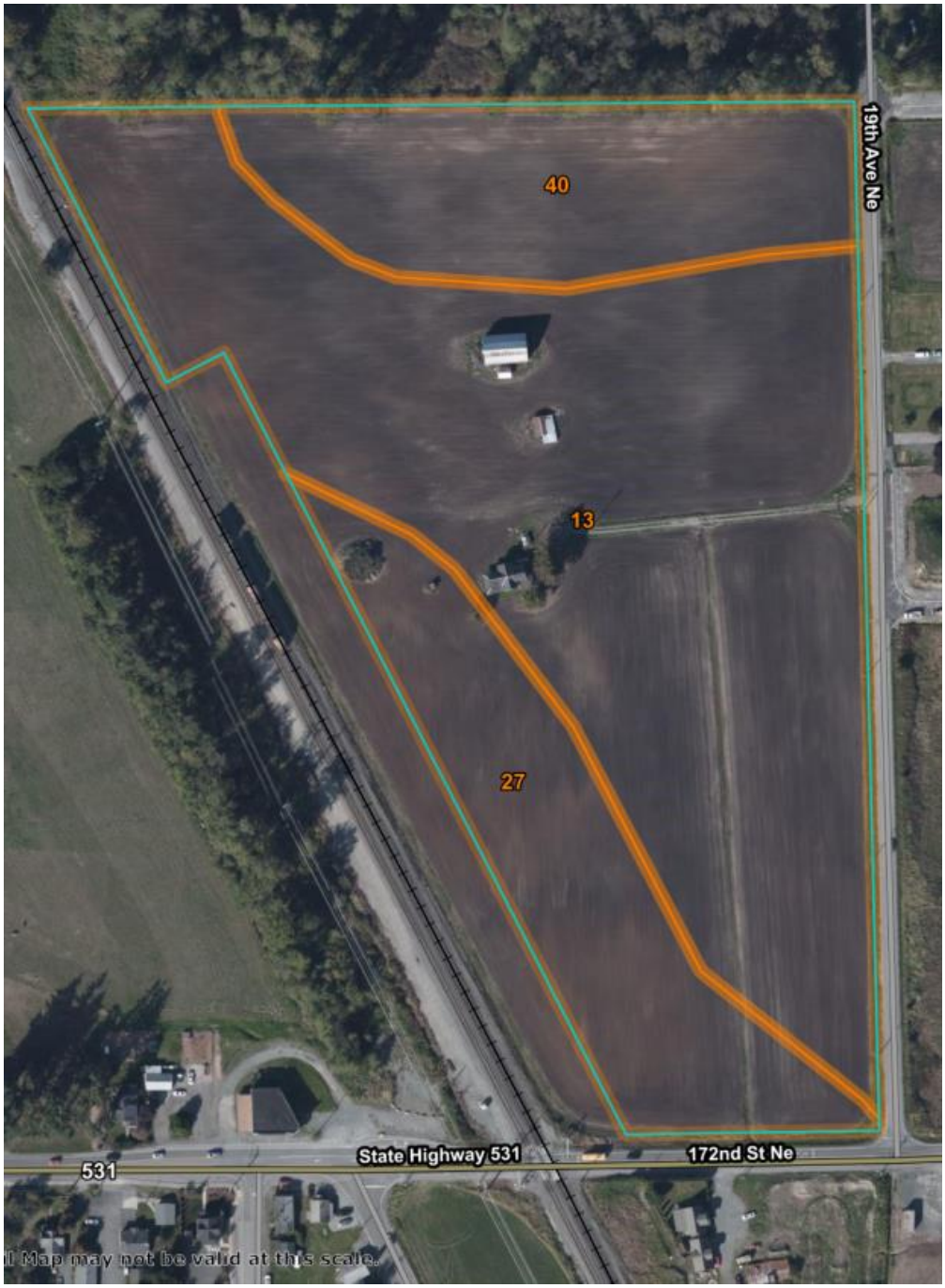


Figure 5 – Soil Map (Not to Scale)

Section 4 Support Data

4.1 Soils Data

72—Tokul gravelly medial loam, 0 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2t61k
Elevation: 160 to 1,150 feet
Mean annual precipitation: 45 to 70 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 140 to 200 days
Farmland classification: All areas are prime farmland
Map Unit Composition
*Tokul and similar soils:*85 percent
*Minor components:*15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.
Description of Tokul
Setting
*Landform:*Hillslopes, till plains
*Landform position (two-dimensional):*Toeslope
*Landform position (three-dimensional):*Side slope, tread
*Down-slope shape:*Convex
*Across-slope shape:*Convex
*Parent material:*Volcanic ash mixed with loess over glacial till
Typical profile
Oi - 0 to 1 inches: slightly decomposed plant material
Oa - 1 to 2 inches: highly decomposed plant material
A - 2 to 6 inches: gravelly medial loam
Bs1 - 6 to 9 inches: gravelly medial loam
Bs2 - 9 to 17 inches: gravelly medial loam
Bs3 - 17 to 24 inches: gravelly medial loam
BC - 24 to 33 inches: gravelly medial fine sandy loam
2Bsm - 33 to 62 inches: cemented material
Properties and qualities
*Slope:*0 to 8 percent
*Depth to restrictive feature:*20 to 39 inches to densic material; 20 to 39 inches to cemented horizon
*Drainage class:*Moderately well drained
*Capacity of the most limiting layer to transmit water (Ksat):*Very low to moderately low (0.00 to 0.06 in/hr)
*Depth to water table:*About 18 to 36 inches
*Frequency of flooding:*None
*Frequency of ponding:*None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)
Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: B
Ecological site: F002XA005WA - Puget Lowlands Moist Forest

Forage suitability group: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA)
Other vegetative classification: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA)
Hydric soil rating: No

Minor Components

Pastik

*Percent of map unit:*5 percent
*Landform:*Terraces
*Landform position (three-dimensional):*Tread
*Down-slope shape:*Linear
*Across-slope shape:*Linear
Hydric soil rating: No

Barneston

*Percent of map unit:*5 percent
*Landform:*Moraines, eskers, kames
*Landform position (two-dimensional):*Summit, shoulder
*Landform position (three-dimensional):*Crest, interfluve
*Down-slope shape:*Convex
*Across-slope shape:*Convex
Hydric soil rating: No

Norma

*Percent of map unit:*3 percent
*Landform:*Drainageways, depressions
*Landform position (three-dimensional):*Dip
*Down-slope shape:*Linear, concave
*Across-slope shape:*Concave
Hydric soil rating: Yes

Mckenna

*Percent of map unit:*2 percent
*Landform:*Drainageways, depressions
*Landform position (three-dimensional):*Dip
*Down-slope shape:*Linear, concave
*Across-slope shape:*Concave
Hydric soil rating: Yes

Section 5 Works Cited

Mays, L. W. (2011). *Water Resources Engineering.* Hoboken: Wiley & Sons, Inc.

Puget Sound Action Team. (2005, January). Low Impact Development Technical Guidance Manual for Puget Sound. *Publication No. PSAT 05-03*. Washington: Washington State University - Pierce County Extension.

Puget Sound LIDAR Consortium. (2003, April). LIDAR Bare Earth DEM File. q47121h24be.e00. Snohomish County, Washington. Retrieved May 2013, from http://pugetsoundlidar.ess.washington.edu/index.htm

Snohomish County Planning and Development Services. (2007, October 1). Aquifer Recharge/Wellhead Protection. Everett, WA.

Snohomish County Surface Water Management Division. (2002, December). Snohomish UGA Drainage Needs Report. Everett, Washington.

5.1 Topographic Data

- The various on and off site topography, utilities, and drainage elements were professionally surveyed by Pacific Coast Surveying in 2019.

- Snohomish County 2003 LiDAR survey was used to augment the existing site topography and the downstream and surrounding areas.

The modeled coordinate system:
Lateral - Washington State Plan Plane - North, FIPS 4601;
Vertical – NAVD 88

Section 6 - Continuous Simulation Modeling

6.1 Continuous Simulation Background

HSPF based continuous simulation modeling was used to evaluate the hydrologic performances of the pre-developed and developed sub-basins in order to accurately assess flow rates.

The currently adopted continuous simulation models use the HSPF (Hydraulic Simulation Program in FORTRAN) software engine. The HSPF model uses a robust and detail accounting of the 'water budget', including evaporation, evapotranspiration, interception, interflow, and groundwater. The modeling accounts for and assesses land segment areas that include vegetation or impervious cover, soil types, and slopes. The modeling also uses utilized over 50 years of continuous rainfall data (precipitation) and evaporation data for the area. The HSPF continuous modeling is considered the best available science for hydrologic analysis.

6.2 Modeling Methodology

HSPF modeling was managed via the Western Washington Hydrology Model (WWHM) interface program. The current professional version of WWHM by Clearcreek Solutions, Inc., WWHM-2012 was used. The current data precipitation and evaporation set provided by DOE with the WWHM-2012 software interface was used that includes quantized data in 15-minute time steps from October 1948 to October 2009.

The WWHM program comes packaged with generic, well considered HSPF modeling parameters. These settings allow for the modeling of the majority of the topological conditions found in the Puget Sound area. Where conditions fall reasonably outside the range of the default HSPF parameters, adjustments should be made to more accurately reflect those conditions. These is generally limited to the pervious land segments (IMPLNDS) and are mostly limited to slopes (SLSUR), infiltration rates (INFILT), and length of flow path (LSUR). For this project, HSPF parameters were not adjusted to reflect site conditions.

6.2.1 Existing Conditions

The surface vegetative cover is assumed fully forested with an average slope of 5% in the area of development, based on the LIDAR based TIN analysis. The LIDAR model represents the pre-graded conditions and is in accordance with the predeveloped requirements to be represented as native vegetation and soils that existed at a site prior to the influence of Euro-American settlement.

The NRCS soil mapping of Tokul gravelly medial loam within the modeled area is listed as Type C hydrologic soils. Land segments of Pasture Flat, Mod are representative of the existing site areas. The wetland area itself is modeled in the WWHM as Sat Forest, Flat.

6.2.2 Developed Conditions

Default mapping for flat road was used for the road areas. Roof was for the rooftop areas. Driveway was for the driveway areas and sidewalk for the paths. Pasture was used for the amended soils from DOE recommendations for amended soils modeling. The intent of the modeling of this site was to determine the infiltration and treatment efficiencies of the bio-retention cell. Flow control modeling took place for the bypass area that is unable to be introduced to street system.

It should be noted that when ponds, bio-swales, or other open detention facilities are used, the corresponding WWHM analysis module includes the ponded area. Consequently, this area is not included in the basin land segment mappings so the total area is often different between the developed and pre-developed conditions.

The current DOE specification for amended soils in 2019 is labeled as 'SMMWW' in the Bio-Swale and other WWHM modules that employ amended soils. The parameters for modeling the SMMWW are preset and based on current state-of-the-art modeling using a combination of the Darcy's and Van Genuchten's equations to account for the variability of permeability and water content as the soils transition from dry or partly damp to saturated conditions as the bio-cell cycles through the process of filling, emptying, and drying out. The SMMWW settings based on the WSU amended soils.

Section 7 - Software Output

The following WWHM reports in this section represent individual sub-basin analysis for hydrologic flow evaluations. The following heading is common to all reports.

Western Washington Hydrology Model,

WWHM2012

WWHM2012
PROJECT REPORT

Project Name: Biocells-0510
Site Name: English Crossing
Site Address: 17406 19th Ave NE
City : Marysville, WA
Report Date: 5/12/2023
MGS Regoin : Puget East
Data Start : 1901/10/1
Data End : 2058/09/30
DOT Data Number: 05
Version Date: 2019/09/13
Version : 4.2.17

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

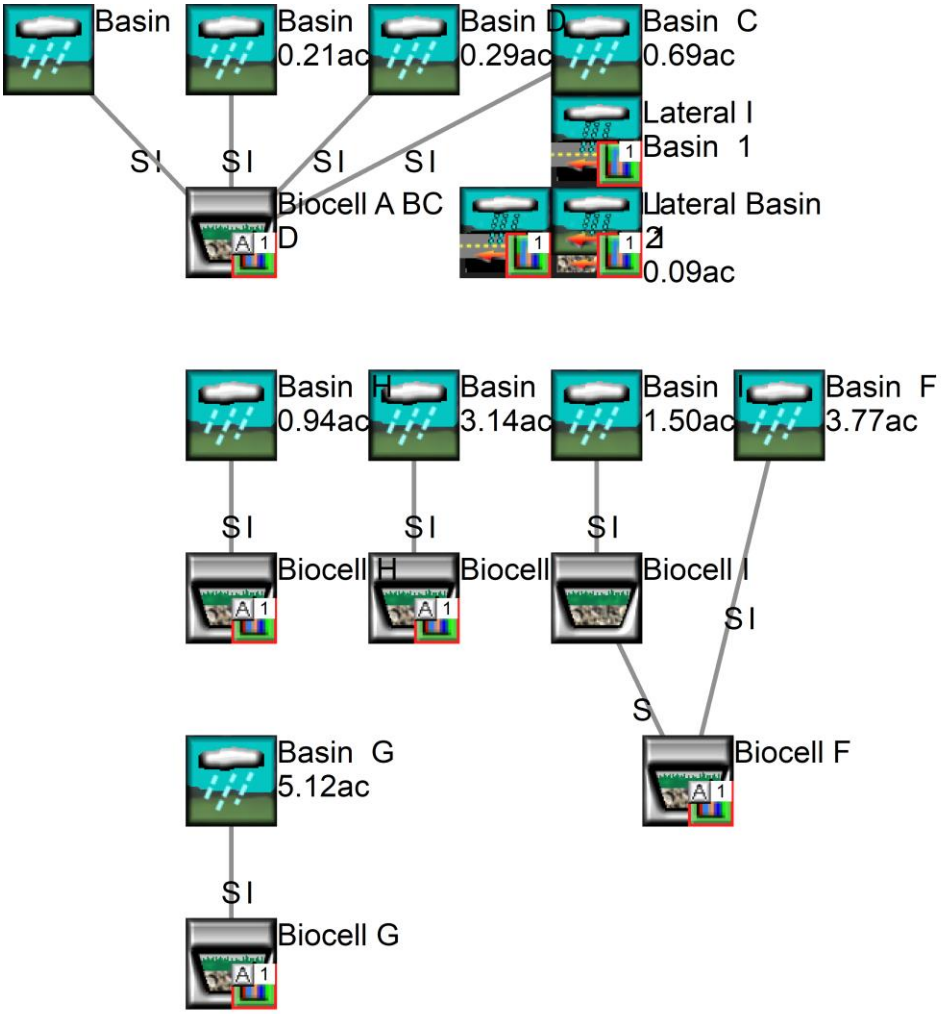
Pervious Land Use	acre
C, Forest, Flat	17.646
Pervious Total	17.646

Impervious Land Use	acre
Impervious Total	0
Basin Total	17.646

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE



Name : Basin A
Bypass: No

GroundWater: No

Pervious Land Use	**acre**
Pervious Total	**0**

Impervious Land Use	**acre**
ROADS FLAT	**0.066**
DRIVEWAYS FLAT	**0.018**
SIDEWALKS FLAT	**0.016**
Impervious Total	**0.1**
Basin Total	**0.1**

Element Flows To:

Surface	Interflow	Groundwater
Surface ocell A BC D	Surface ocell A BC D	

Name : Basin B
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.11
Pervious Total	**0.11**

Impervious Land Use	acre
ROADS FLAT	0.073
DRIVEWAYS FLAT	0.018
SIDEWALKS FLAT	0.01
Impervious Total	**0.101**
Basin Total	**0.211**

Element Flows To:

Surface	Interflow	Groundwater
Surface ocell A BC D	Surface ocell A BC D	

Name : Basin C
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.208
Pervious Total	**0.208**

Impervious Land Use	acre
ROADS FLAT	0.318
ROOF TOPS FLAT	0.074
SIDEWALKS FLAT	0.089
Impervious Total	**0.481**
Basin Total	**0.689**

Element Flows To:

Surface	Interflow	Groundwater
Surface ocell A BC D	Surface ocell A BC D	

Name : Basin F
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	1.27
Pervious Total	**1.27**

Impervious Land Use	acre
ROADS FLAT	0.707
ROOF TOPS FLAT	0.985
DRIVEWAYS FLAT	0.698
SIDEWALKS FLAT	0.106
Impervious Total	**2.496**
Basin Total	**3.766**

Element Flows To:

Surface	Interflow	Groundwater
Surface Biocell F	Surface Biocell F	

Name : Basin E
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.855
Pervious Total	**0.855**

Impervious Land Use	acre
ROADS FLAT	0.545
ROOF TOPS FLAT	1.179
DRIVEWAYS FLAT	0.468
SIDEWALKS FLAT	0.096
Impervious Total	**2.288**
Basin Total	**3.143**

Element Flows To:

Surface	Interflow	Groundwater
Surface Biocell E	Surface Biocell E	

Name : Basin G
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	1.49
Pervious Total	**1.49**

Impervious Land Use	acre
ROADS FLAT	1.067
ROOF TOPS FLAT	1.578
DRIVEWAYS FLAT	0.753
SIDEWALKS FLAT	0.233
Impervious Total	**3.631**
Basin Total	**5.121**

Element Flows To:

Surface	Interflow	Groundwater
Surface Biocell G	Surface Biocell G	

Name : Basin H
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.382
Pervious Total	**0.382**

Impervious Land Use	acre
ROADS FLAT	0.103
ROOF TOPS FLAT	0.326
DRIVEWAYS FLAT	0.105
SIDEWALKS FLAT	0.019
Impervious Total	**0.553**
Basin Total	**0.935**

Element Flows To:

Surface	Interflow	Groundwater
Surface Biocell H	Surface Biocell H	

Name : Basin D
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.131
Pervious Total	**0.131**

Impervious Land Use	acre
ROADS FLAT	0.114
SIDEWALKS FLAT	0.042
Impervious Total	**0.156**
Basin Total	**0.287**

Element Flows To:

Surface	Interflow	Groundwater
Surface ocell A BC D	Surface ocell A BC D	

Name : Biocell A BC D
Bottom Length: 100.00 ft.
Bottom Width: 47.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0.5
Material type for second layer: Sand
Material thickness of third layer: 0
Material type for third layer: GRAVEL
Infiltration On
Infiltration rate: 0
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 0
Total Volume Through Riser (ac-ft.): 14.774
Total Volume Through Facility (ac-ft.): 440.293
Percent Infiltrated: 0
Total Precip Applied to Facility: 54.117
Total Evap From Facility: 28.844
Underdrain used
Underdrain Diameter (feet): 0.5
Orifice Diameter (in.): 0.75
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 425.519
Total Outflow (ac-ft.): 440.293
Percent Through Underdrain: 96.64

Discharge Structure
Riser Height: 0.75 ft.
Riser Diameter: 6 in.
Orifice 1 Diameter: 0.2 in. **Elevation:** 0.02 ft.
Orifice 2 Diameter: 0.2 in. **Elevation:** 0.2 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Biocell A BC D Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.1079	0.0000	0.0000	0.0000
0.0357	0.1079	0.0018	0.0000	0.0000
0.0714	0.1079	0.0035	0.0000	0.0000
0.1071	0.1079	0.0053	0.0000	0.0000
0.1429	0.1079	0.0070	0.0000	0.0000
0.1786	0.1079	0.0088	0.0000	0.0000
0.2143	0.1079	0.0106	0.0000	0.0000
0.2500	0.1079	0.0123	0.0030	0.0000
0.2857	0.1079	0.0141	0.0038	0.0000
0.3214	0.1079	0.0159	0.0044	0.0000
0.3571	0.1079	0.0176	0.0050	0.0000
0.3929	0.1079	0.0194	0.0055	0.0000
0.4286	0.1079	0.0211	0.0059	0.0000
0.4643	0.1079	0.0229	0.0063	0.0000
0.5000	0.1079	0.0247	0.0066	0.0000
0.5357	0.1079	0.0264	0.0070	0.0000
0.5714	0.1079	0.0282	0.0073	0.0000
0.6071	0.1079	0.0300	0.0076	0.0000
0.6429	0.1079	0.0317	0.0079	0.0000
0.6786	0.1079	0.0335	0.0082	0.0000
0.7143	0.1079	0.0352	0.0085	0.0000
0.7500	0.1079	0.0370	0.0088	0.0000
0.7857	0.1079	0.0388	0.0090	0.0000
0.8214	0.1079	0.0405	0.0093	0.0000
0.8571	0.1079	0.0423	0.0095	0.0000
0.8929	0.1079	0.0441	0.0097	0.0000
0.9286	0.1079	0.0458	0.0100	0.0000
0.9643	0.1079	0.0476	0.0102	0.0000
1.0000	0.1079	0.0493	0.0105	0.0000
1.0357	0.1079	0.0511	0.0108	0.0000
1.0714	0.1079	0.0529	0.0110	0.0000
1.1071	0.1079	0.0546	0.0112	0.0000
1.1429	0.1079	0.0564	0.0114	0.0000
1.1786	0.1079	0.0582	0.0115	0.0000
1.2143	0.1079	0.0599	0.0117	0.0000
1.2500	0.1079	0.0617	0.0119	0.0000
1.2857	0.1079	0.0634	0.0121	0.0000
1.3214	0.1079	0.0652	0.0122	0.0000
1.3571	0.1079	0.0670	0.0124	0.0000
1.3929	0.1079	0.0687	0.0126	0.0000
1.4286	0.1079	0.0705	0.0127	0.0000
1.4643	0.1079	0.0722	0.0129	0.0000
1.5000	0.1079	0.0738	0.0131	0.0000

1.5357	0.1079	0.0753	0.0132	0.0000
1.5714	0.1079	0.0769	0.0134	0.0000
1.6071	0.1079	0.0784	0.0135	0.0000
1.6429	0.1079	0.0800	0.0137	0.0000
1.6786	0.1079	0.0815	0.0138	0.0000
1.7143	0.1079	0.0830	0.0140	0.0000
1.7500	0.1079	0.0846	0.0141	0.0000
1.7857	0.1079	0.0861	0.0143	0.0000
1.8214	0.1079	0.0877	0.0144	0.0000
1.8571	0.1079	0.0892	0.0146	0.0000
1.8929	0.1079	0.0907	0.0147	0.0000
1.9286	0.1079	0.0923	0.0148	0.0000
1.9643	0.1079	0.0938	0.0150	0.0000
2.0000	0.1079	0.0954	0.0151	0.0000

Surface ocell A BC D Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
2.0000	0.1079	0.0954	0.0000	1.3056	0.0000
2.0357	0.1086	0.0992	0.0001	1.3056	0.0000
2.0714	0.1093	0.1031	0.0002	1.3677	0.0000
2.1071	0.1101	0.1070	0.0003	1.3988	0.0000
2.1429	0.1108	0.1110	0.0004	1.4299	0.0000
2.1786	0.1115	0.1150	0.0004	1.4610	0.0000
2.2143	0.1123	0.1190	0.0006	1.4921	0.0000
2.2500	0.1130	0.1230	0.0008	1.5231	0.0000
2.2857	0.1137	0.1270	0.0009	1.5542	0.0000
2.3214	0.1145	0.1311	0.0010	1.5853	0.0000
2.3571	0.1152	0.1352	0.0011	1.6164	0.0000
2.3929	0.1160	0.1393	0.0011	1.6475	0.0000
2.4286	0.1167	0.1435	0.0012	1.6786	0.0000
2.4643	0.1175	0.1477	0.0013	1.7097	0.0000
2.5000	0.1182	0.1519	0.0013	1.7407	0.0000
2.5357	0.1190	0.1561	0.0014	1.7718	0.0000
2.5714	0.1197	0.1604	0.0015	1.8029	0.0000
2.6071	0.1205	0.1647	0.0015	1.8340	0.0000
2.6429	0.1213	0.1690	0.0016	1.8651	0.0000
2.6786	0.1220	0.1733	0.0016	1.8962	0.0000
2.7143	0.1228	0.1777	0.0017	1.9273	0.0000
2.7500	0.1235	0.1821	0.0017	1.9583	0.0000
2.7857	0.1243	0.1865	0.0375	1.9894	0.0000
2.8214	0.1251	0.1910	0.1014	2.0205	0.0000
2.8571	0.1259	0.1955	0.1780	2.0516	0.0000
2.8929	0.1266	0.2000	0.2546	2.0827	0.0000
2.9286	0.1274	0.2045	0.3191	2.1138	0.0000
2.9643	0.1282	0.2091	0.3639	2.1448	0.0000
3.0000	0.1290	0.2137	0.3915	2.1759	0.0000
3.0357	0.1298	0.2183	0.4230	2.2070	0.0000
3.0714	0.1305	0.2229	0.4485	2.2381	0.0000
3.1071	0.1313	0.2276	0.4727	2.2692	0.0000
3.1429	0.1321	0.2323	0.4957	2.3003	0.0000
3.1786	0.1329	0.2370	0.5177	2.3314	0.0000
3.2143	0.1337	0.2418	0.5388	2.3624	0.0000
3.2500	0.1345	0.2466	0.5591	2.3935	0.0000
3.2500	0.1345	0.2466	0.5787	2.3935	0.0000

Name : Surface ocell A BC D

Element Flows To:
Outlet 1 **Outlet 2**
Biocell A BC D

Name : Biocell F
Bottom Length: 1000.00 ft.
Bottom Width: 19.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0.5
Material type for second layer: Sand
Material thickness of third layer: 6
Material type for third layer: GRAVEL 0.52
Underdrain used
Underdrain Diameter (feet): 0.5
Orifice Diameter (in.): 1.1
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 1847.502
Total Outflow (ac-ft.): 1849.421
Percent Through Underdrain: 99.9
Discharge Structure
Riser Height: 0.75 ft.
Riser Diameter: 6 in.
Orifice 1 Diameter: 0.1 in. **Elevation:** 0.02 ft.
Orifice 2 Diameter: 0.1 in. **Elevation:** 0.1 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Biocell F Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.4362	0.0000	0.0000	0.0000
0.1016	0.4362	0.0203	0.0000	0.0000
0.2033	0.4362	0.0406	0.0000	0.0000
0.3049	0.4362	0.0608	0.0000	0.0000
0.4066	0.4362	0.0811	0.0037	0.0000
0.5082	0.4362	0.1014	0.0083	0.0000
0.6099	0.4362	0.1217	0.0106	0.0000
0.7115	0.4362	0.1419	0.0137	0.0000
0.8132	0.4362	0.1622	0.0152	0.0000
0.9148	0.4362	0.1825	0.0168	0.0000
1.0165	0.4362	0.2028	0.0189	0.0000
1.1181	0.4362	0.2230	0.0200	0.0000
1.2198	0.4362	0.2433	0.0212	0.0000
1.3214	0.4362	0.2636	0.0230	0.0000
1.4231	0.4362	0.2839	0.0239	0.0000
1.5247	0.4362	0.3016	0.0243	0.0000
1.6264	0.4362	0.3193	0.0251	0.0000
1.7280	0.4362	0.3371	0.0255	0.0000
1.8297	0.4362	0.3548	0.0267	0.0000
1.9313	0.4362	0.3725	0.0273	0.0000
2.0330	0.4362	0.3954	0.0281	0.0000

2.1346	0.4362	0.4182	0.0285	0.0000
2.2363	0.4362	0.4410	0.0296	0.0000
2.3379	0.4362	0.4639	0.0302	0.0000
2.4396	0.4362	0.4867	0.0309	0.0000
2.5412	0.4362	0.5095	0.0321	0.0000
2.6429	0.4362	0.5324	0.0327	0.0000
2.7445	0.4362	0.5552	0.0330	0.0000
2.8462	0.4362	0.5780	0.0335	0.0000
2.9478	0.4362	0.6009	0.0338	0.0000
3.0495	0.4362	0.6237	0.0347	0.0000
3.1511	0.4362	0.6465	0.0352	0.0000
3.2527	0.4362	0.6694	0.0362	0.0000
3.3544	0.4362	0.6922	0.0369	0.0000
3.4560	0.4362	0.7150	0.0380	0.0000
3.5577	0.4362	0.7379	0.0393	0.0000
3.6593	0.4362	0.7607	0.0405	0.0000
3.7610	0.4362	0.7835	0.0418	0.0000
3.8626	0.4362	0.8064	0.0431	0.0000
3.9643	0.4362	0.8292	0.0444	0.0000
4.0659	0.4362	0.8520	0.0456	0.0000
4.1676	0.4362	0.8749	0.0468	0.0000
4.2692	0.4362	0.8977	0.0479	0.0000
4.3709	0.4362	0.9205	0.0491	0.0000
4.4725	0.4362	0.9434	0.0502	0.0000
4.5742	0.4362	0.9662	0.0512	0.0000
4.6758	0.4362	0.9890	0.0523	0.0000
4.7775	0.4362	1.0119	0.0533	0.0000
4.8791	0.4362	1.0347	0.0544	0.0000
4.9808	0.4362	1.0575	0.0554	0.0000
5.0824	0.4362	1.0804	0.0564	0.0000
5.1841	0.4362	1.1032	0.0573	0.0000
5.2857	0.4362	1.1260	0.0583	0.0000
5.3874	0.4362	1.1489	0.0592	0.0000
5.4890	0.4362	1.1717	0.0601	0.0000
5.5907	0.4362	1.1945	0.0610	0.0000
5.6923	0.4362	1.2174	0.0619	0.0000
5.7940	0.4362	1.2402	0.0628	0.0000
5.8956	0.4362	1.2630	0.0637	0.0000
5.9973	0.4362	1.2859	0.0645	0.0000
6.0989	0.4362	1.3087	0.0654	0.0000
6.2005	0.4362	1.3315	0.0662	0.0000
6.3022	0.4362	1.3544	0.0670	0.0000
6.4038	0.4362	1.3772	0.0679	0.0000
6.5055	0.4362	1.4000	0.0687	0.0000
6.6071	0.4362	1.4229	0.0695	0.0000
6.7088	0.4362	1.4457	0.0702	0.0000
6.8104	0.4362	1.4685	0.0710	0.0000
6.9121	0.4362	1.4914	0.0718	0.0000
7.0137	0.4362	1.5142	0.0726	0.0000
7.1154	0.4362	1.5370	0.0733	0.0000
7.2170	0.4362	1.5599	0.0741	0.0000
7.3187	0.4362	1.5827	0.0748	0.0000
7.4203	0.4362	1.6055	0.0755	0.0000
7.5220	0.4362	1.6284	0.0763	0.0000
7.6236	0.4362	1.6512	0.0770	0.0000
7.7253	0.4362	1.6740	0.0777	0.0000
7.8269	0.4362	1.6969	0.0784	0.0000
7.9286	0.4362	1.7197	0.0791	0.0000

8.0000	0.4362	1.7358	0.0929	0.0000

Surface Biocell F Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
8.0000	0.4362	1.7358	0.0000	5.2778	0.0000
8.1016	0.4457	1.7806	0.0001	5.2778	0.0000
8.2033	0.4552	1.8264	0.0002	5.9931	0.0000
8.3049	0.4647	1.8731	0.0003	6.3507	0.0000
8.4066	0.4743	1.9208	0.0003	6.7084	0.0000
8.5082	0.4838	1.9695	0.0004	7.0660	0.0000
8.6099	0.4934	2.0192	0.0004	7.4237	0.0000
8.7115	0.5029	2.0698	0.0004	7.7813	0.0000
8.8132	0.5125	2.1215	0.0838	8.1390	0.0000
8.9148	0.5221	2.1740	0.2949	8.4966	0.0000
9.0165	0.5317	2.2276	0.4070	8.8543	0.0000
9.1181	0.5413	2.2821	0.4783	9.2120	0.0000
9.2198	0.5509	2.3376	0.5403	9.5696	0.0000
9.2500	0.5537	2.3543	0.5958	9.6759	0.0000

Name : Surface Biocell F

Element Flows To:
Outlet 1 **Outlet 2**
Biocell F

Name : Biocell E
Bottom Length: 470.00 ft.
Bottom Width: 20.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0.5
Material type for second layer: Sand
Material thickness of third layer: 5
Material type for third layer: GRAVEL 0.52
Underdrain used
Underdrain Diameter (feet): 1
Orifice Diameter (in.): 1.3
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 1134.451
Total Outflow (ac-ft.): 1134.624
Percent Through Underdrain: 99.98
Discharge Structure
Riser Height: 0.75 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 0.1 in. **Elevation:** 0.02 ft.
Orifice 2 Diameter: 0.1 in. **Elevation:** 0.1 ft.
Orifice 3 Diameter: 0.1 in. **Elevation:** 0.6 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Biocell E Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.2158	0.0000	0.0000	0.0000
0.0907	0.2158	0.0089	0.0000	0.0000
0.1813	0.2158	0.0179	0.0000	0.0000
0.2720	0.2158	0.0268	0.0000	0.0000
0.3626	0.2158	0.0358	0.0075	0.0000
0.4533	0.2158	0.0447	0.0121	0.0000
0.5440	0.2158	0.0537	0.0145	0.0000
0.6346	0.2158	0.0626	0.0182	0.0000
0.7253	0.2158	0.0716	0.0200	0.0000
0.8159	0.2158	0.0805	0.0220	0.0000
0.9066	0.2158	0.0895	0.0230	0.0000
0.9973	0.2158	0.0984	0.0244	0.0000
1.0879	0.2158	0.1074	0.0269	0.0000
1.1786	0.2158	0.1163	0.0281	0.0000
1.2692	0.2158	0.1253	0.0288	0.0000
1.3599	0.2158	0.1342	0.0299	0.0000
1.4505	0.2158	0.1431	0.0304	0.0000
1.5412	0.2158	0.1510	0.0322	0.0000
1.6319	0.2158	0.1588	0.0331	0.0000
1.7225	0.2158	0.1666	0.0342	0.0000
1.8132	0.2158	0.1744	0.0348	0.0000
1.9038	0.2158	0.1823	0.0364	0.0000
1.9945	0.2158	0.1901	0.0372	0.0000
2.0852	0.2158	0.2002	0.0382	0.0000
2.1758	0.2158	0.2102	0.0387	0.0000
2.2665	0.2158	0.2203	0.0396	0.0000
2.3571	0.2158	0.2304	0.0411	0.0000
2.4478	0.2158	0.2405	0.0419	0.0000
2.5385	0.2158	0.2505	0.0423	0.0000
2.6291	0.2158	0.2606	0.0431	0.0000
2.7198	0.2158	0.2707	0.0434	0.0000
2.8104	0.2158	0.2808	0.0442	0.0000
2.9011	0.2158	0.2909	0.0456	0.0000
2.9918	0.2158	0.3009	0.0463	0.0000
3.0824	0.2158	0.3110	0.0466	0.0000
3.1731	0.2158	0.3211	0.0478	0.0000
3.2637	0.2158	0.3312	0.0493	0.0000
3.3544	0.2158	0.3412	0.0510	0.0000
3.4451	0.2158	0.3513	0.0527	0.0000
3.5357	0.2158	0.3614	0.0544	0.0000
3.6264	0.2158	0.3715	0.0561	0.0000
3.7170	0.2158	0.3815	0.0578	0.0000
3.8077	0.2158	0.3916	0.0594	0.0000
3.8984	0.2158	0.4017	0.0610	0.0000
3.9890	0.2158	0.4118	0.0626	0.0000
4.0797	0.2158	0.4218	0.0641	0.0000
4.1703	0.2158	0.4319	0.0656	0.0000
4.2610	0.2158	0.4420	0.0670	0.0000
4.3516	0.2158	0.4521	0.0684	0.0000
4.4423	0.2158	0.4621	0.0698	0.0000
4.5330	0.2158	0.4722	0.0712	0.0000
4.6236	0.2158	0.4823	0.0725	0.0000
4.7143	0.2158	0.4924	0.0738	0.0000
4.8049	0.2158	0.5024	0.0751	0.0000
4.8956	0.2158	0.5125	0.0763	0.0000
4.9863	0.2158	0.5226	0.0776	0.0000

5.0769	0.2158	0.5327	0.0788	0.0000
5.1676	0.2158	0.5427	0.0800	0.0000
5.2582	0.2158	0.5528	0.0812	0.0000
5.3489	0.2158	0.5629	0.0824	0.0000
5.4396	0.2158	0.5730	0.0835	0.0000
5.5302	0.2158	0.5830	0.0847	0.0000
5.6209	0.2158	0.5931	0.0858	0.0000
5.7115	0.2158	0.6032	0.0869	0.0000
5.8022	0.2158	0.6133	0.0880	0.0000
5.8929	0.2158	0.6233	0.0891	0.0000
5.9835	0.2158	0.6334	0.0901	0.0000
6.0742	0.2158	0.6435	0.0912	0.0000
6.1648	0.2158	0.6536	0.0922	0.0000
6.2555	0.2158	0.6636	0.0933	0.0000
6.3462	0.2158	0.6737	0.0943	0.0000
6.4368	0.2158	0.6838	0.0953	0.0000
6.5275	0.2158	0.6939	0.0963	0.0000
6.6181	0.2158	0.7039	0.0973	0.0000
6.7088	0.2158	0.7140	0.0983	0.0000
6.7995	0.2158	0.7241	0.0992	0.0000
6.8901	0.2158	0.7342	0.1002	0.0000
6.9808	0.2158	0.7442	0.1012	0.0000
7.0000	0.2158	0.7464	0.1213	0.0000

Surface Biocell E Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
7.0000	0.2158	0.7464	0.0000	2.6111	0.0000
7.0907	0.2219	0.7662	0.0001	2.6111	0.0000
7.1813	0.2281	0.7866	0.0002	2.9267	0.0000
7.2720	0.2342	0.8076	0.0002	3.0846	0.0000
7.3626	0.2404	0.8291	0.0003	3.2424	0.0000
7.4533	0.2466	0.8512	0.0003	3.4002	0.0000
7.5440	0.2528	0.8738	0.0004	3.5580	0.0000
7.6346	0.2590	0.8970	0.0005	3.7158	0.0000
7.7253	0.2652	0.9207	0.0005	3.8736	0.0000
7.8159	0.2714	0.9451	0.1798	4.0314	0.0000
7.9066	0.2777	0.9700	0.6441	4.1893	0.0000
7.9973	0.2839	0.9954	1.2015	4.3471	0.0000
8.0879	0.2902	1.0214	1.7064	4.5049	0.0000
8.1786	0.2965	1.0480	2.0480	4.6627	0.0000
8.2500	0.3015	1.0694	2.2704	4.7870	0.0000

Name : Surface Biocell E

Element Flows To:

Outlet 1	Outlet 2
Biocell E	

Name : Lateral I Basin 1
Bypass: No

Impervious Land Use	acre
ROOF TOPS FLAT LAT	0.099

Element Flows To:
Outlet 1 **Outlet 2**

Name : Biocell H
Bottom Length: 100.00 ft.
Bottom Width: 43.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0.5
Material type for second layer: Sand
Material thickness of third layer: 3
Material type for third layer: GRAVEL 0.52
Underdrain used
Underdrain Diameter (feet): 1
Orifice Diameter (in.): 0.5
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 302.679
Total Outflow (ac-ft.): 304.219
Percent Through Underdrain: 99.49
Discharge Structure
Riser Height: 0.75 ft.
Riser Diameter: 6 in.
Orifice 1 Diameter: 0.2 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Biocell H Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0987	0.0000	0.0000	0.0000
0.0687	0.0987	0.0031	0.0000	0.0000
0.1374	0.0987	0.0062	0.0000	0.0000
0.2060	0.0987	0.0093	0.0000	0.0000
0.2747	0.0987	0.0124	0.0000	0.0000
0.3434	0.0987	0.0155	0.0005	0.0000
0.4121	0.0987	0.0186	0.0007	0.0000
0.4808	0.0987	0.0217	0.0014	0.0000
0.5495	0.0987	0.0248	0.0017	0.0000
0.6181	0.0987	0.0279	0.0021	0.0000
0.6868	0.0987	0.0310	0.0022	0.0000
0.7555	0.0987	0.0341	0.0025	0.0000
0.8242	0.0987	0.0372	0.0026	0.0000
0.8929	0.0987	0.0403	0.0028	0.0000
0.9615	0.0987	0.0434	0.0029	0.0000
1.0302	0.0987	0.0465	0.0031	0.0000
1.0989	0.0987	0.0496	0.0032	0.0000
1.1676	0.0987	0.0527	0.0033	0.0000
1.2363	0.0987	0.0558	0.0034	0.0000
1.3049	0.0987	0.0589	0.0036	0.0000
1.3736	0.0987	0.0620	0.0037	0.0000
1.4423	0.0987	0.0651	0.0038	0.0000

1.5110	0.0987	0.0678	0.0039	0.0000
1.5797	0.0987	0.0705	0.0040	0.0000
1.6484	0.0987	0.0732	0.0041	0.0000
1.7170	0.0987	0.0760	0.0042	0.0000
1.7857	0.0987	0.0787	0.0043	0.0000
1.8544	0.0987	0.0814	0.0044	0.0000
1.9231	0.0987	0.0841	0.0044	0.0000
1.9918	0.0987	0.0868	0.0046	0.0000
2.0604	0.0987	0.0903	0.0046	0.0000
2.1291	0.0987	0.0938	0.0047	0.0000
2.1978	0.0987	0.0973	0.0048	0.0000
2.2665	0.0987	0.1008	0.0049	0.0000
2.3352	0.0987	0.1043	0.0050	0.0000
2.4038	0.0987	0.1078	0.0050	0.0000
2.4725	0.0987	0.1112	0.0051	0.0000
2.5412	0.0987	0.1147	0.0052	0.0000
2.6099	0.0987	0.1182	0.0052	0.0000
2.6786	0.0987	0.1217	0.0054	0.0000
2.7473	0.0987	0.1252	0.0055	0.0000
2.8159	0.0987	0.1287	0.0058	0.0000
2.8846	0.0987	0.1322	0.0060	0.0000
2.9533	0.0987	0.1357	0.0063	0.0000
3.0220	0.0987	0.1392	0.0065	0.0000
3.0907	0.0987	0.1427	0.0067	0.0000
3.1593	0.0987	0.1462	0.0070	0.0000
3.2280	0.0987	0.1497	0.0072	0.0000
3.2967	0.0987	0.1531	0.0074	0.0000
3.3654	0.0987	0.1566	0.0076	0.0000
3.4341	0.0987	0.1601	0.0078	0.0000
3.5027	0.0987	0.1636	0.0080	0.0000
3.5714	0.0987	0.1671	0.0082	0.0000
3.6401	0.0987	0.1706	0.0084	0.0000
3.7088	0.0987	0.1741	0.0086	0.0000
3.7775	0.0987	0.1776	0.0088	0.0000
3.8462	0.0987	0.1811	0.0090	0.0000
3.9148	0.0987	0.1846	0.0091	0.0000
3.9835	0.0987	0.1881	0.0093	0.0000
4.0522	0.0987	0.1916	0.0095	0.0000
4.1209	0.0987	0.1950	0.0096	0.0000
4.1896	0.0987	0.1985	0.0098	0.0000
4.2582	0.0987	0.2020	0.0100	0.0000
4.3269	0.0987	0.2055	0.0101	0.0000
4.3956	0.0987	0.2090	0.0103	0.0000
4.4643	0.0987	0.2125	0.0104	0.0000
4.5330	0.0987	0.2160	0.0106	0.0000
4.6016	0.0987	0.2195	0.0107	0.0000
4.6703	0.0987	0.2230	0.0109	0.0000
4.7390	0.0987	0.2265	0.0110	0.0000
4.8077	0.0987	0.2300	0.0112	0.0000
4.8764	0.0987	0.2335	0.0113	0.0000
4.9451	0.0987	0.2369	0.0115	0.0000
5.0000	0.0987	0.2397	0.0152	0.0000

Surface Biocell H Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
5.0000	0.0987	0.2397	0.0000	1.1944	0.0000
5.0687	0.1001	0.2466	0.0003	1.1944	0.0000
5.1374	0.1014	0.2535	0.0004	1.3038	0.0000

5.2060	0.1028	0.2605	0.0005	1.3585	0.0000
5.2747	0.1042	0.2676	0.0006	1.4132	0.0000
5.3434	0.1056	0.2748	0.0006	1.4679	0.0000
5.4121	0.1070	0.2821	0.0007	1.5226	0.0000
5.4808	0.1084	0.2895	0.0008	1.5773	0.0000
5.5495	0.1098	0.2970	0.0008	1.6320	0.0000
5.6181	0.1112	0.3046	0.0009	1.6867	0.0000
5.6868	0.1126	0.3123	0.0009	1.7414	0.0000
5.7555	0.1141	0.3201	0.0031	1.7960	0.0000
5.8242	0.1155	0.3279	0.1062	1.8507	0.0000
5.8929	0.1170	0.3359	0.2537	1.9054	0.0000
5.9615	0.1184	0.3440	0.3602	1.9601	0.0000
6.0302	0.1199	0.3522	0.4179	2.0148	0.0000
6.0989	0.1214	0.3605	0.4662	2.0695	0.0000
6.1676	0.1228	0.3689	0.5100	2.1242	0.0000
6.2363	0.1243	0.3773	0.5503	2.1789	0.0000
6.2500	0.1246	0.3791	0.5878	2.1898	0.0000

Name : Surface Biocell H

Element Flows To:
Outlet 1 **Outlet 2**
Biocell H

Name : Biocell G
Bottom Length: 1000.00 ft.
Bottom Width: 30.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0.5
Material type for second layer: Sand
Material thickness of third layer: 6
Material type for third layer: GRAVEL 0.48
Infiltration On
Infiltration rate: 0
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 0
Total Volume Through Riser (ac-ft.): 18.401
Total Volume Through Facility (ac-ft.): 1868.602
Percent Infiltrated: 0
Total Precip Applied to Facility: 342.694
Total Evap From Facility: 218.478
Underdrain used
Underdrain Diameter (feet): 1
Orifice Diameter (in.): 0.8
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 1850.201
Total Outflow (ac-ft.): 1868.602
Percent Through Underdrain: 99.02
Discharge Structure
Riser Height: 0.75 ft.
Riser Diameter: 6 in.
Orifice 1 Diameter: 0.1 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 0.1 in. **Elevation:** 0.1 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Biocell G Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.6887	0.0000	0.0000	0.0000
0.1071	0.6887	0.0337	0.0000	0.0000
0.2143	0.6887	0.0675	0.0000	0.0000
0.3214	0.6887	0.1012	0.0000	0.0000
0.4286	0.6887	0.1350	0.0000	0.0000
0.5357	0.6887	0.1687	0.0000	0.0000
0.6429	0.6887	0.2025	0.0000	0.0000
0.7500	0.6887	0.2362	0.0000	0.0000
0.8571	0.6887	0.2700	0.0000	0.0000
0.9643	0.6887	0.3037	0.0000	0.0000
1.0714	0.6887	0.3374	0.0000	0.0000
1.1786	0.6887	0.3712	0.0000	0.0000
1.2857	0.6887	0.4049	0.0000	0.0000
1.3929	0.6887	0.4387	0.0000	0.0000
1.5000	0.6887	0.4724	0.0000	0.0000
1.6071	0.6887	0.5019	0.0000	0.0000
1.7143	0.6887	0.5314	0.0000	0.0000
1.8214	0.6887	0.5610	0.0000	0.0000
1.9286	0.6887	0.5905	0.0000	0.0000
2.0357	0.6887	0.6255	0.0000	0.0000
2.1429	0.6887	0.6606	0.0000	0.0000
2.2500	0.6887	0.6956	0.0000	0.0000
2.3571	0.6887	0.7307	0.0000	0.0000
2.4643	0.6887	0.7657	0.0000	0.0000
2.5714	0.6887	0.8008	0.0000	0.0000
2.6786	0.6887	0.8358	0.0000	0.0000
2.7857	0.6887	0.8709	0.0000	0.0000
2.8929	0.6887	0.9059	0.0000	0.0000
3.0000	0.6887	0.9410	0.0000	0.0000
3.1071	0.6887	0.9760	0.0000	0.0000
3.2143	0.6887	1.0111	0.0000	0.0000
3.3214	0.6887	1.0461	0.0000	0.0000
3.4286	0.6887	1.0812	0.0000	0.0000
3.5357	0.6887	1.1162	0.0000	0.0000
3.6429	0.6887	1.1513	0.0000	0.0000
3.7500	0.6887	1.1863	0.0000	0.0000
3.8571	0.6887	1.2214	0.0000	0.0000
3.9643	0.6887	1.2564	0.0000	0.0000
4.0714	0.6887	1.2915	0.0000	0.0000
4.1786	0.6887	1.3265	0.0000	0.0000
4.2857	0.6887	1.3616	0.0000	0.0000
4.3929	0.6887	1.3966	0.0000	0.0000
4.5000	0.6887	1.4317	0.0000	0.0000
4.6071	0.6887	1.4667	0.0000	0.0000
4.7143	0.6887	1.5018	0.0000	0.0000
4.8214	0.6887	1.5368	0.0000	0.0000
4.9286	0.6887	1.5719	0.0000	0.0000
5.0357	0.6887	1.6069	0.0000	0.0000
5.1429	0.6887	1.6420	0.0000	0.0000

5.2500	0.6887	1.6770	0.0000	0.0000
5.3571	0.6887	1.7121	0.0000	0.0000
5.4643	0.6887	1.7471	0.0000	0.0000
5.5714	0.6887	1.7822	0.0000	0.0000
5.6786	0.6887	1.8172	0.0000	0.0000
5.7857	0.6887	1.8523	0.0000	0.0000
5.8929	0.6887	1.8873	0.0000	0.0000
6.0000	0.6887	1.9224	0.0000	0.0000
6.1071	0.6887	1.9574	0.0000	0.0000
6.2143	0.6887	1.9925	0.0000	0.0000
6.3214	0.6887	2.0275	0.0000	0.0000
6.4286	0.6887	2.0626	0.0000	0.0000
6.5357	0.6887	2.0976	0.0000	0.0000
6.6429	0.6887	2.1327	0.0000	0.0000
6.7500	0.6887	2.1677	0.0000	0.0000
6.8571	0.6887	2.2028	0.0000	0.0000
6.9643	0.6887	2.2378	0.0000	0.0000
7.0714	0.6887	2.2729	0.0000	0.0000
7.1786	0.6887	2.3079	0.0000	0.0000
7.2857	0.6887	2.3430	0.0000	0.0000
7.3929	0.6887	2.3780	0.0000	0.0000
7.5000	0.6887	2.4131	0.0000	0.0000
7.6071	0.6887	2.4481	0.0000	0.0000
7.7143	0.6887	2.4832	0.0000	0.0000
7.8214	0.6887	2.5182	0.0000	0.0000
7.9286	0.6887	2.5533	0.0000	0.0000
8.0000	0.6887	2.5767	0.0000	0.0000

Surface Biocell G Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
8.0000	0.6887	2.5767	0.0000	8.3333	0.0000
8.1071	0.6988	2.6510	0.0000	8.3333	0.0000
8.2143	0.7090	2.7264	0.0000	9.5238	0.0000
8.3214	0.7191	2.8029	0.0000	10.119	0.0000
8.4286	0.7293	2.8805	0.0021	10.714	0.0000
8.5357	0.7395	2.9592	0.0046	11.310	0.0000
8.6429	0.7497	3.0390	0.0058	11.905	0.0000
8.7500	0.7598	3.1198	0.0075	12.500	0.0000
8.8571	0.7700	3.2018	0.0083	13.095	0.0000
8.9643	0.7803	3.2849	0.0091	13.690	0.0000
9.0714	0.7905	3.3690	0.0103	14.286	0.0000
9.1786	0.8007	3.4542	0.0109	14.881	0.0000
9.2857	0.8109	3.5406	0.0116	15.476	0.0000
9.3929	0.8212	3.6280	0.0125	16.071	0.0000
9.5000	0.8314	3.7165	0.0130	16.667	0.0000
9.6071	0.8417	3.8062	0.0132	17.262	0.0000
9.7143	0.8519	3.8969	0.0136	17.857	0.0000
9.7500	0.8553	3.9274	0.0138	18.056	0.0000

Name : Surface Biocell G

Element Flows To:

Outlet 1	Outlet 2
Biocell G	

Name : Lateral I Basin 2
Bypass: No

Impervious Land Use	acre
SIDEWALKS FLAT LAT	0.016

Element Flows To:

Outlet 1	Outlet 2

Name : Lateral Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.085

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin I
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.424
Pervious Total	0.424

Impervious Land Use	acre
ROADS FLAT	0.299
ROOF TOPS FLAT	0.592
DRIVEWAYS FLAT	0.134
SIDEWALKS FLAT	0.051
Impervious Total	1.076
Basin Total	1.5

Element Flows To:

Surface	Interflow	Groundwater
Surface Biocell I	Surface Biocell I	

Name : Biocell I
Bottom Length: 100.00 ft.

Bottom Width: 36.00 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 0
Material type for second layer: Sand
Material thickness of third layer: 0
Material type for third layer: GRAVEL
Underdrain used
Underdrain Diameter (feet): 0.5
Orifice Diameter (in.): 1
Offset (in.): 0
Flow Through Underdrain (ac-ft.): 516.807
Total Outflow (ac-ft.): 535.928
Percent Through Underdrain: 96.43
Discharge Structure
Riser Height: 0.5 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 0.5 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1 **Outlet 2**
Surface Biocell F

Biocell I Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0826	0.0000	0.0000	0.0000
0.0275	0.0826	0.0010	0.0000	0.0000
0.0549	0.0826	0.0021	0.0000	0.0000
0.0824	0.0826	0.0031	0.0000	0.0000
0.1099	0.0826	0.0042	0.0000	0.0000
0.1374	0.0826	0.0052	0.0002	0.0000
0.1648	0.0826	0.0062	0.0045	0.0000
0.1923	0.0826	0.0073	0.0065	0.0000
0.2198	0.0826	0.0083	0.0090	0.0000
0.2473	0.0826	0.0093	0.0120	0.0000
0.2747	0.0826	0.0104	0.0142	0.0000
0.3022	0.0826	0.0114	0.0149	0.0000
0.3297	0.0826	0.0125	0.0156	0.0000
0.3571	0.0826	0.0135	0.0162	0.0000
0.3846	0.0826	0.0145	0.0168	0.0000
0.4121	0.0826	0.0156	0.0174	0.0000
0.4396	0.0826	0.0166	0.0180	0.0000
0.4670	0.0826	0.0177	0.0185	0.0000
0.4945	0.0826	0.0187	0.0191	0.0000
0.5220	0.0826	0.0197	0.0196	0.0000
0.5495	0.0826	0.0208	0.0201	0.0000
0.5769	0.0826	0.0218	0.0206	0.0000
0.6044	0.0826	0.0228	0.0211	0.0000
0.6319	0.0826	0.0239	0.0216	0.0000
0.6593	0.0826	0.0249	0.0220	0.0000
0.6868	0.0826	0.0260	0.0225	0.0000
0.7143	0.0826	0.0270	0.0229	0.0000
0.7418	0.0826	0.0280	0.0234	0.0000
0.7692	0.0826	0.0291	0.0238	0.0000
0.7967	0.0826	0.0301	0.0242	0.0000

0.8242	0.0826	0.0311	0.0246	0.0000
0.8516	0.0826	0.0322	0.0250	0.0000
0.8791	0.0826	0.0332	0.0254	0.0000
0.9066	0.0826	0.0343	0.0258	0.0000
0.9341	0.0826	0.0353	0.0262	0.0000
0.9615	0.0826	0.0363	0.0266	0.0000
0.9890	0.0826	0.0374	0.0270	0.0000
1.0165	0.0826	0.0384	0.0274	0.0000
1.0440	0.0826	0.0395	0.0277	0.0000
1.0714	0.0826	0.0405	0.0281	0.0000
1.0989	0.0826	0.0415	0.0284	0.0000
1.1264	0.0826	0.0426	0.0288	0.0000
1.1538	0.0826	0.0436	0.0291	0.0000
1.1813	0.0826	0.0446	0.0295	0.0000
1.2088	0.0826	0.0457	0.0298	0.0000
1.2363	0.0826	0.0467	0.0302	0.0000
1.2637	0.0826	0.0478	0.0305	0.0000
1.2912	0.0826	0.0488	0.0308	0.0000
1.3187	0.0826	0.0498	0.0312	0.0000
1.3462	0.0826	0.0509	0.0315	0.0000
1.3736	0.0826	0.0519	0.0318	0.0000
1.4011	0.0826	0.0530	0.0321	0.0000
1.4286	0.0826	0.0540	0.0324	0.0000
1.4560	0.0826	0.0550	0.0327	0.0000
1.4835	0.0826	0.0561	0.0331	0.0000
1.5000	0.0826	0.0567	0.0384	0.0000

Surface Biocell I Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
1.5000	0.0826	0.0567	0.0000	1.0000	0.0000
1.5275	0.0832	0.0590	0.0011	1.0000	0.0000
1.5549	0.0837	0.0613	0.0016	1.0366	0.0000
1.5824	0.0842	0.0636	0.0019	1.0549	0.0000
1.6099	0.0847	0.0659	0.0022	1.0733	0.0000
1.6374	0.0852	0.0682	0.0025	1.0916	0.0000
1.6648	0.0858	0.0706	0.0028	1.1099	0.0000
1.6923	0.0863	0.0729	0.0030	1.1282	0.0000
1.7198	0.0868	0.0753	0.0032	1.1465	0.0000
1.7473	0.0873	0.0777	0.0034	1.1648	0.0000
1.7747	0.0879	0.0801	0.0036	1.1832	0.0000
1.8022	0.0884	0.0825	0.0037	1.2015	0.0000
1.8297	0.0889	0.0850	0.0039	1.2198	0.0000
1.8571	0.0894	0.0874	0.0041	1.2381	0.0000
1.8846	0.0900	0.0899	0.0042	1.2564	0.0000
1.9121	0.0905	0.0924	0.0044	1.2747	0.0000
1.9396	0.0910	0.0949	0.0045	1.2930	0.0000
1.9670	0.0916	0.0974	0.0046	1.3114	0.0000
1.9945	0.0921	0.0999	0.0048	1.3297	0.0000
2.0220	0.0926	0.1024	0.0395	1.3333	0.0000
2.0495	0.0932	0.1050	0.1216	1.3333	0.0000
2.0769	0.0937	0.1075	0.2308	1.3333	0.0000
2.1044	0.0943	0.1101	0.3608	1.3333	0.0000
2.1319	0.0948	0.1127	0.5069	1.3333	0.0000
2.1593	0.0954	0.1153	0.6652	1.3333	0.0000
2.1868	0.0959	0.1180	0.8317	1.3333	0.0000
2.2143	0.0964	0.1206	1.0023	1.3333	0.0000
2.2418	0.0970	0.1233	1.1729	1.3333	0.0000
2.2692	0.0975	0.1259	1.3393	1.3333	0.0000

2.2967	0.0981	0.1286	1.4975	1.3333	0.0000
2.3242	0.0986	0.1313	1.6440	1.3333	0.0000
2.3516	0.0992	0.1340	1.7758	1.3333	0.0000
2.3791	0.0998	0.1368	1.8908	1.3333	0.0000
2.4066	0.1003	0.1395	1.9882	1.3333	0.0000
2.4341	0.1009	0.1423	2.0685	1.3333	0.0000
2.4615	0.1014	0.1451	2.1341	1.3333	0.0000
2.4890	0.1020	0.1479	2.1894	1.3333	0.0000
2.5000	0.1022	0.1490	2.2704	1.3333	0.0000

Name : Surface Biocell I

Element Flows To:

Outlet 1	**Outlet 2**
Surface Biocell F	Biocell I

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:17.646
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:4.955
Total Impervious Area:10.997

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.381477
5 year	0.561009
10 year	0.654942
25 year	0.748566
50 year	0.803401
100 year	0.848083

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.242107
5 year	0.413274
10 year	0.572768
25 year	0.841843
50 year	1.102431
100 year	1.425311

Stream Protection Duration

POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1907	55986	49138	87	Pass
0.1969	51736	41288	79	Pass
0.2031	47382	34891	73	Pass
0.2093	43969	30459	69	Pass
0.2155	40842	26936	65	Pass
0.2217	38051	23683	62	Pass
0.2279	35557	20892	58	Pass
0.2341	32799	17941	54	Pass
0.2402	30641	15755	51	Pass
0.2464	28648	13955	48	Pass
0.2526	26787	12397	46	Pass
0.2588	25158	11137	44	Pass
0.2650	23319	9893	42	Pass
0.2712	21893	9078	41	Pass
0.2774	20572	8263	40	Pass
0.2836	19328	7663	39	Pass
0.2898	18128	7157	39	Pass
0.2959	17049	6700	39	Pass
0.3021	15838	6259	39	Pass
0.3083	14902	5962	40	Pass
0.3145	14010	5681	40	Pass
0.3207	13185	5385	40	Pass
0.3269	12414	5081	40	Pass
0.3331	11610	4759	40	Pass
0.3393	11010	4524	41	Pass
0.3455	10393	4305	41	Pass
0.3516	9859	4112	41	Pass
0.3578	9292	3941	42	Pass
0.3640	8731	3770	43	Pass
0.3702	8269	3639	44	Pass
0.3764	7834	3532	45	Pass
0.3826	7399	3416	46	Pass
0.3888	7030	3300	46	Pass
0.3950	6689	3199	47	Pass
0.4011	6336	3053	48	Pass
0.4073	6078	2944	48	Pass
0.4135	5824	2835	48	Pass
0.4197	5577	2743	49	Pass
0.4259	5349	2645	49	Pass
0.4321	5089	2530	49	Pass
0.4383	4875	2441	50	Pass
0.4445	4676	2348	50	Pass
0.4507	4444	2280	51	Pass
0.4568	4242	2201	51	Pass
0.4630	4012	2132	53	Pass
0.4692	3853	2056	53	Pass
0.4754	3698	2001	54	Pass
0.4816	3547	1933	54	Pass
0.4878	3406	1864	54	Pass
0.4940	3290	1798	54	Pass
0.5002	3151	1728	54	Pass
0.5064	3055	1659	54	Pass

0.5125	2969	1604	54	Pass
0.5187	2891	1551	53	Pass
0.5249	2806	1503	53	Pass
0.5311	2718	1436	52	Pass
0.5373	2636	1383	52	Pass
0.5435	2505	1347	53	Pass
0.5497	2427	1314	54	Pass
0.5559	2328	1273	54	Pass
0.5620	2200	1227	55	Pass
0.5682	2103	1187	56	Pass
0.5744	2005	1147	57	Pass
0.5806	1915	1111	58	Pass
0.5868	1845	1079	58	Pass
0.5930	1771	1049	59	Pass
0.5992	1701	1011	59	Pass
0.6054	1635	984	60	Pass
0.6116	1574	960	60	Pass
0.6177	1509	942	62	Pass
0.6239	1451	923	63	Pass
0.6301	1389	899	64	Pass
0.6363	1325	877	66	Pass
0.6425	1268	857	67	Pass
0.6487	1226	839	68	Pass
0.6549	1176	819	69	Pass
0.6611	1115	793	71	Pass
0.6673	1066	762	71	Pass
0.6734	1029	724	70	Pass
0.6796	994	699	70	Pass
0.6858	958	673	70	Pass
0.6920	922	646	70	Pass
0.6982	882	618	70	Pass
0.7044	821	593	72	Pass
0.7106	759	573	75	Pass
0.7168	722	552	76	Pass
0.7230	690	531	76	Pass
0.7291	643	507	78	Pass
0.7353	608	492	80	Pass
0.7415	562	479	85	Pass
0.7477	530	464	87	Pass
0.7539	494	443	89	Pass
0.7601	453	430	94	Pass
0.7663	427	413	96	Pass
0.7725	396	397	100	Pass
0.7786	367	380	103	Pass
0.7848	355	369	103	Pass
0.7910	333	351	105	Pass
0.7972	317	343	108	Pass
0.8034	300	330	110	Pass