Preliminary Drainage Report for:

Rivertown Homes LLC –Unit-Lot Subdivision

PLN #1115/1116
Arlington, WA

January 2024

Prepared by:

Cascade Surveying & Engineering., Inc

Job #23305

Table of Contents

Executive Summary

The proposal is a unit lot subdivision to create twelve unit lots from two existing adjacent lots that have an approximate combined size of 0.69 ac. Two existing residences will be demolished, and 6 duplexes will be proposed for a total of 12 units. Each of the units will have a one-car garage with a second parking space provided on the driveway. Additionally, one guest parking space will be provided for every 4 units. Proposed driveways and parking will take access via an alley along the southern boundary of the properties.

Compliance with Minimum Requirements:

1	*Prepare Stormwater Site Plan*	A stormwater site plan report and drawing are presented in this document.
2	*SWPPP*	A SWPPP document is prepared and provided. (See separate document.)
3	*Water Pollution Source Control*	BMP's for source control are noted in the SWPPP.
4	*Preserve Natural Drainage*	Natural drainage to the city storm drain system is maintained.
5	*On-site Stormwater Management*	Onsite stormwater will be managed by implementing Downspout Infiltration systems and permeable pavement. Frontage improvements will be mitigated though detention. Post Construction Soil Quality and Depth will also be implemented as outlined in MR#5.
6	*Runoff Treatment*	Not Required
7	*Flow Control*	Exempt from flow control.
8	*Stormwater Discharge to Wetland*	Wetlands have not been identified onsite. Proposed conditions will not discharge to wetlands.
9	*Inspection, Operation and Maintenance*	The Operation & Maintenance Manual will be provided in the final drainage report.

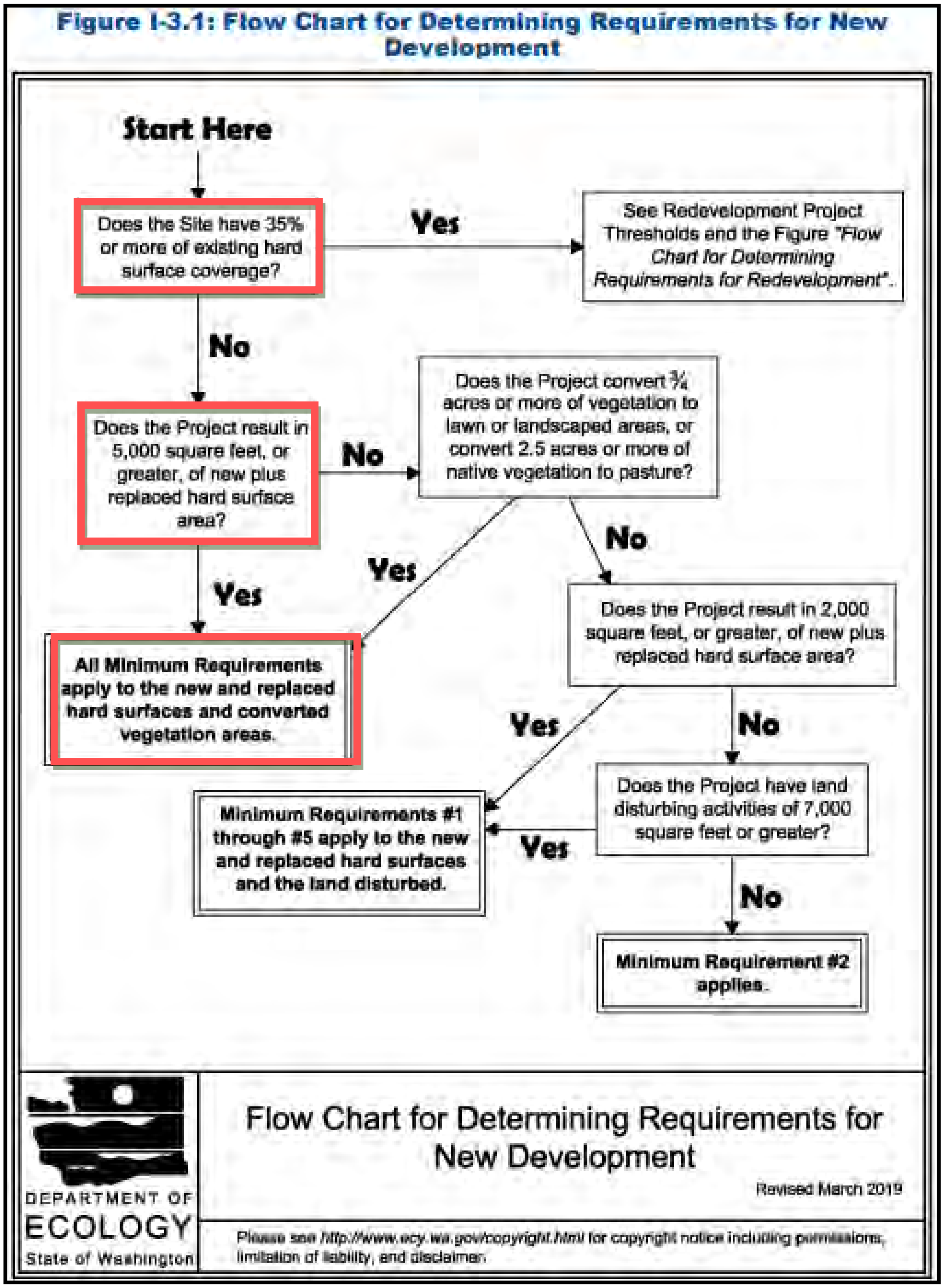


Figure 1: *Minimum Requirements Flow chart*

Vicinity Map

PROPERTY DESCRIPTION

The project site is in a portion of Government Lot 11, Section 02, Township 31 North, Range 05 East W.M. More specifically the site lies at 416 & 422 E Gilman Ave, Arlington, WA 98223. The site is identified as tax parcel #'s 00461801000400 & 00461801000100 as shown below in Figure 1, highlighted in red.

***Figure 2**: Vicinity Map. Not to scale.*

DRAINAGE INFORMATION SUMMARY FORM

Project Total Area: **0.69 ± acres**

Area of Disturbance: **0.69 ± acres**

Number of Lots (if applies): **2 lots existing, 12 lots proposed**

Summary Table

Drainage Basin Information	**Individual Basin Information**
	A
On-site Sub-basin Area (acres)	0.69-ac
Type of Storage Proposed	None (Exempt)
Appx. Dead Storage Vol (cf)	N/A
Appx. Live Storage Vol (cf)	N/A
Soil Type(s) (Natural Resource Conservation Service)	Everett Very Gravelly Sandy Loam
Pre-developed Discharge Rates	Assumes Forested
Q (cfs.)	
2 yr.	0.045
10 yr.	0.079
50 yr./100 yr.	0.116/0.134
Post-development Runoff Rates (without quantity controls)	
Q (cfs.)	
2 yr.	0.299
10 yr.	0.482
50 yr./100 yr.	0.668/0.755
Post-development Runoff Rates (with quantity controls)	
Q (cfs.)	
2 yr.	N/A
10 yr.	N/A
50 yr.	N/A
Offsite Upstream Area	
Number of acres	0.03

MR #1 Stormwater Site Plan Narrative

PROJECT DESCRIPTION

This project proposes a twelve-lot major plat from two existing lots with a combined size of 0.69-acre. There will be 6 proposed duplexes and 12 total lots. All existing structures will be removed. Driveways, parking, and sidewalks will be provided for each lot.

METHODOLOGY

The drainage calculations have been prepared using the 2019 Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW2019), The City of Arlington Engineering Standards, and the 2012 Western Washington Hydrology Model (WWHM2012). The total impervious surfaces is greater than 5,000 sf. Therefore, the site will need to comply with Minimum Requirements (MR's) 1-9 from the Stormwater Management Manual for Western Washington.

EXISTING CONDITIONS

The 2 existing parcels contain two single family homes and multiple outbuildings. The existing homes take access off the alley located along the south property line. The parcels are bounded by Gilman Avenue to the north, Talcott Street to the east, an alley to the south and an existing single family home to the west.

Table 1: Existing Impervious Surfaces

Existing Roof	2,815 sf
Existing Driveway/Parking	979 sf
Existing Walkway	190 sf
Total	**3,984 sf**

NRCS Soil Survey the site is soils are Everett Very Gravelly Sandy Loam, 0 to 8 percent slope. Everett very gravelly sandy loam is described as being very deep, somewhat excessively drained soil found on terraces and outwash plains. Permeability of the soil is rapid and available water capacity is low. The top 6 inches is typically a dark brown gravelly sandy loam. The subsoil is about 12 inches thick and is dark brown very gravelly sandy loam. Below these layers the substratum is brown very gravelly loam for about 5 inches and then dark brown extremely gravely sand to a depth of 60 inches or more. It is categorized as hydrologic soils group A.

GeoTest performed an infiltration assessment of the project site. Four test pits were dug on the southern portion of the site. Per the GeoTest report, surface explorations found "approximately 1.2 to 1.2 feet of topsoil overlying medium-dense, weathered, sandy gravel to gravelly sand (Arlington Gravel) that became unweathered at approximately 3.5 to 4 feet below ground level (BGS.) Till was encountered in TP-1, TP-3, and the PIT excavation at approximately 6 to 7 feet BGS." An infiltration test performed in their PIT excavation found the soils to have a limited to moderate infiltration potential. No ground water was encountered at the time of exploration, but it was noted that there is potential for perched water atop the till layer. The recommended, long-term infiltration rate provided for design is 1.9 in/hr. (See Infiltration Assessment Report, GeoTest separate document.

Onsite topography is flat along the south property line then has a 2 horizontal to 1 vertical slope to the north side of the property, down to the existing sidewalk on Gilman Ave. The southerly portion of the property is lawn and the northerly portion is wooded. The slopes are covered in trees and ivy. See figure 3 below.

***Figure 3**: Property Existing Vegetation. Photo from Gilman Looking South*

DEVELOPED CONDITIONS

This project is proposing a 12 lot unit lot subdivision, 6 duplexes with a driveway, parking pads and walkways are proposed. Lots will take access from proposed driveways at the alley. The alleyway connects to E Manhattan St and N Talcott St to the west and east respectively. Impervious surface breakdown is as follows:

Table 2: Proposed Impervious Surfaces Onsite

Proposed Roof	14,640 sf
Proposed Driveway	3,634 sf
Proposed Sidewalk	1,669 sf
Total Proposed	**19,943 sf**

Table 3: Proposed Offsite & Frontage Impervious Surfaces

Road Widening	1,004 sf
Sidewalk	524 sf
Alley Pavement	411 sf
Total Proposed Offsite	**1,939 sf**

The proposed development results in more than 5,000 sq ft of new and replaced impervious surface. and the project must comply with minimum requirements 1-9.

UPSTREAM ANALYSIS

The surrounding area generally slopes to the north which is the direction surface runoff will travel if not infiltrated. The upstream alley is mostly paved with asphalt draining to the east. The asphalt section is channeled to the center and drains into an existing city storm catch basin located in Talcott St at the center of the alley. This section of the alley will intercept upstream flow from the south and route the flow along the frontage through the city storm drainage system.

The upstream Basin that drains to the alley and frontage of Talcott St is approximately 0.90 acres and consists of an existing apartment building, lawn, and forested area.

The west 45' of alley is gravel and a portion of this gravel flows onto the property.

DOWNSTREAM ANALYSIS

Stormwater that does not infiltrate onsite will leave the north property line and enter into 2 existing catch basins on the south side of E Gilman Ave, located approximately at the middle of the north property line and wets of the property. The two city storm catch basins capture runoff and look to flow back onto the site. It is not clear how they connect to the city system if at all.

From the catch basin closest to the frontage of the property flow travels towards the site in a 4" HDPE pipe where it likely is infiltrated. Any flow that dose not flow onto the site will sheet flow to the west in Gilman Ave. Flow will then enter an existing catch basins on Gilman and Manhattan St where it will drain north in a 8" PVC pipe then head will travel generally east up to 465 ft through an 8" concrete pipe on the north side of E. Gilman Ave. Flow enters a Type 2 manhole then drains north 260 ft through a 24" HDPE pipe along the west side of N. Talcott St. then northeast 125 ft through 18" HDPE then 18" concrete pipe, along the south side of SR 530, to an outfall discharging into the South Fork Stillaguamish River. The outfall is protected with a rip-rap headwall that extends to the ordinary high-water mark of the river shown in figure 3 below. Flow continues in the South Fork Stillaguamish River past the point where flow has traveled ¼ mile from where it leaves the site. See the Drainage Basin Map in the appendix showing the downstream flow path.

Figure 3*: City of Arlington MS4 Rip Rap Protected Outfall*

FLOW CONTROL

The project does not meet any of the thresholds requiring flow control. See MR 7 for more information.

RUNOFF TREATMENT

The on-site basin proposes less than 5,000 sf of pollutant generating impervious surfaces and therefore runoff treatment is not required.

MR #2 Stormwater Pollution Prevention Plan Narrative

Element 1: Preserve Vegetation/Mark Clearing Limits

The clearing limits will be depicted on the construction plans and will be delineated in the field prior to construction.

Element 2: Establish Construction Access

Construction access will be via the existing gravel driveway on the property. The driveway will be re-graveled as necessary to ensure it will continue to function adequately.

Element 3: Control Flow Rates

Flow rate controls for the construction phase will be outlined on the SWPPP construction plans.

Element 4: Install Sediment Controls

Sediment control will be identified on the construction plans, and further discussed under MR #3 in this report. The following BMPs will be used:

BMP C105 Stabilized Construction Entrance
BMP C233 Silt Fence

Element 5: Stabilize Soils

Soil stabilization controls will be identified on the construction plans, and further discussed under MR #3 in this report. The following BMPs will be used:

BMP C 101 Preserve Natural Vegetation
BMP C120 Temporary & Permanent Seeding
BMP C121 Mulching
BMP C123 Plastic Covering
BMP C125 Topsoiling

Element 6: Protect Slopes

All new cut/fill slopes will be limited to a maximum slope of 3:1

Element 7: Protect Permanent Drain Inlets

Storm drain inlet protection will be provided for any existing and proposed storm drain inlets. The following BMPs will be used:

BMP C220 Storm Drain Inlet Protection

Element 8: Stabilize Channels and Outlets

There are no channels being proposed at this time.

Element 9: Control Pollutants

All pollutants, including waste materials and demolition debris, that occur on-site shall be handled and disposed of in a manner that does not cause contamination of stormwater.

Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (See Chapter 173-304 WAC for the definition of inert waste). On-site fueling tanks shall include secondary containment capable of containing 110% of the tank volume.

Maintenance and repair of heavy equipment and vehicles involving oil changes, hydraulic system drain down, solvent and de-greasing cleaning operations, fuel tank drain down and removal, and other activities which may result in discharge or spillage of pollutants to the ground or into stormwater runoff must be conducted using spill prevention measures, such as drip pans. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle.

Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations for applications rates and procedures shall be followed.

BMPs shall be used to prevent or treat contaminated stormwater runoff by pH modifying sources. These sources include, but are not limited to, bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, and concrete pumping and mixer washout waters. Stormwater discharges shall not cause or contribute to a violation of the water quality standard for pH in the receiving water.

Element 10: Control Dewatering

There is no dewatering proposed at this time.

Element 11: Maintain Best Management Practices

Notes for the maintenance of erosion control facilities will be included in the construction plans.

Element 12: Manage the Project

The project will be subject to seasonal work limitations, site inspection and monitoring as required by City of Arlington. Erosion control monitoring and supervision will be managed by the contractor.

Element 13: Protect Low Impact Development (LID) BMP's

Erosion control techniques will be implemented to avoid introducing sediment from surrounding land uses onto permeable pavements. Note: Do not allow muddy construction

equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements.
All heavy equipment must be kept off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils.

MR #3 Water Pollution Source Control

No known pollution generating activities described in volume IV, chapters 3 and 4 of the SWMMWW will be performed on-site during construction or are proposed for the developed site following construction. Any sources of pollution that may result from the construction activity will be controlled according to SWPPP Element #9, Control Pollutants.

MR #4 Preservation of Natural Drainage Patterns

The natural drainage patterns identified in the drainage report under MR #1 and on the stormwater site plan will be maintained during construction and post development. Existing stormwater generally tends to flow northwest towards the right of way flowline as discussed in MR #1.

MR #5 On-Site Stormwater Management

As outlined in Volume I, Chapter 1-3.4.5 of the 2019 SWMMWW, sites triggering MR's 1-9 must meet requirements in Table 1-3.1 in the manual. For this new development project in the UGA List #2 of Table 1-3.2 will be implemented; considering each BMP listed for each surface will be analyzed in the order provided with design criteria and infeasibility as outlined in the manual.

List #2

Surface Type: Lawn and Landscaped Areas

All lawn and landscape areas shall implement Post-Construction Soil Quality and Depth as outlined below.

1. **BMP T5.13 Post Construction Soil Quality and Depth:**
   Post Construction Soil Quality and Depth will be used on site to recondition those areas that were impacted due to construction activities. Those areas to be reconditioned will be identified on the construction plans. The existing on-site topsoil will be stockpiled for use to meet the post construction soil standard. If the quantity or quality of the stockpiled on-site topsoil is insufficient, the soil amendment areas can be tilled, and compost added to the soil prior to final seeding. The intent of this BMP is to restore the pre-developed drainage characteristics of the

soil. The specific requirements for the post construction soil quality and depth are detailed on the construction plans.

Surface Type: Roofs

Roof areas shall be considered in the order listed and analyzed for infeasibility. As outlined in Volume I, of the SWMMWW BMPs shall be analyzed as follows:

2. **BMP T5.30 Full Dispersion or BMP T5.10A: Downspout Full Infiltration**

   Full dispersion is considered infeasible due to the inability of attaining the minimum 100 ft vegetated flow path because of limited space on the site.

   Downspout full infiltration is considered feasible with the proposed infiltration trench located south of the buildings. This requires the downspouts for the north roof area to be piped along the side of the buildings to the south side (at approximately the second floor level), where all roof runoff will be conveyed to an infiltration trench. The trench size is calculated using a rate for medium sand (30LF/1000 SF roof area). This area is omitted from the WWHM models consistent with guidelines of BMP T5.10A.

Surface Type: Other Hard Surfaces

Other Hard Surfaces shall be considered in the order listed in list 2 of Table 1-3.2 and analyzed for infeasibility as outlined in Volume I.

3. **BMP T5.30 Full-Dispersion**
   Full dispersion is considered infeasible due to the inability of attaining the minimum 100 ft vegetated flow path because of limited space on the site.

4. **BMP T5.15 Permeable Pavement**
   Permeable pavement is considered feasible and will be implemented for the driveways and parking area. Permeable pavement is not considered feasible for the frontage improvement on N. Talcott St. or the onsite walkway along E. Gilman Ave due the proximity to the wall and building foundations.

5. **BMP T7.30 Bioretention**
   Bioretention is not considered feasible for the frontage improvements on N. Talcott St. due to the slopes and proposed walls.

6. **BMP T5.12 Sheet Flow Dispersion or BMP T5.11 Concentrated Flow Dispersion**
   Sidewalk north of the buildings will implement sheet flow dispersion and sheet flow through the yard area.

None of the BMPs for "other hard surfaces" for the frontage improvements to N. Talcott St. are considered feasible. It is proposed that the runoff from the road and sidewalk be conveyed into a detention system located in the northeast corner of the property that will outlet to the existing catch basin at the intersection of E. Gilman Ave and N. Talcott St. Overflow for the permeable pavement and downspout infiltration trench will be routed through this proposed detention system.

MR #6 Runoff Treatment

The on-site basin proposes less than 5,000 sf of pollutant generating impervious surfaces and therefore runoff treatment is not required.

MR #7 Flow Control

Per SWMMWW I-3.4.7 *MR 7 Flow Control TDA Thresholds*, the thresholds requiring flow control are shown below:

- The total "effective impervious surfaces" is less than 10,000 square feet. (Buildings and driveway/parking are fully infiltrated making them ineffective.)
- Less than 3/4-acre of native vegetation is converted to lawn or landscape.
- Less than 2.5 acres of native vegetation are converted to pasture.
- Converted vegetation areas and effective impervious surfaces, cause less than 0.15 cubic feet per second (cfs) in the 100-year flow (See No Control WWHM report in Appendix).

Roof areas infiltrated through downspout full infiltration systems and driveway/parking areas 100% infiltrated through permeable pavement are considered "ineffective impervious areas" and are omitted from the WWHM models. The project results in 950 sf of effective impervious area and as demonstrated in the no control WWHM, causes less than 0.15 cfs for the 100 year flow. Therefore the project does not meet any of the thresholds listed above that require flow control.

MR #8 Wetland Protection

There are no wetlands within the property limits or on nearby adjacent properties. No treatment or flow facilities are necessary regarding wetland protection.

MR #9 Operations & Maintenance

An operation and maintenance manual will be provided with construction plans.

Appendix

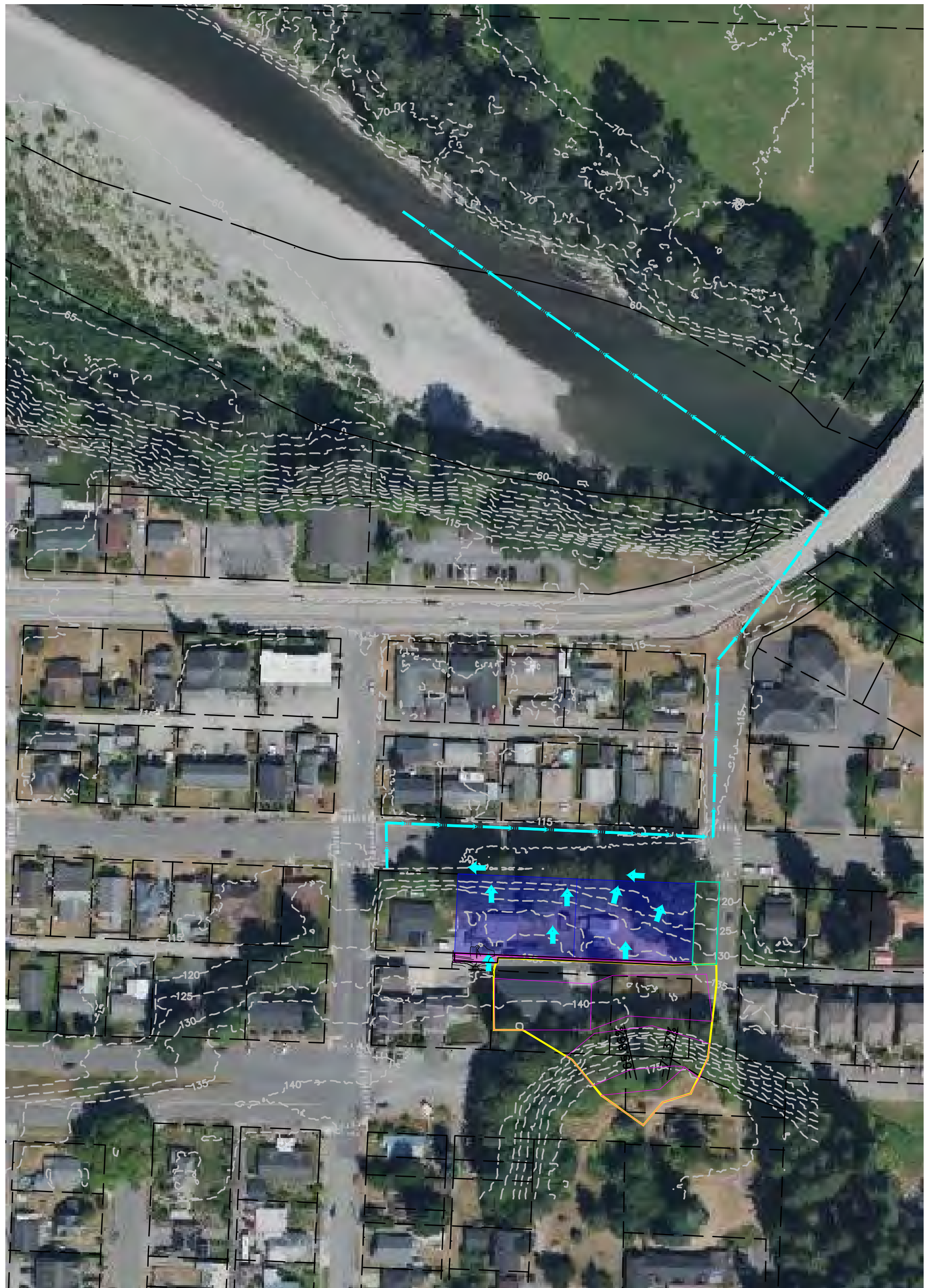
DRAINAGE BASIN MAP

NRCS SOIL REPORT

NO CONTROL WWHM

PERMEABLE PAVEMENT & STORMCHAMBER SIZING WWHM

PORT'N GOV'T LOT 11, SEC.2, TWP.31N, RGE.5E, W.M.



GRAPHIC SCALE

200 0 100 200 400

1 inch = 200ft.

LEGEND:

- ON–SITE BASIN
- UPSTREAM BASIN
- SHEET FLOW PATH
- CONCENTRATED FLOW PATH
- ADJACENT PROPERTY LINE

CASCADE SURVEYING & ENGINEERING, INC.
Engineers Surveyors Planners
P.O. BOX 326
ARLINGTON, WASHINGTON 98223
WWW.CASCADESURVEYING.COM
FAX:(360)435–4012
1–800–593–5551
(360) 435–5551

PRELIMINARY

REVISION	DATE	BY

DESIGNED ____ DATE ____
DRAWN ____ DATE ____
CHECKED ____ DATE ____
FIELD BOOK ____ REF: ____

RIVERTOWN HOMES
DRAINAGE BASIN MAP
SNOHOMISH COUNTY

22-

1 OF 1

23305

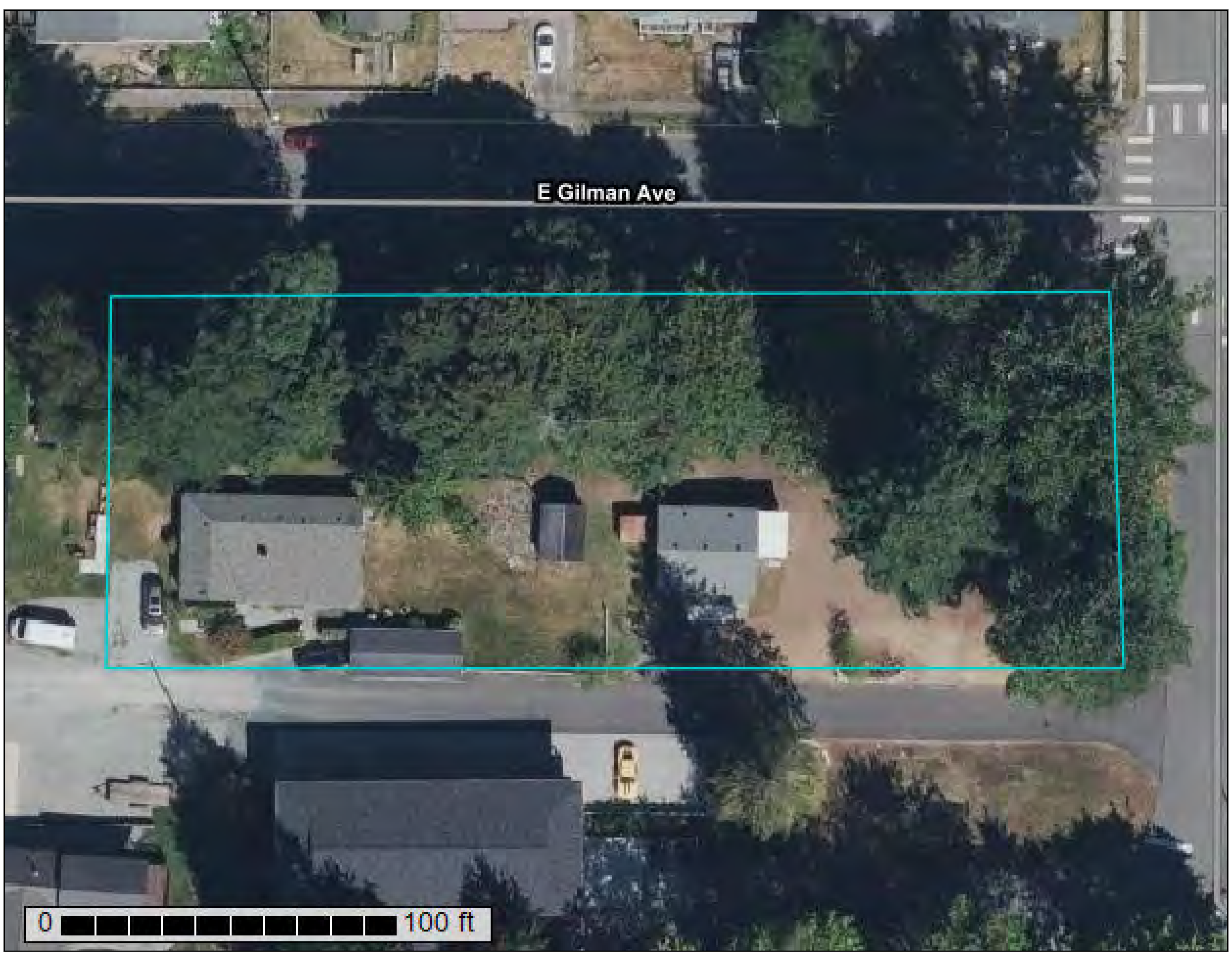
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Snohomish County Area, Washington



December 23, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

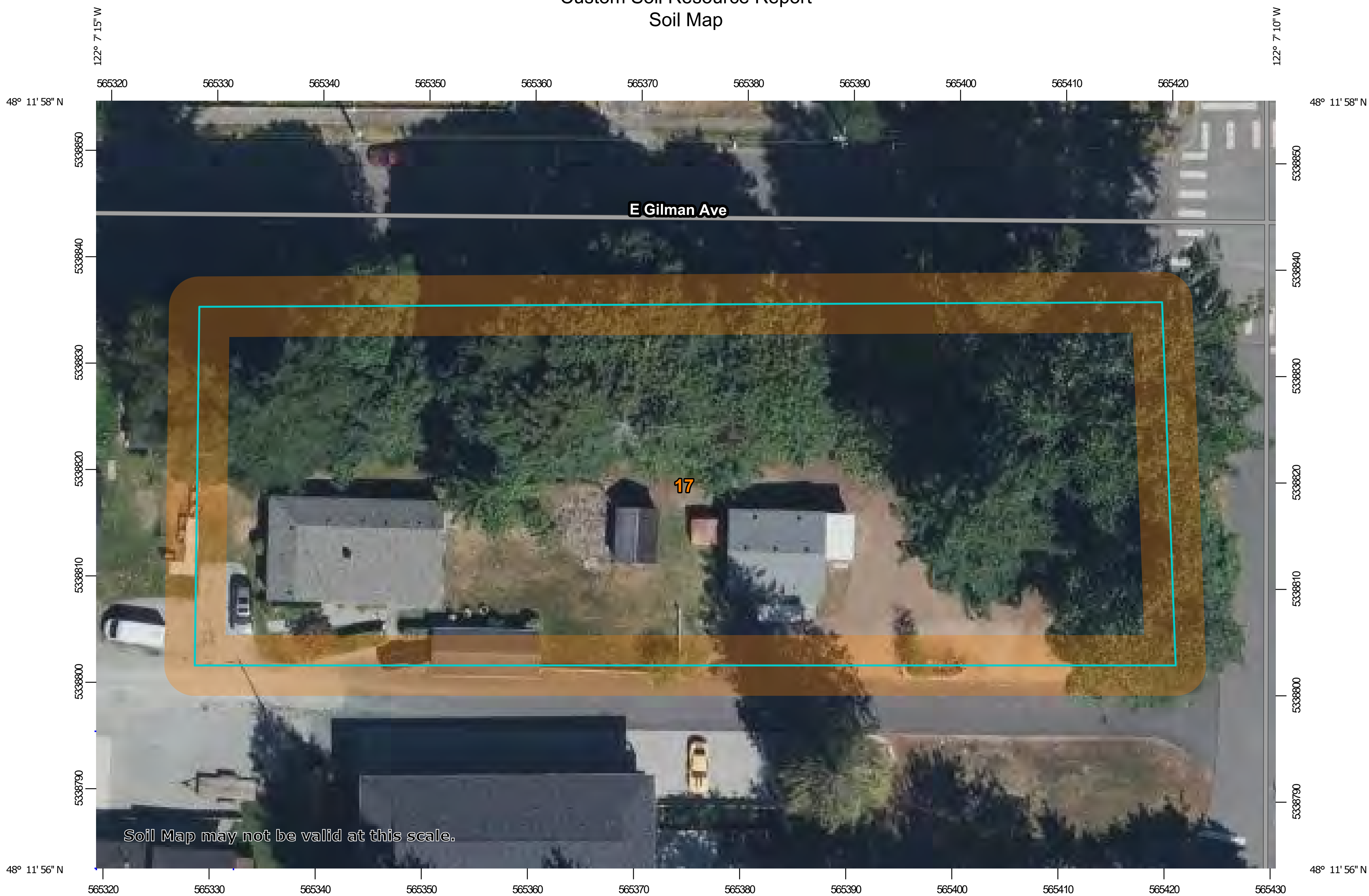
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:508 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 24, Sep 8, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 16, 2020—Aug 19, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
17	Everett very gravelly sandy loam, 0 to 8 percent slopes	0.8	100.0%
Totals for Area of Interest		**0.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Snohomish County Area, Washington

17—Everett very gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t629
Elevation: 30 to 900 feet
Mean annual precipitation: 35 to 91 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Everett and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Everett

Setting

Landform: Kames, moraines, eskers
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glacial outwash

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: very gravelly sandy loam
Bw - 3 to 24 inches: very gravelly sandy loam
C1 - 24 to 35 inches: very gravelly loamy sand
C2 - 35 to 60 inches: extremely cobbly coarse sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Droughty Soils (G002XN402WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XS401WA)
Other vegetative classification: Droughty Soils (G002XN402WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XS401WA)
Hydric soil rating: No

Minor Components

Indianola

Percent of map unit: 10 percent
Landform: Terraces, kames, eskers
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Alderwood

Percent of map unit: 10 percent
Landform: Hills, ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

WWHM2012

PROJECT REPORT

NO CONTROL MODEL

General Model Information

Project Name:	23305 Rivertown No control
Site Name:	
Site Address:	
City:	
Report Date:	1/8/2024
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
Version Date:	2021/08/18
Version:	4.2.18

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

Frontage

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	0.0579
Pervious Total	0.0579
Impervious Land Use	acre
ROADS MOD	0.0324
Impervious Total	0.0324
Basin Total	0.0903

Element Flows To:

Surface	Interflow	Groundwater

Up Stream ONTO Site

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.00554
Pervious Total	0.00554
Impervious Land Use	acre
ROADS FLAT	0.0266
Impervious Total	0.0266
Basin Total	0.03214

Element Flows To:

Surface	Interflow	Groundwater

Site

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Flat	0.1326
A B, Forest, Mod	0.0285
A B, Forest, Steep	0.0854
Pervious Total	0.2465
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.2465

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Frontage

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	0.0203
Pervious Total	0.0203
Impervious Land Use	acre
ROADS MOD	0.07
Impervious Total	0.07
Basin Total	0.0903

Element Flows To:

Surface	Interflow	Groundwater

Up Stream ONTO Site

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.00554
Pervious Total	0.00554
Impervious Land Use	acre
ROADS FLAT	0.0266
Impervious Total	0.0266
Basin Total	0.03214

Element Flows To:

Surface	Interflow	Groundwater

Site

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.1607
A B, Lawn, Steep	0.064
Pervious Total	0.2247
Impervious Land Use	acre
SIDEWALKS FLAT	0.0218
Impervious Total	0.0218
Basin Total	0.2465

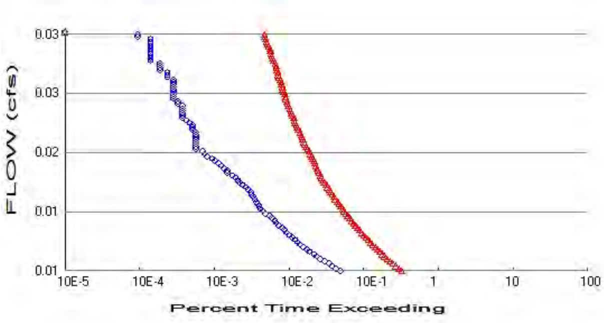
Element Flows To:

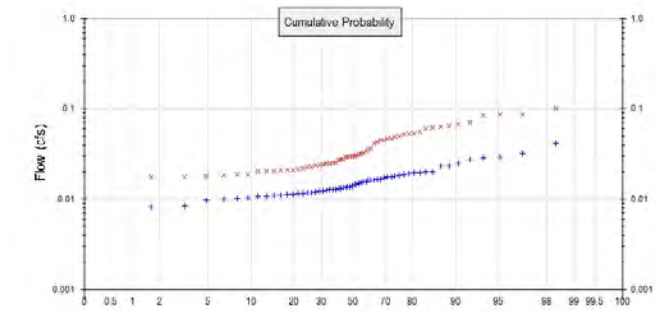
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.25204
Total Impervious Area: 0.0266

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.23024
Total Impervious Area: 0.0484

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.014557
5 year	0.019712
10 year	0.023407
25 year	0.028406
50 year	0.032375
100 year	0.03656

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.032427
5 year	0.049557
10 year	0.063022
25 year	0.082622
50 year	0.099214
100 year	0.117609

POC 1 + POC 2
<0.15 CFS INCREASE

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.015	0.028
1950	0.017	0.049
1951	0.018	0.032
1952	0.013	0.031
1953	0.017	0.035
1954	0.023	0.101
1955	0.018	0.067
1956	0.008	0.018
1957	0.013	0.047
1958	0.032	0.061

1959	0.013	0.030
1960	0.013	0.025
1961	0.041	0.087
1962	0.016	0.030
1963	0.018	0.063
1964	0.011	0.034
1965	0.012	0.023
1966	0.012	0.023
1967	0.028	0.050
1968	0.015	0.029
1969	0.029	0.062
1970	0.011	0.020
1971	0.015	0.045
1972	0.020	0.037
1973	0.016	0.030
1974	0.020	0.053
1975	0.016	0.031
1976	0.011	0.020
1977	0.011	0.020
1978	0.008	0.018
1979	0.019	0.085
1980	0.012	0.027
1981	0.011	0.025
1982	0.012	0.021
1983	0.015	0.041
1984	0.014	0.025
1985	0.019	0.047
1986	0.019	0.064
1987	0.016	0.030
1988	0.013	0.024
1989	0.014	0.043
1990	0.011	0.021
1991	0.014	0.025
1992	0.013	0.027
1993	0.010	0.019
1994	0.012	0.022
1995	0.010	0.018
1996	0.016	0.054
1997	0.020	0.086
1998	0.018	0.033
1999	0.008	0.019
2000	0.029	0.054
2001	0.010	0.018
2002	0.010	0.017
2003	0.013	0.024
2004	0.025	0.045
2005	0.012	0.021
2006	0.023	0.070
2007	0.015	0.056
2008	0.011	0.024
2009	0.012	0.021

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0409	0.1012
2	0.0320	0.0870
3	0.0294	0.0864

4	0.0285	0.0847
5	0.0276	0.0700
6	0.0248	0.0671
7	0.0233	0.0644
8	0.0231	0.0626
9	0.0201	0.0615
10	0.0200	0.0610
11	0.0198	0.0556
12	0.0195	0.0539
13	0.0193	0.0538
14	0.0188	0.0527
15	0.0182	0.0502
16	0.0181	0.0490
17	0.0176	0.0470
18	0.0176	0.0466
19	0.0171	0.0454
20	0.0167	0.0453
21	0.0164	0.0427
22	0.0163	0.0413
23	0.0163	0.0366
24	0.0162	0.0354
25	0.0156	0.0341
26	0.0154	0.0330
27	0.0152	0.0320
28	0.0150	0.0313
29	0.0146	0.0308
30	0.0146	0.0301
31	0.0139	0.0301
32	0.0137	0.0298
33	0.0136	0.0295
34	0.0135	0.0291
35	0.0134	0.0276
36	0.0132	0.0273
37	0.0132	0.0269
38	0.0129	0.0255
39	0.0129	0.0252
40	0.0129	0.0248
41	0.0124	0.0247
42	0.0124	0.0245
43	0.0123	0.0240
44	0.0120	0.0239
45	0.0117	0.0226
46	0.0117	0.0225
47	0.0115	0.0217
48	0.0115	0.0213
49	0.0113	0.0211
50	0.0112	0.0209
51	0.0111	0.0208
52	0.0109	0.0205
53	0.0109	0.0203
54	0.0107	0.0203
55	0.0102	0.0190
56	0.0101	0.0187
57	0.0099	0.0184
58	0.0097	0.0180
59	0.0083	0.0177
60	0.0082	0.0177
61	0.0075	0.0175

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0073	1050	6939	660	Fail
0.0075	914	6297	688	Fail
0.0078	805	5754	714	Fail
0.0080	730	5221	715	Fail
0.0083	641	4776	745	Fail
0.0085	561	4419	787	Fail
0.0088	503	4072	809	Fail
0.0091	460	3771	819	Fail
0.0093	404	3503	867	Fail
0.0096	366	3258	890	Fail
0.0098	333	3044	914	Fail
0.0101	303	2834	935	Fail
0.0103	282	2637	935	Fail
0.0106	257	2453	954	Fail
0.0108	238	2284	959	Fail
0.0111	217	2134	983	Fail
0.0113	199	2002	1006	Fail
0.0116	185	1878	1015	Fail
0.0118	172	1764	1025	Fail
0.0121	157	1651	1051	Fail
0.0123	144	1563	1085	Fail
0.0126	138	1468	1063	Fail
0.0129	126	1392	1104	Fail
0.0131	117	1306	1116	Fail
0.0134	102	1231	1206	Fail
0.0136	95	1171	1232	Fail
0.0139	88	1116	1268	Fail
0.0141	85	1054	1240	Fail
0.0144	81	1000	1234	Fail
0.0146	78	954	1223	Fail
0.0149	74	894	1208	Fail
0.0151	71	848	1194	Fail
0.0154	67	812	1211	Fail
0.0156	65	776	1193	Fail
0.0159	60	742	1236	Fail
0.0162	57	700	1228	Fail
0.0164	51	674	1321	Fail
0.0167	46	634	1378	Fail
0.0169	44	602	1368	Fail
0.0172	41	584	1424	Fail
0.0174	37	564	1524	Fail
0.0177	32	539	1684	Fail
0.0179	32	521	1628	Fail
0.0182	29	508	1751	Fail
0.0184	27	488	1807	Fail
0.0187	24	473	1970	Fail
0.0189	22	463	2104	Fail
0.0192	20	448	2240	Fail
0.0194	17	431	2535	Fail
0.0197	16	414	2587	Fail
0.0200	15	400	2666	Fail
0.0202	12	380	3166	Fail
0.0205	12	364	3033	Fail
0.0207	12	349	2908	Fail

0.0210	12	338	2816	Fail
0.0212	12	329	2741	Fail
0.0215	12	321	2675	Fail
0.0217	12	313	2608	Fail
0.0220	12	303	2525	Fail
0.0222	11	284	2581	Fail
0.0225	11	275	2500	Fail
0.0227	11	269	2445	Fail
0.0230	10	258	2580	Fail
0.0232	9	252	2800	Fail
0.0235	8	247	3087	Fail
0.0238	8	240	3000	Fail
0.0240	8	233	2912	Fail
0.0243	8	226	2825	Fail
0.0245	8	218	2725	Fail
0.0248	8	210	2625	Fail
0.0250	7	205	2928	Fail
0.0253	7	199	2842	Fail
0.0255	6	194	3233	Fail
0.0258	6	192	3200	Fail
0.0260	6	188	3133	Fail
0.0263	6	182	3033	Fail
0.0265	6	176	2933	Fail
0.0268	6	175	2916	Fail
0.0271	6	169	2816	Fail
0.0273	6	168	2800	Fail
0.0276	6	163	2716	Fail
0.0278	5	158	3160	Fail
0.0281	5	154	3080	Fail
0.0283	5	151	3020	Fail
0.0286	4	148	3700	Fail
0.0288	4	145	3625	Fail
0.0291	4	144	3600	Fail
0.0293	4	139	3475	Fail
0.0296	3	133	4433	Fail
0.0298	3	128	4266	Fail
0.0301	3	126	4200	Fail
0.0303	3	122	4066	Fail
0.0306	3	120	4000	Fail
0.0309	3	119	3966	Fail
0.0311	3	113	3766	Fail
0.0314	3	110	3666	Fail
0.0316	3	107	3566	Fail
0.0319	3	103	3433	Fail
0.0321	2	101	5050	Fail
0.0324	2	100	5000	Fail

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

Water Quality

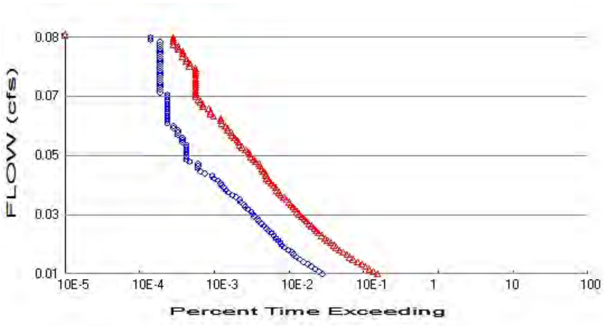
Water Quality BMP Flow and Volume for POC #1

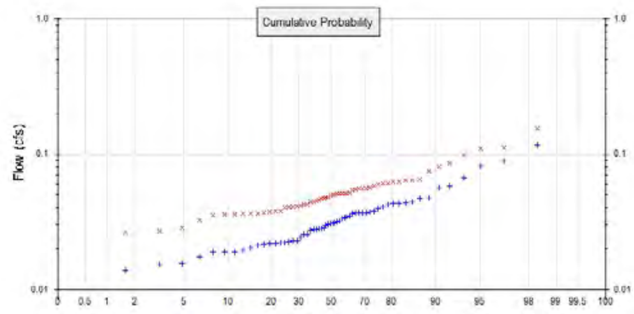
On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

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

POC 2





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 0.0579
Total Impervious Area: 0.0324

Mitigated Landuse Totals for POC #2
Total Pervious Area: 0.0203
Total Impervious Area: 0.07

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	**Flow(cfs)**
2 year	0.029902
5 year	0.043945
10 year	0.05466
25 year	0.069892
50 year	0.082523
100 year	0.096301

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	**Flow(cfs)**
2 year	0.047976
5 year	0.065435
10 year	0.078282
25 year	0.096039
50 year	0.110416
100 year	0.125813

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	**Predeveloped**	**Mitigated**
1949	0.037	0.051
1950	0.038	0.050
1951	0.028	0.060
1952	0.028	0.046
1953	0.037	0.054
1954	0.058	0.075
1955	0.035	0.058
1956	0.017	0.026
1957	0.030	0.041
1958	0.088	0.111
1959	0.028	0.045

1960	0.034	0.047
1961	0.116	0.154
1962	0.028	0.050
1963	0.044	0.054
1964	0.025	0.036
1965	0.019	0.041
1966	0.023	0.041
1967	0.039	0.080
1968	0.028	0.043
1969	0.081	0.098
1970	0.021	0.037
1971	0.033	0.048
1972	0.047	0.064
1973	0.034	0.051
1974	0.042	0.065
1975	0.037	0.051
1976	0.022	0.036
1977	0.019	0.035
1978	0.015	0.029
1979	0.044	0.059
1980	0.028	0.055
1981	0.022	0.036
1982	0.020	0.041
1983	0.037	0.051
1984	0.031	0.047
1985	0.031	0.060
1986	0.047	0.064
1987	0.037	0.055
1988	0.030	0.049
1989	0.030	0.044
1990	0.023	0.038
1991	0.024	0.052
1992	0.031	0.047
1993	0.022	0.038
1994	0.019	0.040
1995	0.023	0.038
1996	0.032	0.062
1997	0.043	0.055
1998	0.043	0.063
1999	0.014	0.024
2000	0.067	0.110
2001	0.014	0.027
2002	0.016	0.032
2003	0.020	0.042
2004	0.056	0.085
2005	0.022	0.036
2006	0.041	0.057
2007	0.037	0.051
2008	0.025	0.044
2009	0.021	0.036

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated
1	0.1161	0.1539
2	0.0885	0.1114
3	0.0814	0.1097
4	0.0665	0.0984

5	0.0575	0.0853
6	0.0564	0.0800
7	0.0474	0.0751
8	0.0466	0.0650
9	0.0440	0.0643
10	0.0435	0.0636
11	0.0431	0.0625
12	0.0430	0.0620
13	0.0424	0.0605
14	0.0408	0.0603
15	0.0393	0.0593
16	0.0381	0.0576
17	0.0371	0.0566
18	0.0368	0.0555
19	0.0368	0.0555
20	0.0367	0.0554
21	0.0366	0.0544
22	0.0365	0.0536
23	0.0350	0.0517
24	0.0343	0.0513
25	0.0340	0.0513
26	0.0333	0.0511
27	0.0319	0.0511
28	0.0314	0.0507
29	0.0310	0.0500
30	0.0308	0.0499
31	0.0305	0.0493
32	0.0302	0.0477
33	0.0298	0.0472
34	0.0285	0.0466
35	0.0282	0.0466
36	0.0282	0.0456
37	0.0277	0.0450
38	0.0276	0.0443
39	0.0275	0.0441
40	0.0254	0.0426
41	0.0253	0.0423
42	0.0241	0.0415
43	0.0227	0.0414
44	0.0227	0.0407
45	0.0225	0.0407
46	0.0222	0.0401
47	0.0221	0.0380
48	0.0217	0.0376
49	0.0217	0.0375
50	0.0214	0.0369
51	0.0212	0.0365
52	0.0202	0.0363
53	0.0196	0.0363
54	0.0190	0.0358
55	0.0190	0.0357
56	0.0190	0.0352
57	0.0172	0.0323
58	0.0156	0.0287
59	0.0153	0.0271
60	0.0139	0.0262
61	0.0137	0.0236

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0150	595	3260	547	Fail
0.0156	538	2890	537	Fail
0.0163	477	2537	531	Fail
0.0170	427	2237	523	Fail
0.0177	380	2008	528	Fail
0.0184	337	1785	529	Fail
0.0190	297	1556	523	Fail
0.0197	270	1405	520	Fail
0.0204	246	1272	517	Fail
0.0211	234	1134	484	Fail
0.0218	209	1014	485	Fail
0.0225	187	922	493	Fail
0.0231	173	853	493	Fail
0.0238	164	771	470	Fail
0.0245	153	700	457	Fail
0.0252	143	644	450	Fail
0.0259	133	582	437	Fail
0.0266	124	534	430	Fail
0.0272	114	498	436	Fail
0.0279	106	469	442	Fail
0.0286	99	426	430	Fail
0.0293	91	394	432	Fail
0.0300	84	369	439	Fail
0.0306	80	344	430	Fail
0.0313	73	315	431	Fail
0.0320	71	294	414	Fail
0.0327	67	274	408	Fail
0.0334	60	254	423	Fail
0.0341	55	243	441	Fail
0.0347	53	226	426	Fail
0.0354	48	213	443	Fail
0.0361	46	197	428	Fail
0.0368	42	182	433	Fail
0.0375	37	166	448	Fail
0.0382	33	156	472	Fail
0.0388	31	147	474	Fail
0.0395	29	142	489	Fail
0.0402	27	132	488	Fail
0.0409	26	123	473	Fail
0.0416	24	115	479	Fail
0.0423	21	109	519	Fail
0.0429	20	103	515	Fail
0.0436	16	103	643	Fail
0.0443	14	98	700	Fail
0.0450	13	92	707	Fail
0.0457	13	87	669	Fail
0.0463	13	85	653	Fail
0.0470	10	77	770	Fail
0.0477	9	72	800	Fail
0.0484	9	66	733	Fail
0.0491	9	64	711	Fail
0.0498	9	61	677	Fail
0.0504	9	56	622	Fail
0.0511	9	51	566	Fail

0.0518	9	46	511	Fail
0.0525	8	45	562	Fail
0.0532	8	43	537	Fail
0.0539	8	40	500	Fail
0.0545	7	37	528	Fail
0.0552	7	36	514	Fail
0.0559	7	32	457	Fail
0.0566	6	32	533	Fail
0.0573	6	30	500	Fail
0.0580	5	27	540	Fail
0.0586	5	26	520	Fail
0.0593	5	26	520	Fail
0.0600	5	21	419	Fail
0.0607	5	19	380	Fail
0.0614	5	19	380	Fail
0.0620	5	18	360	Fail
0.0627	5	15	300	Fail
0.0634	5	15	300	Fail
0.0641	5	14	280	Fail
0.0648	5	13	260	Fail
0.0655	5	12	240	Fail
0.0661	5	12	240	Fail
0.0668	4	12	300	Fail
0.0675	4	12	300	Fail
0.0682	4	12	300	Fail
0.0689	4	12	300	Fail
0.0696	4	12	300	Fail
0.0702	4	12	300	Fail
0.0709	4	12	300	Fail
0.0716	4	12	300	Fail
0.0723	4	12	300	Fail
0.0730	4	12	300	Fail
0.0736	4	12	300	Fail
0.0743	4	10	250	Fail
0.0750	4	10	250	Fail
0.0757	4	9	225	Fail
0.0764	4	9	225	Fail
0.0771	4	8	200	Fail
0.0777	4	8	200	Fail
0.0784	4	8	200	Fail
0.0791	4	7	175	Fail
0.0798	4	7	175	Fail
0.0805	4	6	150	Fail
0.0812	4	6	150	Fail
0.0818	3	6	200	Fail
0.0825	3	6	200	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #2

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

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic

WWHM2012

PROJECT REPORT

PERMEABLE PAVEMENT SIZING FOR 100% INFILTRATION
STORMTECH CHAMBE SIZING FOR FRONTAGE IMPROVEMENTS

General Model Information

Project Name:	23305 Redesign 4
Site Name:	
Site Address:	
City:	
Report Date:	12/12/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
Version Date:	2021/08/18
Version:	4.2.18

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

Frontage

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	0.0579
Pervious Total	0.0579
Impervious Land Use	acre
ROADS MOD	0.0324
Impervious Total	0.0324
Basin Total	0.0903

Element Flows To:

Surface	Interflow	Groundwater

Up Stream ONTO Site

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.00554
Pervious Total	0.00554
Impervious Land Use	acre
ROADS FLAT	0.0266
Impervious Total	0.0266
Basin Total	0.03214

Element Flows To:

Surface	Interflow	Groundwater

Site

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Flat	0.119277
A B, Forest, Mod	0.0899
A B, Forest, Steep	0.1433
Pervious Total	0.352477
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.352477

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Frontage

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	0.0203
Pervious Total	0.0203
Impervious Land Use	acre
ROADS MOD	0.07
Impervious Total	0.07
Basin Total	0.0903

Element Flows To:

Surface	Interflow	Groundwater
StormTech 1	StormTech 1	

Site

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
A B, Lawn, Flat	0.109
A B, Lawn, Steep	0.064
Pervious Total	0.173
Impervious Land Use	acre
SIDEWALKS FLAT	0.0218
Impervious Total	0.0218
Basin Total	0.1948

Element Flows To:

Surface	Interflow	Groundwater

Alley Onto Site Upstream

Bypass:	No
Impervious Land Use	acre
ROADS FLAT	0.0266

Element Flows To:

Outlet 1	Outlet 2
Permeable Pavement 1	

Upstream Onto Site

Bypass:	Yes
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	.00554

Element Flows To:

Surface	Interflow	Groundwater
Permeable Pavement 1	Permeable Pavement 1	

Lateral Basin 1

Bypass: Yes

GroundWater: No

Pervious Land Use	acre
A B, Lawn, Flat	.0577

Element Flows To:

Surface	Interflow	Groundwater
Permeable Pavement 1	Permeable Pavement 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Permeable Pavement 1

Pavement Area:0.1000 acre.Pavement Length:	174.20 ft.
Pavement Width:	25.00 ft.
	Pavement slope 1:0 To 1
Pavement thickness:	0.5
Pour Space of Pavement:	0.4
Material thickness of second layer:	0.5
Pour Space of material for second layer:	0.33
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	1.9
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	23.106
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	23.106
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	1.333

Element Flows To:
Outlet 1 Outlet 2

Permeable Pavement Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.100	0.000	0.000	0.000
0.0111	0.100	0.000	0.000	0.191
0.0222	0.100	0.000	0.000	0.191
0.0333	0.100	0.001	0.000	0.191
0.0444	0.100	0.001	0.000	0.191
0.0556	0.100	0.001	0.000	0.191
0.0667	0.100	0.002	0.000	0.191
0.0778	0.100	0.002	0.000	0.191
0.0889	0.100	0.002	0.000	0.191
0.1000	0.100	0.003	0.000	0.191
0.1111	0.100	0.003	0.000	0.191
0.1222	0.100	0.004	0.000	0.191
0.1333	0.100	0.004	0.000	0.191
0.1444	0.100	0.004	0.000	0.191
0.1556	0.100	0.005	0.000	0.191
0.1667	0.100	0.005	0.000	0.191
0.1778	0.100	0.005	0.000	0.191
0.1889	0.100	0.006	0.000	0.191
0.2000	0.100	0.006	0.000	0.191
0.2111	0.100	0.007	0.000	0.191
0.2222	0.100	0.007	0.000	0.191
0.2333	0.100	0.007	0.000	0.191
0.2444	0.100	0.008	0.000	0.191
0.2556	0.100	0.008	0.000	0.191
0.2667	0.100	0.008	0.000	0.191
0.2778	0.100	0.009	0.000	0.191
0.2889	0.100	0.009	0.000	0.191
0.3000	0.100	0.009	0.000	0.191
0.3111	0.100	0.010	0.000	0.191

0.3222	0.100	0.010	0.000	0.191
0.3333	0.100	0.011	0.000	0.191
0.3444	0.100	0.011	0.000	0.191
0.3556	0.100	0.011	0.000	0.191
0.3667	0.100	0.012	0.000	0.191
0.3778	0.100	0.012	0.000	0.191
0.3889	0.100	0.012	0.000	0.191
0.4000	0.100	0.013	0.000	0.191
0.4111	0.100	0.013	0.000	0.191
0.4222	0.100	0.013	0.000	0.191
0.4333	0.100	0.014	0.000	0.191
0.4444	0.100	0.014	0.000	0.191
0.4556	0.100	0.015	0.000	0.191
0.4667	0.100	0.015	0.000	0.191
0.4778	0.100	0.015	0.000	0.191
0.4889	0.100	0.016	0.000	0.191
0.5000	0.100	0.016	0.000	0.191
0.5111	0.100	0.017	0.000	0.191
0.5222	0.100	0.017	0.000	0.191
0.5333	0.100	0.017	0.000	0.191
0.5444	0.100	0.018	0.000	0.191
0.5556	0.100	0.018	0.000	0.191
0.5667	0.100	0.019	0.000	0.191
0.5778	0.100	0.019	0.000	0.191
0.5889	0.100	0.020	0.000	0.191
0.6000	0.100	0.020	0.000	0.191
0.6111	0.100	0.021	0.000	0.191
0.6222	0.100	0.021	0.000	0.191
0.6333	0.100	0.021	0.000	0.191
0.6444	0.100	0.022	0.000	0.191
0.6556	0.100	0.022	0.000	0.191
0.6667	0.100	0.023	0.000	0.191
0.6778	0.100	0.023	0.000	0.191
0.6889	0.100	0.024	0.000	0.191
0.7000	0.100	0.024	0.000	0.191
0.7111	0.100	0.025	0.000	0.191
0.7222	0.100	0.025	0.000	0.191
0.7333	0.100	0.025	0.000	0.191
0.7444	0.100	0.026	0.000	0.191
0.7556	0.100	0.026	0.000	0.191
0.7667	0.100	0.027	0.000	0.191
0.7778	0.100	0.027	0.000	0.191
0.7889	0.100	0.028	0.000	0.191
0.8000	0.100	0.028	0.000	0.191
0.8111	0.100	0.029	0.000	0.191
0.8222	0.100	0.029	0.000	0.191
0.8333	0.100	0.029	0.000	0.191
0.8444	0.100	0.030	0.000	0.191
0.8556	0.100	0.030	0.000	0.191
0.8667	0.100	0.031	0.000	0.191
0.8778	0.100	0.031	0.000	0.191
0.8889	0.100	0.032	0.000	0.191
0.9000	0.100	0.032	0.000	0.191
0.9111	0.100	0.033	0.000	0.191
0.9222	0.100	0.033	0.000	0.191
0.9333	0.100	0.033	0.000	0.191
0.9444	0.100	0.034	0.000	0.191
0.9556	0.100	0.034	0.000	0.191

0.9667	0.100	0.035	0.000	0.191
0.9778	0.100	0.035	0.000	0.191
0.9889	0.100	0.036	0.000	0.191
1.0000	0.100	0.036	0.000	0.191

StormTech 1

Chamber Model: 310
Dimensions
Max Row Length: 200
Number of Chambers: 5
Number of Endcaps: 2
Top Stone Depth: 6
Bottom Stone Depth: 6
Discharge Structure
Riser Height: 2 ft.
Riser Diameter: 8 in.
Orifice 1 Diameter: 0.7 in. Elevation:0 ft.
Orifice 2 Diameter: 0.8 in. Elevation:1.2 ft.
Element Flows To:
Outlet 1 Outlet 2

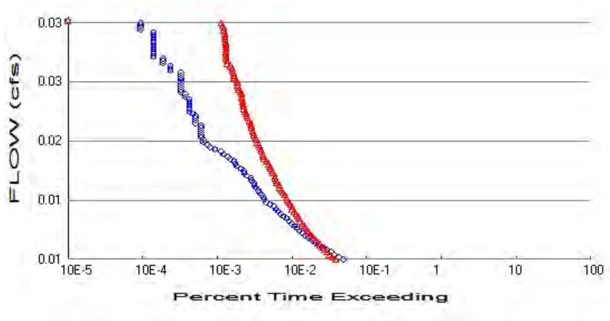
StormTech Hydraulic Table

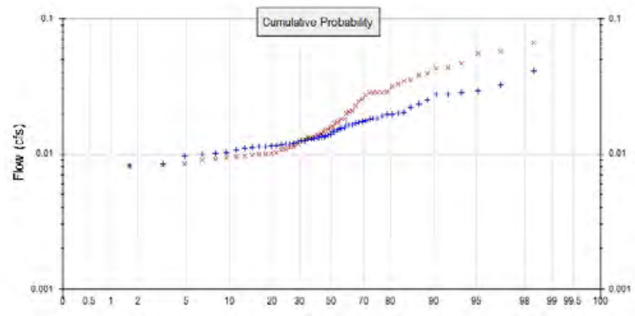
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.002	0.000	0.000	0.000
0.0833	0.002	0.000	0.003	0.000
0.1667	0.002	0.000	0.005	0.000
0.2500	0.002	0.000	0.006	0.000
0.3333	0.002	0.000	0.007	0.000
0.4167	0.002	0.000	0.008	0.000
0.5000	0.002	0.000	0.009	0.000
0.5833	0.002	0.000	0.010	0.000
0.6667	0.002	0.000	0.010	0.000
0.7500	0.002	0.001	0.011	0.000
0.8333	0.002	0.001	0.012	0.000
0.9167	0.002	0.001	0.012	0.000
1.0000	0.002	0.001	0.013	0.000
1.0833	0.002	0.001	0.013	0.000
1.1667	0.002	0.002	0.014	0.000
1.2500	0.002	0.002	0.018	0.000
1.3333	0.002	0.002	0.021	0.000
1.4167	0.002	0.002	0.023	0.000
1.5000	0.002	0.002	0.025	0.000
1.5833	0.002	0.002	0.027	0.000
1.6667	0.002	0.002	0.029	0.000
1.7500	0.002	0.002	0.030	0.000
1.8333	0.002	0.003	0.031	0.000
1.9167	0.002	0.003	0.033	0.000
2.0000	0.002	0.003	0.034	0.000
2.0833	0.002	0.003	0.203	0.000
2.1667	0.002	0.003	0.478	0.000
2.2500	0.002	0.003	0.715	0.000
2.3333	0.002	0.003	0.838	0.000

Analysis Results

POC 1

USED FOR SIZING PERMEABLE PAVEMENT.
NOT REQUIRED TO MEET FLOW CONTROL.
SEE NO CONTROL MODEL





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area:	0.358017
Total Impervious Area:	0.0266

Mitigated Landuse Totals for POC #1

Total Pervious Area:	0.23624
Total Impervious Area:	0.148377

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.014671
5 year	0.019976
10 year	0.023794
25 year	0.028976
50 year	0.033104
100 year	0.037466

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.01706
5 year	0.02817
10 year	0.03743
25 year	0.051556
50 year	0.064011
100 year	0.07827

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.015	0.012
1950	0.017	0.028
1951	0.018	0.017
1952	0.013	0.017
1953	0.017	0.020
1954	0.023	0.066
1955	0.018	0.043
1956	0.008	0.010
1957	0.013	0.029
1958	0.032	0.029

1959	0.013	0.018
1960	0.013	0.015
1961	0.041	0.044
1962	0.016	0.013
1963	0.018	0.038
1964	0.011	0.021
1965	0.012	0.010
1966	0.012	0.010
1967	0.028	0.023
1968	0.015	0.016
1969	0.029	0.031
1970	0.011	0.010
1971	0.015	0.028
1972	0.020	0.017
1973	0.016	0.014
1974	0.020	0.033
1975	0.016	0.015
1976	0.011	0.014
1977	0.011	0.009
1978	0.008	0.009
1979	0.019	0.055
1980	0.012	0.016
1981	0.011	0.014
1982	0.012	0.011
1983	0.015	0.027
1984	0.014	0.011
1985	0.020	0.029
1986	0.019	0.039
1987	0.016	0.018
1988	0.013	0.012
1989	0.014	0.025
1990	0.011	0.013
1991	0.014	0.011
1992	0.013	0.013
1993	0.010	0.008
1994	0.012	0.010
1995	0.010	0.008
1996	0.017	0.035
1997	0.022	0.057
1998	0.018	0.015
1999	0.008	0.010
2000	0.029	0.024
2001	0.010	0.008
2002	0.010	0.008
2003	0.013	0.011
2004	0.025	0.020
2005	0.012	0.009
2006	0.028	0.046
2007	0.015	0.035
2008	0.011	0.013
2009	0.012	0.010

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0409	0.0660
2	0.0321	0.0570
3	0.0294	0.0551

4	0.0285	0.0464
5	0.0278	0.0436
6	0.0277	0.0426
7	0.0248	0.0394
8	0.0233	0.0382
9	0.0220	0.0351
10	0.0201	0.0348
11	0.0198	0.0326
12	0.0195	0.0311
13	0.0195	0.0290
14	0.0191	0.0286
15	0.0183	0.0285
16	0.0182	0.0285
17	0.0181	0.0283
18	0.0176	0.0271
19	0.0173	0.0253
20	0.0171	0.0244
21	0.0167	0.0226
22	0.0164	0.0207
23	0.0163	0.0205
24	0.0163	0.0199
25	0.0156	0.0180
26	0.0154	0.0179
27	0.0152	0.0174
28	0.0150	0.0169
29	0.0146	0.0169
30	0.0146	0.0159
31	0.0140	0.0157
32	0.0138	0.0151
33	0.0136	0.0149
34	0.0135	0.0145
35	0.0134	0.0141
36	0.0132	0.0137
37	0.0132	0.0137
38	0.0130	0.0133
39	0.0129	0.0132
40	0.0129	0.0131
41	0.0125	0.0128
42	0.0124	0.0124
43	0.0123	0.0118
44	0.0120	0.0114
45	0.0118	0.0112
46	0.0118	0.0108
47	0.0116	0.0107
48	0.0115	0.0102
49	0.0114	0.0101
50	0.0113	0.0100
51	0.0112	0.0100
52	0.0111	0.0098
53	0.0109	0.0097
54	0.0107	0.0095
55	0.0102	0.0094
56	0.0101	0.0091
57	0.0100	0.0090
58	0.0097	0.0084
59	0.0083	0.0083
60	0.0082	0.0081
61	0.0075	0.0079

Duration Flows

USED FOR SIZING PERMEABLE PAVEMENT.
NOT REQUIRED TO MEET FLOW CONTROL.
SEE NO CONTROL MODEL

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0073	1041	818	78	Pass
0.0076	904	732	80	Pass
0.0079	792	674	85	Pass
0.0081	720	634	88	Pass
0.0084	623	582	93	Pass
0.0086	555	549	98	Pass
0.0089	500	514	102	Fail
0.0092	444	475	106	Fail
0.0094	393	443	112	Fail
0.0097	357	410	114	Fail
0.0099	319	387	121	Fail
0.0102	294	363	123	Fail
0.0105	273	342	125	Fail
0.0107	249	327	131	Fail
0.0110	233	311	133	Fail
0.0112	212	291	137	Fail
0.0115	195	276	141	Fail
0.0118	182	266	146	Fail
0.0120	165	256	155	Fail
0.0123	151	242	160	Fail
0.0125	142	232	163	Fail
0.0128	132	217	164	Fail
0.0131	123	214	173	Fail
0.0133	108	204	188	Fail
0.0136	97	195	201	Fail
0.0138	91	185	203	Fail
0.0141	88	180	204	Fail
0.0144	83	169	203	Fail
0.0146	78	161	206	Fail
0.0149	75	153	204	Fail
0.0151	71	147	207	Fail
0.0154	67	144	214	Fail
0.0157	65	134	206	Fail
0.0159	62	130	209	Fail
0.0162	60	127	211	Fail
0.0164	54	126	233	Fail
0.0167	49	120	244	Fail
0.0170	48	115	239	Fail
0.0172	44	110	250	Fail
0.0175	39	108	276	Fail
0.0177	37	103	278	Fail
0.0180	36	97	269	Fail
0.0183	32	89	278	Fail
0.0185	30	88	293	Fail
0.0188	26	87	334	Fail
0.0190	24	83	345	Fail
0.0193	20	81	405	Fail
0.0196	17	79	464	Fail
0.0198	16	77	481	Fail
0.0201	14	74	528	Fail
0.0203	14	72	514	Fail
0.0206	13	69	530	Fail
0.0209	13	65	500	Fail
0.0211	13	65	500	Fail

0.0214	13	64	492	Fail
0.0217	13	61	469	Fail
0.0219	13	61	469	Fail
0.0222	11	60	545	Fail
0.0224	11	57	518	Fail
0.0227	11	55	500	Fail
0.0230	11	53	481	Fail
0.0232	10	52	520	Fail
0.0235	9	51	566	Fail
0.0237	9	48	533	Fail
0.0240	9	48	533	Fail
0.0243	9	48	533	Fail
0.0245	9	47	522	Fail
0.0248	9	46	511	Fail
0.0250	8	45	562	Fail
0.0253	8	45	562	Fail
0.0256	7	44	628	Fail
0.0258	7	41	585	Fail
0.0261	7	41	585	Fail
0.0263	7	40	571	Fail
0.0266	7	40	571	Fail
0.0269	7	39	557	Fail
0.0271	7	36	514	Fail
0.0274	7	36	514	Fail
0.0276	7	35	500	Fail
0.0279	5	34	680	Fail
0.0282	5	34	680	Fail
0.0284	5	32	640	Fail
0.0287	4	29	725	Fail
0.0289	4	29	725	Fail
0.0292	4	28	700	Fail
0.0295	3	28	933	Fail
0.0297	3	28	933	Fail
0.0300	3	28	933	Fail
0.0302	3	28	933	Fail
0.0305	3	28	933	Fail
0.0308	3	28	933	Fail
0.0310	3	28	933	Fail
0.0313	3	27	900	Fail
0.0315	3	27	900	Fail
0.0318	3	27	900	Fail
0.0321	3	27	900	Fail
0.0323	2	26	1300	Fail
0.0326	2	26	1300	Fail
0.0328	2	25	1250	Fail
0.0331	2	24	1200	Fail

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

Water Quality

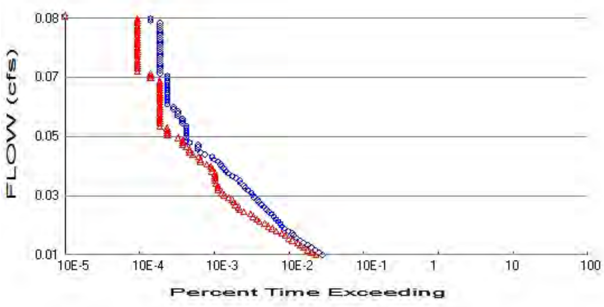
Water Quality BMP Flow and Volume for POC #1

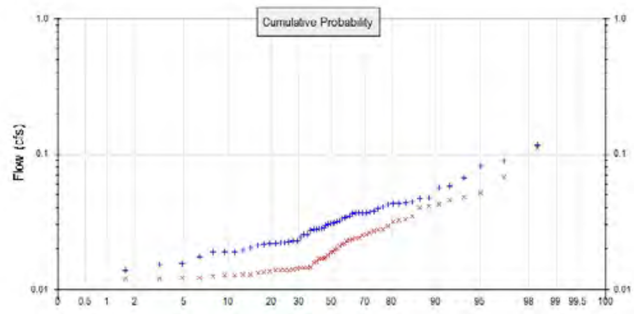
On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Permeable Pavement 1 POC	☐	21.03			☐	100.00			
Total Volume Infiltrated		21.03	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

POC 2





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 0.0579
Total Impervious Area: 0.0324

Mitigated Landuse Totals for POC #2
Total Pervious Area: 0.0203
Total Impervious Area: 0.07

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	Flow(cfs)
2 year	0.029902
5 year	0.043945
10 year	0.05466
25 year	0.069892
50 year	0.082523
100 year	0.096301

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	Flow(cfs)
2 year	0.019526
5 year	0.030382
10 year	0.039599
25 year	0.05395
50 year	0.066877
100 year	0.081967

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #2

Year	Predeveloped	Mitigated
1949	0.037	0.014
1950	0.038	0.029
1951	0.028	0.024
1952	0.028	0.016
1953	0.037	0.021
1954	0.058	0.027
1955	0.035	0.032
1956	0.017	0.012
1957	0.030	0.018
1958	0.088	0.048
1959	0.028	0.017

1960	0.034	0.014
1961	0.116	0.111
1962	0.028	0.014
1963	0.044	0.032
1964	0.025	0.014
1965	0.019	0.013
1966	0.023	0.013
1967	0.039	0.067
1968	0.028	0.025
1969	0.081	0.041
1970	0.021	0.013
1971	0.033	0.026
1972	0.047	0.042
1973	0.034	0.020
1974	0.042	0.024
1975	0.037	0.021
1976	0.022	0.017
1977	0.019	0.014
1978	0.015	0.012
1979	0.044	0.040
1980	0.028	0.013
1981	0.022	0.014
1982	0.020	0.017
1983	0.037	0.023
1984	0.031	0.017
1985	0.031	0.025
1986	0.047	0.028
1987	0.037	0.020
1988	0.030	0.015
1989	0.030	0.016
1990	0.023	0.012
1991	0.024	0.014
1992	0.031	0.013
1993	0.022	0.014
1994	0.019	0.012
1995	0.023	0.014
1996	0.032	0.022
1997	0.043	0.046
1998	0.043	0.035
1999	0.014	0.012
2000	0.067	0.033
2001	0.014	0.014
2002	0.016	0.012
2003	0.020	0.014
2004	0.056	0.052
2005	0.022	0.023
2006	0.041	0.019
2007	0.037	0.023
2008	0.025	0.028
2009	0.021	0.019

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #2

Rank	Predeveloped	Mitigated
1	0.1161	0.1113
2	0.0885	0.0674
3	0.0814	0.0515
4	0.0665	0.0484

5	0.0575	0.0456
6	0.0564	0.0423
7	0.0474	0.0412
8	0.0466	0.0403
9	0.0440	0.0350
10	0.0435	0.0328
11	0.0431	0.0325
12	0.0430	0.0317
13	0.0424	0.0294
14	0.0408	0.0277
15	0.0393	0.0277
16	0.0381	0.0269
17	0.0371	0.0261
18	0.0368	0.0254
19	0.0368	0.0252
20	0.0367	0.0242
21	0.0366	0.0241
22	0.0365	0.0234
23	0.0350	0.0232
24	0.0343	0.0229
25	0.0340	0.0218
26	0.0333	0.0213
27	0.0319	0.0208
28	0.0314	0.0199
29	0.0310	0.0196
30	0.0308	0.0189
31	0.0305	0.0188
32	0.0302	0.0178
33	0.0298	0.0171
34	0.0285	0.0170
35	0.0282	0.0170
36	0.0282	0.0168
37	0.0277	0.0160
38	0.0276	0.0157
39	0.0275	0.0147
40	0.0254	0.0145
41	0.0253	0.0144
42	0.0241	0.0144
43	0.0227	0.0142
44	0.0227	0.0140
45	0.0225	0.0139
46	0.0222	0.0139
47	0.0221	0.0138
48	0.0217	0.0138
49	0.0217	0.0136
50	0.0214	0.0135
51	0.0212	0.0133
52	0.0202	0.0129
53	0.0196	0.0128
54	0.0190	0.0127
55	0.0190	0.0126
56	0.0190	0.0125
57	0.0172	0.0121
58	0.0156	0.0121
59	0.0153	0.0120
60	0.0139	0.0120
61	0.0137	0.0120

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0150	595	488	82	Pass
0.0156	538	432	80	Pass
0.0163	477	382	80	Pass
0.0170	427	337	78	Pass
0.0177	380	306	80	Pass
0.0184	337	281	83	Pass
0.0190	297	241	81	Pass
0.0197	270	211	78	Pass
0.0204	246	190	77	Pass
0.0211	234	171	73	Pass
0.0218	209	145	69	Pass
0.0225	187	127	67	Pass
0.0231	173	113	65	Pass
0.0238	164	101	61	Pass
0.0245	153	86	56	Pass
0.0252	143	79	55	Pass
0.0259	133	71	53	Pass
0.0266	124	65	52	Pass
0.0272	114	53	46	Pass
0.0279	106	47	44	Pass
0.0286	99	45	45	Pass
0.0293	91	41	45	Pass
0.0300	84	39	46	Pass
0.0306	80	37	46	Pass
0.0313	73	33	45	Pass
0.0320	71	29	40	Pass
0.0327	67	27	40	Pass
0.0334	60	24	40	Pass
0.0341	55	24	43	Pass
0.0347	53	24	45	Pass
0.0354	48	23	47	Pass
0.0361	46	22	47	Pass
0.0368	42	22	52	Pass
0.0375	37	22	59	Pass
0.0382	33	22	66	Pass
0.0388	31	20	64	Pass
0.0395	29	20	68	Pass
0.0402	27	19	70	Pass
0.0409	26	17	65	Pass
0.0416	24	14	58	Pass
0.0423	21	14	66	Pass
0.0429	20	13	65	Pass
0.0436	16	11	68	Pass
0.0443	14	10	71	Pass
0.0450	13	10	76	Pass
0.0457	13	9	69	Pass
0.0463	13	8	61	Pass
0.0470	10	8	80	Pass
0.0477	9	8	88	Pass
0.0484	9	7	77	Pass
0.0491	9	5	55	Pass
0.0498	9	5	55	Pass
0.0504	9	5	55	Pass

0.0511	9	5	55	Pass
0.0518	9	4	44	Pass
0.0525	8	4	50	Pass
0.0532	8	4	50	Pass
0.0539	8	4	50	Pass
0.0545	7	4	57	Pass
0.0552	7	4	57	Pass
0.0559	7	4	57	Pass
0.0566	6	4	66	Pass
0.0573	6	4	66	Pass
0.0580	5	4	80	Pass
0.0586	5	4	80	Pass
0.0593	5	4	80	Pass
0.0600	5	4	80	Pass
0.0607	5	4	80	Pass
0.0614	5	4	80	Pass
0.0620	5	4	80	Pass
0.0627	5	4	80	Pass
0.0634	5	4	80	Pass
0.0641	5	4	80	Pass
0.0648	5	4	80	Pass
0.0655	5	3	60	Pass
0.0661	5	3	60	Pass
0.0668	4	3	75	Pass
0.0675	4	2	50	Pass
0.0682	4	2	50	Pass
0.0689	4	2	50	Pass
0.0696	4	2	50	Pass
0.0702	4	2	50	Pass
0.0709	4	2	50	Pass
0.0716	4	2	50	Pass
0.0723	4	2	50	Pass
0.0730	4	2	50	Pass
0.0736	4	2	50	Pass
0.0743	4	2	50	Pass
0.0750	4	2	50	Pass
0.0757	4	2	50	Pass
0.0764	4	2	50	Pass
0.0771	4	2	50	Pass
0.0777	4	2	50	Pass
0.0784	4	2	50	Pass
0.0791	4	2	50	Pass
0.0798	4	2	50	Pass
0.0805	4	2	50	Pass
0.0812	4	2	50	Pass
0.0818	3	2	66	Pass
0.0825	3	2	66	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #2

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
StormTech 1 POC	☐	14.53			☐	0.00			
Total Volume Infiltrated		14.53	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic