# Drainage Report for:
## Grandview North, LLC – Paisley Lofts

January, 2022

PROFESSIONAL SURVEYING & ENGINEERING
SINCE 1970

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Job # 22923

# Table of Contents

# Executive Summary

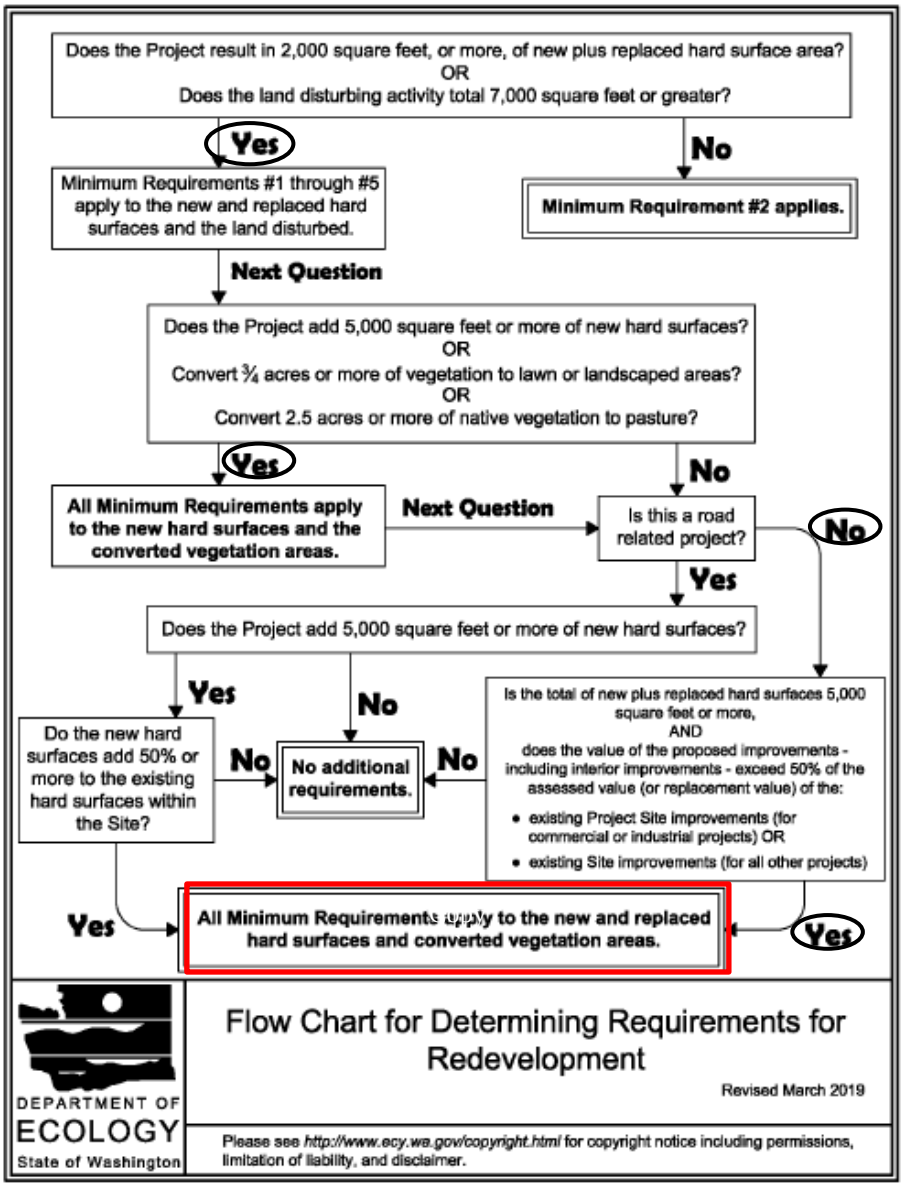
The 0.39-acre site will have a new four-story building constructed along with paved parking areas. The site currently has a building and the remaining property is gravel. Frontage improvements are required on E. Division St. consisting of angled parking, curb, gutter and sidewalk. As part of the proposed project's construction, the alleys on both sides of Centennial Trail, west of the site, will be improved to include additional parking spaces. The project will implement a design to meet the minimum requirements as outlined below:

## Compliance with Minimum Requirements:

| | | |
|---|---|---|
| 1 | *Prepare Stormwater Site Plan* | A stormwater site plan report is presented in this document. |
| 2 | *SWPPP* | A SWPPP will be submitted with construction submittal. |
| 3 | *Water Pollution Source Control* | BMPs for source control will be noted in the SWPPP. |
| 4 | *Preserve Natural Drainage* | All stormwater runoff from the proposed development will be fully infiltrated given the existing well-drained soils on-site. |
| 5 | *On-site Stormwater Management* | All stormwater runoff from the proposed development will be collected and fully infiltrated. |
| 6 | *Runoff Treatment* | Runoff treatment for the proposed parking lot areas will be provided through water quality infiltration trenches. |
| 7 | *Flow Control* | Flow control for the proposed development will be met using infiltration trenches to fully infiltrate all runoff. |
| 8 | *Stormwater Discharge to Wetland* | There are no known wetlands existing within the area of disturbance or on-site. |
| 9 | *Inspection, Operation and Maintenance* | Stormwater facilities will be regularly inspected and maintained. The Operation & Maintenance Manual can be found in the Appendix. |

# Decision Tree

**Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment**




*2019 Stormwater Management Manual for Western Washington*

*Volume I - Chapter 3 - Page 90*

**Figure 1 - Decision Tree (DOE Stormwater Management Manual for Western Wash. 2019)**

# Drainage Information Summary Form

Project Total Area: 0.70 ± acres

Area of Disturbance: 0.70 ± acres

Number of Lots (if applies): N/A

**Table 1 - Drainage Information Summary**

| **Drainage Basin Information** | | **Individual Basin Information** |
|---|---|---|
| | | **Site Drainage Basin** |
| On & Off-Site Sub-Basin Area (acres) | | 0.70 |
| Type of Storage Proposed | | N/A |
| Approx. Dead Storage Vol (cf) | | N/A |
| Approx. Live Storage Vol (cf) | | N/A |
| Soil Type(s) (Natural Resource Conservation Service) | | Everett very gravelly sandy loam |
| **Pre-developed Discharge Rates** | | |
| Q (cfs.) | 2 yr. | 0.001 |
| | 10 yr. | 0.002 |
| | 50 yr./ 100 yr. | 0.009/0.014 |
| Redevelopment Area (acres) | | |
| **Post-development Runoff Rates (w/o quantity controls)** | | |
| Q (cfs.) | 2 yr. | 0.362 |
| | 10 yr. | 0.580 |
| | 50 yr./ 100 yr. | 0.808/0.916 |
| **Post-development Runoff Rates (with quantity controls)** | | |
| Q (cfs.) | 2 yr. | 0 |
| | 10 yr. | 0 |
| | 50 yr. | 0 |
| **Offsite Upstream Area** | | |
| | Number of acres | 0 |
| **Offsite Downstream Flow** | | |
| Q(cfs) | 50 yr. | 0 |

# Vicinity Map

## PROPERTY DESCRIPTION

The project site is located in a portion of Section 2, Township 31 North, Range 05 East W.M. More specifically the site lies at 540 N. Olympic Avenue, Arlington, WA 98223. The property is identified by tax parcels #00529900900101 and #00529900900300 and is shown below in Figure 1, highlighted in red.


*Source PDS Map Portal*

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

# MR #1 Stormwater Site Plan Narrative

## PROJECT DESCRIPTION

The proposal is to remove the existing building on site, construct a four-story multi-use building, and pave the parking lot. The main floor of the proposed building will be for commercial use while the remaining floors will contain 2 one-bedroom units and 44 studio units. A 2,500 sf courtyard is located on the third floor. Offsite improvements will include diagonal parking, curb, gutter, and sidewalk along E. Division St. frontage, and improvements to the alleys on both sides of Centennial Trail to create additional parking.

## METHODOLOGY

Drainage calculations for the on-site area have been prepared using the 2019 Department of Ecology Stormwater Management Manual for Western Washington (DOE SMMWW). The preliminary site drainage design meets Low Impact Development (LID) standards by fully infiltrating all stormwater runoff on-site. The infiltration trenches were sized using the 2012 Western Washington Hydrology Model (WWHM). Given the total proposed new+replaced impervious surface for the project is over 5,000 sf, the development will be required to meet minimum requirements (MRs) 1-9 according to Volume I of the Department of Ecology Stormwater Management Manual for Western Washington (DOE SMMWW).

## EXISTING CONDITIONS

The 0.39-acre site is located in the Old Town Business District 2 zone of the City of Arlington. The site has an existing 1,520 sf building with asphalt for parking along the south and west of the building. The remaining site is gravel that is used as a parking lot. With the existing conditions of the site being more than 35% impervious, the project is characterized a redevelopment.

A subsurface exploration was carried out by GeoTest on October 22, 2021 (see separate report). There were six exploration test pits, the majority of which were advanced to a depth between 10 and 12 ft below ground surface. The test pit located in the area west of Centennial Trail was advanced to a depth of 5 ft. Four test pits were located in the vicinity of the proposed building and a test pit was located in the alley on either side of Centennial Trail. Historic fill was encountered in TP-1,TP-2, and TP-4 between 2 and 8 ft deep over native Arlington gravel member. TP-3, TP-5, and TP-6 encountered topsoil or surficial fill soils associated with the parking lot for depths of 1 to 1.5 ft over native Arlington gravel member. Geotest provided an infiltration rate of 8 in/hr for this Arlington gravel member. Refer to separate report for more detail.

According to the NRCS (see Appendix A), the entire site is comprised of Everett very gravelly sandy loam. This soil 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.

## DEVELOPED CONDITIONS

The proposed redevelopment will remove the existing structure on-site as well as the existing asphalt and gravel areas and replace them with a four-story building, new asphalt parking lot areas, concrete walkways, and landscaped areas. The offsite improvements include diagonal parking, curb, gutter, and sidewalk along E. Division St. frontage, and improvements to the alleys on both sides of Centennial Trail to create additional parking. The proposed areas are outlined in Table 2 and Table 3 below.

**Table 2: Onsite Areas**

| **Proposed Areas** | |
|---|---|
| **Area Description** | **Area (square feet)** |
| Building | 9,760 |
| Asphalt Parking/Drive | 6,701 |
| Dumpster Pad | 160 |
| Landscape areas | 328 |
| **Total** | **16,949** |

**Table 3: Offsite Areas**

| **Proposed Areas** | |
|---|---|
| **Area Description** | **Area (square feet)** |
| E. Division St Frontage | |
| Asphalt Parking/Drive | 3,930 |
| Concrete sidewalk | 1,823 |
| Landscape areas | 1,076 |
| Alley East of Centennial | |
| Asphalt | 4,700 |
| Alley West of Centennial | |
| Asphalt | 1,760 |
| **Total** | **13,289** |

Given total proposed new+replaced impervious surface for the project is over 5,000 sf, the development will be required to meet MRs 1-9 according to Volume I of the DOE SMMWW.

## UPSTREAM ANALYSIS

Due to the developed surrounding properties, there is no upstream area that contributes flow to the subject site.

## DOWNSTREAM ANALYSIS

The proposed development is not anticipated to have any downstream impact as all the site's stormwater runoff will be collected and fully infiltrated on-site. Fully infiltrating all runoff is anticipated to meet or lower the site's runoff from its predeveloped, native forested condition.

**FLOW CONTROL**

Flow control will be provided by fully infiltrating all runoff on-site through the use of an infiltration trench. The infiltration trench was sized for 100% infiltration of 8% of the 2-year peak flow through the full 50-year peak flow using the 2012 Western Washington Hydrology Model (WWHM). Specifics about the proposed flow control trenches are further discussed in MR 7.

**RUNOFF TREATMENT**

The infiltration trench will have 1.5' of soil amended to have a cation exchange capacity (CEC) of 5 milliequivalents CEC/100g of dry soil or better. This will provide runoff treatment for the pollution generating hard surfaces. The trench was sized for 100% infiltration so all stormwater runoff will pass through the amended soils. Specifics about the proposed water quality trench are further discussed in MR 6.

# MR #2 Stormwater Pollution Prevention Plan Narrative

**To be submitted with Civil Construction Application**

# MR #3 Water Pollution Source Control

No known pollution generating activities described in volume IV, chapters 3 and 4 of the Snohomish County Drainage Manual 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. The natural drainage is to sheetflow offsite. The proposed construction will reduce the runoff downstream.

# MR #5 On-Site Stormwater Management

The proposed development will meet Low Impact Development (LID) and flow control requirements per Sections I-2.5.5 and I-2.5.7 of the 2014 Stormwater Management Manual for Western Washington (SMMWW). The post-developed conditions will have flow rates meeting 8% of the 2-year peak flow through the full 50-year peak flow.
Three infiltration trenches will be located within the project site:

1. A trench will be located beneath the parking in the alley to mitigate runoff from onsite impervious areas and the alley east of Centennial Trail.
2. A trench will be located in the E. Division St. frontage to mitigate runoff from frontage improvements.

3. A trench will be located under the proposed parking in the alley west of Centennial Trail.

The infiltration rate of 8 in/hr used in the calculations was measured by Geotest. All proposed impervious surfaces will be conveyed to one of the above trenches. The size of each trench can be seen in WWHM (Appendix B).

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 have been identified on the construction plans as landscape areas. The existing on-site topsoil will 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 will be detailed on the construction plans.

## MR #6 Runoff Treatment

Runoff treatment for the proposed parking lot and driveway areas will be provided through water quality infiltration trenches. These trenches will have 1.5’ of soil amended to have a cation exchange capacity (CEC) of 5 milliequivalents CEC/100g of dry soil or better.

The water quality trenches are sized by achieving 100% infiltration using WWHM. Details on the proposed trench are outlined in the WWHM report provided in Appendix B.

## MR #7 Flow Control

Flow control will be provided for the impervious areas included in construction through the implementation of infiltration trenches. These infiltration trenches are designed using WWHM to detain all runoff from 8% of the 2-year storm through the full 50-year storm until it fully infiltrates. Details on the proposed trenches are outlined in the WWHM report provided in Appendix B.

## MR #8 Wetland Protection

There are no wetlands on site or within the area of disturbance.

## MR #9 Operations & Maintenance

An operation and maintenance manual has been included in Appendix C.

# Appendix

Appendix A - NRCS SOILS REPORT

Appendix B - WWHM REPORT

Appendix C - OPERATIONS AND MAINTENANCE MANUAL

# APPENDIX A – NRCS SOILS REPORT

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


October 22, 2021

# 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.

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# 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.

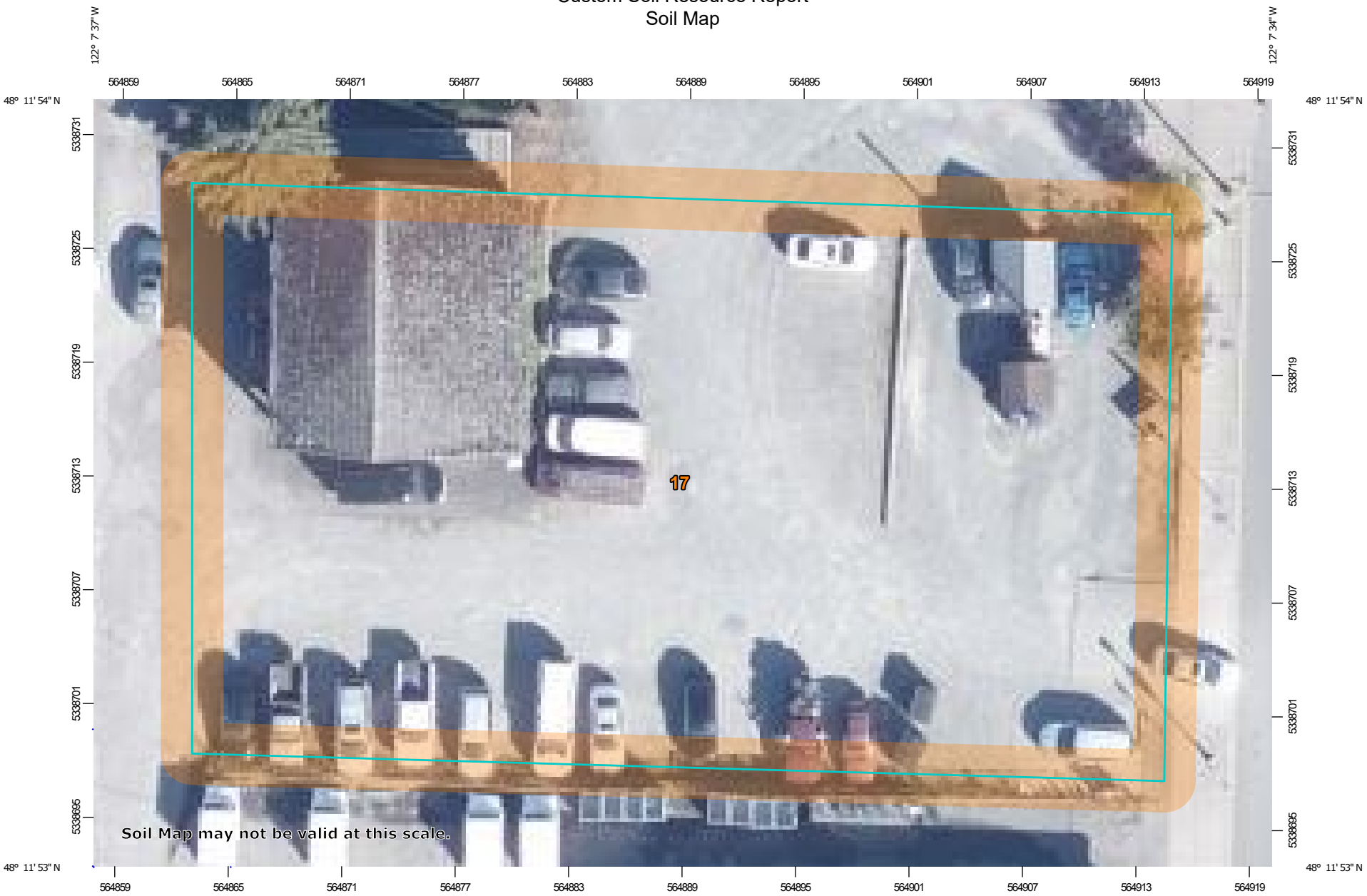
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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.

# Custom Soil Resource Report
## Soil Map




Map Scale: 1:285 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 4 8 16 24

Feet: 0 10 20 40 60

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 23, Aug 31, 2021

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

Date(s) aerial images were photographed: Sep 26, 2018—Oct 16, 2018

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 | 0.4 | 100.0% |
| **Totals for Area of Interest** | | **0.4** | **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):* Interfluve, crest
*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

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# APPENDIX B – WWHM REPORT

# WWHM2012

# PROJECT REPORT

# General Model Information

| | |
|---|---|
| Project Name: | 98223 INFILTRATION REV2 |
| Site Name: | PAISLEY LOFTS |
| Site Address: | 102 E. DIVISION ST. |
| City: | ARLINGTON 98223 |
| Report Date: | 12/1/2021 |
| Gage: | Everett |
| Data Start: | 1948/10/01 |
| Data End: | 2009/09/30 |
| Timestep: | 15 Minute |
| Precip Scale: | 1.200 |
| 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 |

# *Landuse Basin Data*

## *Predeveloped Land Use*

### ONSITE BASIN

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |

| Pervious Land Use | acre |
|---|---|
| A B, Forest, Flat | 0.264 |
| A B, Forest, Mod | 0.089 |
| A B, Forest, Steep | 0.035 |
| Pervious Total | 0.388 |

| Impervious Land Use | acre |
|---|---|
| Impervious Total | 0 |
| Basin Total | 0.388 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## DIVISION FRONTAGE

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |

| Pervious Land Use | acre |
|---|---|
| A B, Forest, Flat | 0.046 |
| A B, Forest, Mod | 0.067 |
| A B, Forest, Steep | 0.041 |
| Pervious Total | 0.154 |

| Impervious Land Use | acre |
|---|---|
| Impervious Total | 0 |
| Basin Total | 0.154 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## WEST OF CENTENNIAL TRAIL

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| A B, Forest, Flat | 0.036 |
| Pervious Total | 0.036 |
| Impervious Land Use | acre |
| Impervious Total | 0 |
| Basin Total | 0.036 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## ALLEY AREA

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |

| Pervious Land Use | acre |
|---|---|
| A B, Forest, Flat | 0.089 |
| A B, Forest, Mod | 0.024 |
| A B, Forest, Steep | 0.012 |
| Pervious Total | 0.125 |

| Impervious Land Use | acre |
|---|---|
| Impervious Total | 0 |
| Basin Total | 0.125 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|

## *Mitigated Land Use*

### ONSITE BASIN

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |

| Pervious Land Use | acre |
|---|---|
| A B, Lawn, Flat | 0.008 |
| Pervious Total | 0.008 |

| Impervious Land Use | acre |
|---|---|
| ROADS FLAT | 0.133 |
| ROADS MOD | 0.02 |
| ROOF TOPS FLAT | 0.224 |
| SIDEWALKS FLAT | 0.004 |
| Impervious Total | 0.381 |
| Basin Total | 0.389 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Gravel Trench Bed 1 | Gravel Trench Bed 1 | |

## DIVISION FRONTAGE

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |

| Pervious Land Use | acre |
|---|---|
| A B, Lawn, Flat | 0.018 |
| Pervious Total | 0.018 |

| Impervious Land Use | acre |
|---|---|
| ROADS FLAT | 0.086 |
| SIDEWALKS FLAT | 0.049 |
| Impervious Total | 0.135 |
| Basin Total | 0.153 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Gravel Trench Bed 3 | Gravel Trench Bed 3 | |

## WEST OF CENTENNIAL TRAIL

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| Pervious Total | 0 |
| Impervious Land Use | acre |
| ROADS FLAT | 0.036 |
| Impervious Total | 0.036 |
| Basin Total | 0.036 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Gravel Trench Bed 2 | Gravel Trench Bed 2 | |

## ALLEY AREA

| | |
|---|---|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| Pervious Total | 0 |
| Impervious Land Use | acre |
| ROADS FLAT | 0.124 |
| Impervious Total | 0.124 |
| Basin Total | 0.124 |

Element Flows To:

| Surface | Interflow | Groundwater |
|---|---|---|
| Gravel Trench Bed 1 | Gravel Trench Bed 1 | |

# Routing Elements
## Predeveloped Routing

## *Mitigated Routing*

### Gravel Trench Bed 1

| | |
|---|---|
| Bottom Length: | 120.00 ft. |
| Bottom Width: | 10.00 ft. |
| Trench bottom slope 1: | 0 To 1 |
| Trench Left side slope 0: | 0 To 1 |
| Trench right side slope 2: | 0 To 1 |
| Material thickness of first layer: | 1.5 |
| Pour Space of material for first layer: | 0.3 |
| Material thickness of second layer: | 1.5 |
| Pour Space of material for second layer: | 0.3 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 8 |
| Infiltration safety factor: | 1 |
| Total Volume Infiltrated (ac-ft.): | 97.407 |
| Total Volume Through Riser (ac-ft.): | 0.003 |
| Total Volume Through Facility (ac-ft.): | 97.41 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 0 |
| Total Evap From Facility: | 0 |
| Discharge Structure | |
| Riser Height: | 2.9 ft. |
| Riser Diameter: | 50 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

Gravel Trench Bed Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.027 | 0.000 | 0.000 | 0.000 |
| 0.0333 | 0.027 | 0.000 | 0.000 | 0.222 |
| 0.0667 | 0.027 | 0.000 | 0.000 | 0.222 |
| 0.1000 | 0.027 | 0.000 | 0.000 | 0.222 |
| 0.1333 | 0.027 | 0.001 | 0.000 | 0.222 |
| 0.1667 | 0.027 | 0.001 | 0.000 | 0.222 |
| 0.2000 | 0.027 | 0.001 | 0.000 | 0.222 |
| 0.2333 | 0.027 | 0.001 | 0.000 | 0.222 |
| 0.2667 | 0.027 | 0.002 | 0.000 | 0.222 |
| 0.3000 | 0.027 | 0.002 | 0.000 | 0.222 |
| 0.3333 | 0.027 | 0.002 | 0.000 | 0.222 |
| 0.3667 | 0.027 | 0.003 | 0.000 | 0.222 |
| 0.4000 | 0.027 | 0.003 | 0.000 | 0.222 |
| 0.4333 | 0.027 | 0.003 | 0.000 | 0.222 |
| 0.4667 | 0.027 | 0.003 | 0.000 | 0.222 |
| 0.5000 | 0.027 | 0.004 | 0.000 | 0.222 |
| 0.5333 | 0.027 | 0.004 | 0.000 | 0.222 |
| 0.5667 | 0.027 | 0.004 | 0.000 | 0.222 |
| 0.6000 | 0.027 | 0.005 | 0.000 | 0.222 |
| 0.6333 | 0.027 | 0.005 | 0.000 | 0.222 |
| 0.6667 | 0.027 | 0.005 | 0.000 | 0.222 |
| 0.7000 | 0.027 | 0.005 | 0.000 | 0.222 |
| 0.7333 | 0.027 | 0.006 | 0.000 | 0.222 |
| 0.7667 | 0.027 | 0.006 | 0.000 | 0.222 |

| | | | | |
|---|---|---|---|---|
| 0.8000 | 0.027 | 0.006 | 0.000 | 0.222 |
| 0.8333 | 0.027 | 0.006 | 0.000 | 0.222 |
| 0.8667 | 0.027 | 0.007 | 0.000 | 0.222 |
| 0.9000 | 0.027 | 0.007 | 0.000 | 0.222 |
| 0.9333 | 0.027 | 0.007 | 0.000 | 0.222 |
| 0.9667 | 0.027 | 0.008 | 0.000 | 0.222 |
| 1.0000 | 0.027 | 0.008 | 0.000 | 0.222 |
| 1.0333 | 0.027 | 0.008 | 0.000 | 0.222 |
| 1.0667 | 0.027 | 0.008 | 0.000 | 0.222 |
| 1.1000 | 0.027 | 0.009 | 0.000 | 0.222 |
| 1.1333 | 0.027 | 0.009 | 0.000 | 0.222 |
| 1.1667 | 0.027 | 0.009 | 0.000 | 0.222 |
| 1.2000 | 0.027 | 0.009 | 0.000 | 0.222 |
| 1.2333 | 0.027 | 0.010 | 0.000 | 0.222 |
| 1.2667 | 0.027 | 0.010 | 0.000 | 0.222 |
| 1.3000 | 0.027 | 0.010 | 0.000 | 0.222 |
| 1.3333 | 0.027 | 0.011 | 0.000 | 0.222 |
| 1.3667 | 0.027 | 0.011 | 0.000 | 0.222 |
| 1.4000 | 0.027 | 0.011 | 0.000 | 0.222 |
| 1.4333 | 0.027 | 0.011 | 0.000 | 0.222 |
| 1.4667 | 0.027 | 0.012 | 0.000 | 0.222 |
| 1.5000 | 0.027 | 0.012 | 0.000 | 0.222 |
| 1.5333 | 0.027 | 0.012 | 0.000 | 0.222 |
| 1.5667 | 0.027 | 0.012 | 0.000 | 0.222 |
| 1.6000 | 0.027 | 0.013 | 0.000 | 0.222 |
| 1.6333 | 0.027 | 0.013 | 0.000 | 0.222 |
| 1.6667 | 0.027 | 0.013 | 0.000 | 0.222 |
| 1.7000 | 0.027 | 0.014 | 0.000 | 0.222 |
| 1.7333 | 0.027 | 0.014 | 0.000 | 0.222 |
| 1.7667 | 0.027 | 0.014 | 0.000 | 0.222 |
| 1.8000 | 0.027 | 0.014 | 0.000 | 0.222 |
| 1.8333 | 0.027 | 0.015 | 0.000 | 0.222 |
| 1.8667 | 0.027 | 0.015 | 0.000 | 0.222 |
| 1.9000 | 0.027 | 0.015 | 0.000 | 0.222 |
| 1.9333 | 0.027 | 0.016 | 0.000 | 0.222 |
| 1.9667 | 0.027 | 0.016 | 0.000 | 0.222 |
| 2.0000 | 0.027 | 0.016 | 0.000 | 0.222 |
| 2.0333 | 0.027 | 0.016 | 0.000 | 0.222 |
| 2.0667 | 0.027 | 0.017 | 0.000 | 0.222 |
| 2.1000 | 0.027 | 0.017 | 0.000 | 0.222 |
| 2.1333 | 0.027 | 0.017 | 0.000 | 0.222 |
| 2.1667 | 0.027 | 0.017 | 0.000 | 0.222 |
| 2.2000 | 0.027 | 0.018 | 0.000 | 0.222 |
| 2.2333 | 0.027 | 0.018 | 0.000 | 0.222 |
| 2.2667 | 0.027 | 0.018 | 0.000 | 0.222 |
| 2.3000 | 0.027 | 0.019 | 0.000 | 0.222 |
| 2.3333 | 0.027 | 0.019 | 0.000 | 0.222 |
| 2.3667 | 0.027 | 0.019 | 0.000 | 0.222 |
| 2.4000 | 0.027 | 0.019 | 0.000 | 0.222 |
| 2.4333 | 0.027 | 0.020 | 0.000 | 0.222 |
| 2.4667 | 0.027 | 0.020 | 0.000 | 0.222 |
| 2.5000 | 0.027 | 0.020 | 0.000 | 0.222 |
| 2.5333 | 0.027 | 0.020 | 0.000 | 0.222 |
| 2.5667 | 0.027 | 0.021 | 0.000 | 0.222 |
| 2.6000 | 0.027 | 0.021 | 0.000 | 0.222 |
| 2.6333 | 0.027 | 0.021 | 0.000 | 0.222 |
| 2.6667 | 0.027 | 0.022 | 0.000 | 0.222 |
| 2.7000 | 0.027 | 0.022 | 0.000 | 0.222 |

| | | | | |
|---|---|---|---|---|
| 2.7333 | 0.027 | 0.022 | 0.000 | 0.222 |
| 2.7667 | 0.027 | 0.022 | 0.000 | 0.222 |
| 2.8000 | 0.027 | 0.023 | 0.000 | 0.222 |
| 2.8333 | 0.027 | 0.023 | 0.000 | 0.222 |
| 2.8667 | 0.027 | 0.023 | 0.000 | 0.222 |
| 2.9000 | 0.027 | 0.024 | 0.000 | 0.222 |
| 2.9333 | 0.027 | 0.024 | 0.269 | 0.222 |
| 2.9667 | 0.027 | 0.024 | 0.761 | 0.222 |
| 3.0000 | 0.027 | 0.024 | 1.397 | 0.222 |

## Gravel Trench Bed 2

| | |
|---|---|
| Bottom Length: | 42.00 ft. |
| Bottom Width: | 2.00 ft. |
| Trench bottom slope 1: | 0 To 1 |
| Trench Left side slope 0: | 0 To 1 |
| Trench right side slope 2: | 0 To 1 |
| Material thickness of first layer: | 1.5 |
| Pour Space of material for first layer: | 0.3 |
| Material thickness of second layer: | 1.5 |
| Pour Space of material for second layer: | 0.3 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 8 |
| Infiltration safety factor: | 1 |
| Total Volume Infiltrated (ac-ft.): | 6.606 |
| Total Volume Through Riser (ac-ft.): | 0 |
| Total Volume Through Facility (ac-ft.): | 6.606 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 0 |
| Total Evap From Facility: | 0 |
| Discharge Structure | |
| Riser Height: | 2.9 ft. |
| Riser Diameter: | 50 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

Gravel Trench Bed Hydraulic Table

| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.001928 | 0.000000 | 0.000 | 0.000 |
| 0.0333 | 0.001928 | 0.000019 | 0.000 | 0.015 |
| 0.0667 | 0.001928 | 0.000039 | 0.000 | 0.015 |
| 0.1000 | 0.001928 | 0.000058 | 0.000 | 0.015 |
| 0.1333 | 0.001928 | 0.000077 | 0.000 | 0.015 |
| 0.1667 | 0.001928 | 0.000096 | 0.000 | 0.015 |
| 0.2000 | 0.001928 | 0.000116 | 0.000 | 0.015 |
| 0.2333 | 0.001928 | 0.000135 | 0.000 | 0.015 |
| 0.2667 | 0.001928 | 0.000154 | 0.000 | 0.015 |
| 0.3000 | 0.001928 | 0.000174 | 0.000 | 0.015 |
| 0.3333 | 0.001928 | 0.000193 | 0.000 | 0.015 |
| 0.3667 | 0.001928 | 0.000212 | 0.000 | 0.015 |
| 0.4000 | 0.001928 | 0.000231 | 0.000 | 0.015 |
| 0.4333 | 0.001928 | 0.000251 | 0.000 | 0.015 |
| 0.4667 | 0.001928 | 0.000270 | 0.000 | 0.015 |
| 0.5000 | 0.001928 | 0.000289 | 0.000 | 0.015 |
| 0.5333 | 0.001928 | 0.000309 | 0.000 | 0.015 |
| 0.5667 | 0.001928 | 0.000328 | 0.000 | 0.015 |
| 0.6000 | 0.001928 | 0.000347 | 0.000 | 0.015 |
| 0.6333 | 0.001928 | 0.000366 | 0.000 | 0.015 |
| 0.6667 | 0.001928 | 0.000386 | 0.000 | 0.015 |
| 0.7000 | 0.001928 | 0.000405 | 0.000 | 0.015 |
| 0.7333 | 0.001928 | 0.000424 | 0.000 | 0.015 |
| 0.7667 | 0.001928 | 0.000444 | 0.000 | 0.015 |
| 0.8000 | 0.001928 | 0.000463 | 0.000 | 0.015 |
| 0.8333 | 0.001928 | 0.000482 | 0.000 | 0.015 |

| | | | | |
|---|---|---|---|---|
| 0.8667 | 0.001928 | 0.000501 | 0.000 | 0.015 |
| 0.9000 | 0.001928 | 0.000521 | 0.000 | 0.015 |
| 0.9333 | 0.001928 | 0.000540 | 0.000 | 0.015 |
| 0.9667 | 0.001928 | 0.000559 | 0.000 | 0.015 |
| 1.0000 | 0.001928 | 0.000579 | 0.000 | 0.015 |
| 1.0333 | 0.001928 | 0.000598 | 0.000 | 0.015 |
| 1.0667 | 0.001928 | 0.000617 | 0.000 | 0.015 |
| 1.1000 | 0.001928 | 0.000636 | 0.000 | 0.015 |
| 1.1333 | 0.001928 | 0.000656 | 0.000 | 0.015 |
| 1.1667 | 0.001928 | 0.000675 | 0.000 | 0.015 |
| 1.2000 | 0.001928 | 0.000694 | 0.000 | 0.015 |
| 1.2333 | 0.001928 | 0.000713 | 0.000 | 0.015 |
| 1.2667 | 0.001928 | 0.000733 | 0.000 | 0.015 |
| 1.3000 | 0.001928 | 0.000752 | 0.000 | 0.015 |
| 1.3333 | 0.001928 | 0.000771 | 0.000 | 0.015 |
| 1.3667 | 0.001928 | 0.000791 | 0.000 | 0.015 |
| 1.4000 | 0.001928 | 0.000810 | 0.000 | 0.015 |
| 1.4333 | 0.001928 | 0.000829 | 0.000 | 0.015 |
| 1.4667 | 0.001928 | 0.000848 | 0.000 | 0.015 |
| 1.5000 | 0.001928 | 0.000868 | 0.000 | 0.015 |
| 1.5333 | 0.001928 | 0.000887 | 0.000 | 0.015 |
| 1.5667 | 0.001928 | 0.000906 | 0.000 | 0.015 |
| 1.6000 | 0.001928 | 0.000926 | 0.000 | 0.015 |
| 1.6333 | 0.001928 | 0.000945 | 0.000 | 0.015 |
| 1.6667 | 0.001928 | 0.000964 | 0.000 | 0.015 |
| 1.7000 | 0.001928 | 0.000983 | 0.000 | 0.015 |
| 1.7333 | 0.001928 | 0.001003 | 0.000 | 0.015 |
| 1.7667 | 0.001928 | 0.001022 | 0.000 | 0.015 |
| 1.8000 | 0.001928 | 0.001041 | 0.000 | 0.015 |
| 1.8333 | 0.001928 | 0.001061 | 0.000 | 0.015 |
| 1.8667 | 0.001928 | 0.001080 | 0.000 | 0.015 |
| 1.9000 | 0.001928 | 0.001099 | 0.000 | 0.015 |
| 1.9333 | 0.001928 | 0.001118 | 0.000 | 0.015 |
| 1.9667 | 0.001928 | 0.001138 | 0.000 | 0.015 |
| 2.0000 | 0.001928 | 0.001157 | 0.000 | 0.015 |
| 2.0333 | 0.001928 | 0.001176 | 0.000 | 0.015 |
| 2.0667 | 0.001928 | 0.001196 | 0.000 | 0.015 |
| 2.1000 | 0.001928 | 0.001215 | 0.000 | 0.015 |
| 2.1333 | 0.001928 | 0.001234 | 0.000 | 0.015 |
| 2.1667 | 0.001928 | 0.001253 | 0.000 | 0.015 |
| 2.2000 | 0.001928 | 0.001273 | 0.000 | 0.015 |
| 2.2333 | 0.001928 | 0.001292 | 0.000 | 0.015 |
| 2.2667 | 0.001928 | 0.001311 | 0.000 | 0.015 |
| 2.3000 | 0.001928 | 0.001331 | 0.000 | 0.015 |
| 2.3333 | 0.001928 | 0.001350 | 0.000 | 0.015 |
| 2.3667 | 0.001928 | 0.001369 | 0.000 | 0.015 |
| 2.4000 | 0.001928 | 0.001388 | 0.000 | 0.015 |
| 2.4333 | 0.001928 | 0.001408 | 0.000 | 0.015 |
| 2.4667 | 0.001928 | 0.001427 | 0.000 | 0.015 |
| 2.5000 | 0.001928 | 0.001446 | 0.000 | 0.015 |
| 2.5333 | 0.001928 | 0.001466 | 0.000 | 0.015 |
| 2.5667 | 0.001928 | 0.001485 | 0.000 | 0.015 |
| 2.6000 | 0.001928 | 0.001504 | 0.000 | 0.015 |
| 2.6333 | 0.001928 | 0.001523 | 0.000 | 0.015 |
| 2.6667 | 0.001928 | 0.001543 | 0.000 | 0.015 |
| 2.7000 | 0.001928 | 0.001562 | 0.000 | 0.015 |
| 2.7333 | 0.001928 | 0.001581 | 0.000 | 0.015 |
| 2.7667 | 0.001928 | 0.001601 | 0.000 | 0.015 |

| | | | | |
|---|---|---|---|---|
| 2.8000 | 0.001928 | 0.001620 | 0.000 | 0.015 |
| 2.8333 | 0.001928 | 0.001639 | 0.000 | 0.015 |
| 2.8667 | 0.001928 | 0.001658 | 0.000 | 0.015 |
| 2.9000 | 0.001928 | 0.001678 | 0.000 | 0.015 |
| 2.9333 | 0.001928 | 0.001697 | 0.269 | 0.015 |
| 2.9667 | 0.001928 | 0.001716 | 0.761 | 0.015 |
| 3.0000 | 0.001928 | 0.001736 | 1.397 | 0.015 |

## Gravel Trench Bed 3

| | |
|---|---|
| Bottom Length: | 40.00 ft. |
| Bottom Width: | 8.00 ft. |
| Trench bottom slope 1: | 0 To 1 |
| Trench Left side slope 0: | 0 To 1 |
| Trench right side slope 2: | 0 To 1 |
| Material thickness of first layer: | 1.5 |
| Pour Space of material for first layer: | 0.3 |
| Material thickness of second layer: | 1.5 |
| Pour Space of material for second layer: | 0.3 |
| Material thickness of third layer: | 0 |
| Pour Space of material for third layer: | 0 |
| Infiltration On | |
| Infiltration rate: | 8 |
| Infiltration safety factor: | 1 |
| Total Volume Infiltrated (ac-ft.): | 25.759 |
| Total Volume Through Riser (ac-ft.): | 0.001 |
| Total Volume Through Facility (ac-ft.): | 25.759 |
| Percent Infiltrated: | 100 |
| Total Precip Applied to Facility: | 0 |
| Total Evap From Facility: | 0 |
| Discharge Structure | |
| Riser Height: | 2.9 ft. |
| Riser Diameter: | 50 in. |
| Element Flows To: | |
| Outlet 1 | Outlet 2 |

Gravel Trench Bed Hydraulic Table

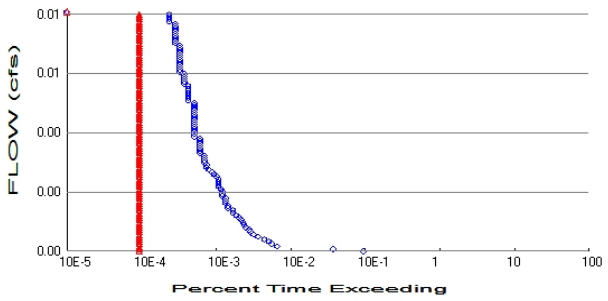
| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|---|---|---|---|---|
| 0.0000 | 0.007 | 0.000 | 0.000 | 0.000 |
| 0.0333 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.0667 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.1000 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.1333 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.1667 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.2000 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.2333 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.2667 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.3000 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.3333 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.3667 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.4000 | 0.007 | 0.000 | 0.000 | 0.059 |
| 0.4333 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.4667 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.5000 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.5333 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.5667 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.6000 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.6333 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.6667 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.7000 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.7333 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.7667 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.8000 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.8333 | 0.007 | 0.001 | 0.000 | 0.059 |

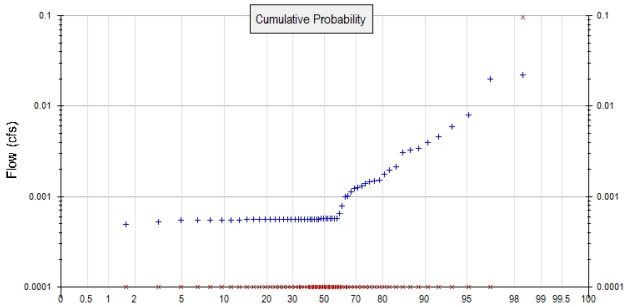
| | | | | |
|---|---|---|---|---|
| 0.8667 | 0.007 | 0.001 | 0.000 | 0.059 |
| 0.9000 | 0.007 | 0.002 | 0.000 | 0.059 |
| 0.9333 | 0.007 | 0.002 | 0.000 | 0.059 |
| 0.9667 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.0000 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.0333 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.0667 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.1000 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.1333 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.1667 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.2000 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.2333 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.2667 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.3000 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.3333 | 0.007 | 0.002 | 0.000 | 0.059 |
| 1.3667 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.4000 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.4333 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.4667 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.5000 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.5333 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.5667 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.6000 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.6333 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.6667 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.7000 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.7333 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.7667 | 0.007 | 0.003 | 0.000 | 0.059 |
| 1.8000 | 0.007 | 0.004 | 0.000 | 0.059 |
| 1.8333 | 0.007 | 0.004 | 0.000 | 0.059 |
| 1.8667 | 0.007 | 0.004 | 0.000 | 0.059 |
| 1.9000 | 0.007 | 0.004 | 0.000 | 0.059 |
| 1.9333 | 0.007 | 0.004 | 0.000 | 0.059 |
| 1.9667 | 0.007 | 0.004 | 0.000 | 0.059 |
| 2.0000 | 0.007 | 0.004 | 0.000 | 0.059 |
| 2.0333 | 0.007 | 0.004 | 0.000 | 0.059 |
| 2.0667 | 0.007 | 0.004 | 0.000 | 0.059 |
| 2.1000 | 0.007 | 0.004 | 0.000 | 0.059 |
| 2.1333 | 0.007 | 0.004 | 0.000 | 0.059 |
| 2.1667 | 0.007 | 0.004 | 0.000 | 0.059 |
| 2.2000 | 0.007 | 0.004 | 0.000 | 0.059 |
| 2.2333 | 0.007 | 0.004 | 0.000 | 0.059 |
| 2.2667 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.3000 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.3333 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.3667 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.4000 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.4333 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.4667 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.5000 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.5333 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.5667 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.6000 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.6333 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.6667 | 0.007 | 0.005 | 0.000 | 0.059 |
| 2.7000 | 0.007 | 0.006 | 0.000 | 0.059 |
| 2.7333 | 0.007 | 0.006 | 0.000 | 0.059 |
| 2.7667 | 0.007 | 0.006 | 0.000 | 0.059 |

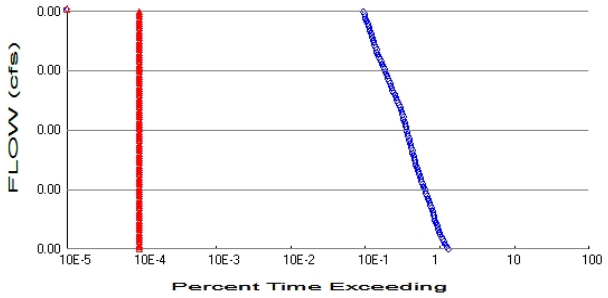
| | | | | |
|---|---|---|---|---|
| 2.8000 | 0.007 | 0.006 | 0.000 | 0.059 |
| 2.8333 | 0.007 | 0.006 | 0.000 | 0.059 |
| 2.8667 | 0.007 | 0.006 | 0.000 | 0.059 |
| 2.9000 | 0.007 | 0.006 | 0.000 | 0.059 |
| 2.9333 | 0.007 | 0.006 | 0.269 | 0.059 |
| 2.9667 | 0.007 | 0.006 | 0.761 | 0.059 |
| 3.0000 | 0.007 | 0.006 | 1.397 | 0.059 |

# *Analysis Results*

## *POC 1*




\+ Predeveloped  x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.703
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.026
Total Impervious Area: 0.676

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0.000856 |
| 5 year | 0.001967 |
| 10 year | 0.003268 |
| 25 year | 0.005949 |
| 50 year | 0.009049 |
| 100 year | 0.013494 |

Flow Frequency Return Periods for Mitigated. POC #1

| **Return Period** | **Flow(cfs)** |
|---|---|
| 2 year | 0 |
| 5 year | 0 |
| 10 year | 0 |
| 25 year | 0 |
| 50 year | 0 |
| 100 year | 0 |

## Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

| Year | Predeveloped | Mitigated |
|---|---|---|
| 1949 | 0.001 | 0.000 |
| 1950 | 0.002 | 0.000 |
| 1951 | 0.001 | 0.000 |
| 1952 | 0.001 | 0.000 |
| 1953 | 0.001 | 0.000 |
| 1954 | 0.005 | 0.000 |
| 1955 | 0.003 | 0.000 |
| 1956 | 0.001 | 0.000 |
| 1957 | 0.001 | 0.000 |
| 1958 | 0.001 | 0.000 |
| 1959 | 0.001 | 0.000 |
| 1960 | 0.001 | 0.000 |
| 1961 | 0.003 | 0.097 |
| 1962 | 0.001 | 0.000 |
| 1963 | 0.001 | 0.000 |
| 1964 | 0.002 | 0.000 |
| 1965 | 0.001 | 0.000 |
| 1966 | 0.001 | 0.000 |
| 1967 | 0.001 | 0.000 |
| 1968 | 0.001 | 0.000 |
| 1969 | 0.001 | 0.000 |
| 1970 | 0.001 | 0.000 |
| 1971 | 0.003 | 0.000 |
| 1972 | 0.001 | 0.000 |
| 1973 | 0.001 | 0.000 |
| 1974 | 0.002 | 0.000 |
| 1975 | 0.001 | 0.000 |
| 1976 | 0.002 | 0.000 |
| 1977 | 0.001 | 0.000 |
| 1978 | 0.001 | 0.000 |
| 1979 | 0.001 | 0.000 |
| 1980 | 0.001 | 0.000 |
| 1981 | 0.001 | 0.000 |
| 1982 | 0.001 | 0.000 |
| 1983 | 0.001 | 0.000 |
| 1984 | 0.001 | 0.000 |
| 1985 | 0.001 | 0.000 |
| 1986 | 0.006 | 0.000 |
| 1987 | 0.004 | 0.000 |
| 1988 | 0.001 | 0.000 |
| 1989 | 0.001 | 0.000 |
| 1990 | 0.001 | 0.000 |
| 1991 | 0.001 | 0.000 |
| 1992 | 0.001 | 0.000 |
| 1993 | 0.001 | 0.000 |
| 1994 | 0.001 | 0.000 |
| 1995 | 0.001 | 0.000 |
| 1996 | 0.008 | 0.000 |
| 1997 | 0.020 | 0.000 |
| 1998 | 0.001 | 0.000 |
| 1999 | 0.001 | 0.000 |
| 2000 | 0.001 | 0.000 |
| 2001 | 0.000 | 0.000 |
| 2002 | 0.001 | 0.000 |
| 2003 | 0.000 | 0.000 |
| 2004 | 0.001 | 0.000 |

| | | |
|---|---|---|
| 2005 | 0.001 | 0.000 |
| 2006 | 0.022 | 0.000 |
| 2007 | 0.001 | 0.000 |
| 2008 | 0.001 | 0.000 |
| 2009 | 0.001 | 0.000 |

## Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

| Rank | Predeveloped | Mitigated |
|---|---|---|
| 1 | 0.0221 | 0.0966 |
| 2 | 0.0198 | 0.0000 |
| 3 | 0.0079 | 0.0000 |
| 4 | 0.0059 | 0.0000 |
| 5 | 0.0046 | 0.0000 |
| 6 | 0.0039 | 0.0000 |
| 7 | 0.0034 | 0.0000 |
| 8 | 0.0032 | 0.0000 |
| 9 | 0.0031 | 0.0000 |
| 10 | 0.0021 | 0.0000 |
| 11 | 0.0020 | 0.0000 |
| 12 | 0.0018 | 0.0000 |
| 13 | 0.0015 | 0.0000 |
| 14 | 0.0015 | 0.0000 |
| 15 | 0.0014 | 0.0000 |
| 16 | 0.0014 | 0.0000 |
| 17 | 0.0013 | 0.0000 |
| 18 | 0.0012 | 0.0000 |
| 19 | 0.0012 | 0.0000 |
| 20 | 0.0011 | 0.0000 |
| 21 | 0.0010 | 0.0000 |
| 22 | 0.0010 | 0.0000 |
| 23 | 0.0008 | 0.0000 |
| 24 | 0.0006 | 0.0000 |
| 25 | 0.0006 | 0.0000 |
| 26 | 0.0006 | 0.0000 |
| 27 | 0.0006 | 0.0000 |
| 28 | 0.0006 | 0.0000 |
| 29 | 0.0006 | 0.0000 |
| 30 | 0.0006 | 0.0000 |
| 31 | 0.0006 | 0.0000 |
| 32 | 0.0006 | 0.0000 |
| 33 | 0.0006 | 0.0000 |
| 34 | 0.0006 | 0.0000 |
| 35 | 0.0006 | 0.0000 |
| 36 | 0.0006 | 0.0000 |
| 37 | 0.0006 | 0.0000 |
| 38 | 0.0006 | 0.0000 |
| 39 | 0.0006 | 0.0000 |
| 40 | 0.0006 | 0.0000 |
| 41 | 0.0006 | 0.0000 |
| 42 | 0.0006 | 0.0000 |
| 43 | 0.0006 | 0.0000 |
| 44 | 0.0006 | 0.0000 |
| 45 | 0.0006 | 0.0000 |
| 46 | 0.0006 | 0.0000 |
| 47 | 0.0006 | 0.0000 |
| 48 | 0.0006 | 0.0000 |
| 49 | 0.0006 | 0.0000 |

| | | |
|---|---|---|
| 50 | 0.0006 | 0.0000 |
| 51 | 0.0006 | 0.0000 |
| 52 | 0.0006 | 0.0000 |
| 53 | 0.0006 | 0.0000 |
| 54 | 0.0006 | 0.0000 |
| 55 | 0.0005 | 0.0000 |
| 56 | 0.0005 | 0.0000 |
| 57 | 0.0005 | 0.0000 |
| 58 | 0.0005 | 0.0000 |
| 59 | 0.0005 | 0.0000 |
| 60 | 0.0005 | 0.0000 |
| 61 | 0.0004 | 0.0000 |

## LID Duration Flows

The Facility PASSED

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|---|---|---|---|---|
| 0.0001 | 27399 | 2 | 0 | Pass |
| 0.0001 | 26180 | 2 | 0 | Pass |
| 0.0001 | 25239 | 2 | 0 | Pass |
| 0.0001 | 24105 | 2 | 0 | Pass |
| 0.0001 | 23185 | 2 | 0 | Pass |
| 0.0001 | 22351 | 2 | 0 | Pass |
| 0.0001 | 21496 | 2 | 0 | Pass |
| 0.0001 | 21025 | 2 | 0 | Pass |
| 0.0001 | 20384 | 2 | 0 | Pass |
| 0.0001 | 19860 | 2 | 0 | Pass |
| 0.0001 | 19447 | 2 | 0 | Pass |
| 0.0001 | 18925 | 2 | 0 | Pass |
| 0.0001 | 18431 | 2 | 0 | Pass |
| 0.0001 | 18080 | 2 | 0 | Pass |
| 0.0001 | 17635 | 2 | 0 | Pass |
| 0.0001 | 17314 | 2 | 0 | Pass |
| 0.0001 | 16906 | 2 | 0 | Pass |
| 0.0001 | 16461 | 2 | 0 | Pass |
| 0.0001 | 16106 | 2 | 0 | Pass |
| 0.0001 | 15644 | 2 | 0 | Pass |
| 0.0001 | 15190 | 2 | 0 | Pass |
| 0.0001 | 14822 | 2 | 0 | Pass |
| 0.0001 | 14380 | 2 | 0 | Pass |
| 0.0002 | 13963 | 2 | 0 | Pass |
| 0.0002 | 13663 | 2 | 0 | Pass |
| 0.0002 | 13285 | 2 | 0 | Pass |
| 0.0002 | 12955 | 2 | 0 | Pass |
| 0.0002 | 12549 | 2 | 0 | Pass |
| 0.0002 | 12207 | 2 | 0 | Pass |
| 0.0002 | 11903 | 2 | 0 | Pass |
| 0.0002 | 11573 | 2 | 0 | Pass |
| 0.0002 | 11255 | 2 | 0 | Pass |
| 0.0002 | 11049 | 2 | 0 | Pass |
| 0.0002 | 10769 | 2 | 0 | Pass |
| 0.0002 | 10532 | 2 | 0 | Pass |
| 0.0002 | 10262 | 2 | 0 | Pass |
| 0.0002 | 10001 | 2 | 0 | Pass |
| 0.0002 | 9835 | 2 | 0 | Pass |
| 0.0002 | 9621 | 2 | 0 | Pass |
| 0.0002 | 9409 | 2 | 0 | Pass |
| 0.0002 | 9261 | 2 | 0 | Pass |
| 0.0002 | 9086 | 2 | 0 | Pass |
| 0.0002 | 8846 | 2 | 0 | Pass |
| 0.0002 | 8680 | 2 | 0 | Pass |
| 0.0002 | 8493 | 2 | 0 | Pass |
| 0.0002 | 8365 | 2 | 0 | Pass |
| 0.0002 | 8181 | 2 | 0 | Pass |
| 0.0002 | 7993 | 2 | 0 | Pass |
| 0.0002 | 7884 | 2 | 0 | Pass |
| 0.0002 | 7732 | 2 | 0 | Pass |
| 0.0003 | 7572 | 2 | 0 | Pass |
| 0.0003 | 7460 | 2 | 0 | Pass |
| 0.0003 | 7304 | 2 | 0 | Pass |

| | | | | |
|---|---|---|---|---|
| 0.0003 | 7193 | 2 | 0 | Pass |
| 0.0003 | 7039 | 2 | 0 | Pass |
| 0.0003 | 6889 | 2 | 0 | Pass |
| 0.0003 | 6782 | 2 | 0 | Pass |
| 0.0003 | 6579 | 2 | 0 | Pass |
| 0.0003 | 6417 | 2 | 0 | Pass |
| 0.0003 | 6282 | 2 | 0 | Pass |
| 0.0003 | 6074 | 2 | 0 | Pass |
| 0.0003 | 5873 | 2 | 0 | Pass |
| 0.0003 | 5709 | 2 | 0 | Pass |
| 0.0003 | 5533 | 2 | 0 | Pass |
| 0.0003 | 5358 | 2 | 0 | Pass |
| 0.0003 | 5153 | 2 | 0 | Pass |
| 0.0003 | 4962 | 2 | 0 | Pass |
| 0.0003 | 4855 | 2 | 0 | Pass |
| 0.0003 | 4697 | 2 | 0 | Pass |
| 0.0003 | 4554 | 2 | 0 | Pass |
| 0.0003 | 4453 | 2 | 0 | Pass |
| 0.0003 | 4297 | 2 | 0 | Pass |
| 0.0003 | 4211 | 2 | 0 | Pass |
| 0.0003 | 4070 | 2 | 0 | Pass |
| 0.0003 | 3953 | 2 | 0 | Pass |
| 0.0003 | 3865 | 2 | 0 | Pass |
| 0.0003 | 3724 | 2 | 0 | Pass |
| 0.0003 | 3583 | 2 | 0 | Pass |
| 0.0004 | 3491 | 2 | 0 | Pass |
| 0.0004 | 3358 | 2 | 0 | Pass |
| 0.0004 | 3230 | 2 | 0 | Pass |
| 0.0004 | 3161 | 2 | 0 | Pass |
| 0.0004 | 3067 | 2 | 0 | Pass |
| 0.0004 | 3005 | 2 | 0 | Pass |
| 0.0004 | 2920 | 2 | 0 | Pass |
| 0.0004 | 2845 | 2 | 0 | Pass |
| 0.0004 | 2793 | 2 | 0 | Pass |
| 0.0004 | 2731 | 2 | 0 | Pass |
| 0.0004 | 2661 | 2 | 0 | Pass |
| 0.0004 | 2609 | 2 | 0 | Pass |
| 0.0004 | 2537 | 2 | 0 | Pass |
| 0.0004 | 2488 | 2 | 0 | Pass |
| 0.0004 | 2421 | 2 | 0 | Pass |
| 0.0004 | 2346 | 2 | 0 | Pass |
| 0.0004 | 2299 | 2 | 0 | Pass |
| 0.0004 | 2216 | 2 | 0 | Pass |
| 0.0004 | 2150 | 2 | 0 | Pass |
| 0.0004 | 2115 | 2 | 0 | Pass |
| 0.0004 | 2061 | 2 | 0 | Pass |
| 0.0004 | 1999 | 2 | 0 | Pass |

## Duration Flows

The Facility PASSED

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|---|---|---|---|---|
| 0.0004 | 1999 | 2 | 0 | Pass |
| 0.0005 | 797 | 2 | 0 | Pass |
| 0.0006 | 142 | 2 | 1 | Pass |
| 0.0007 | 119 | 2 | 1 | Pass |
| 0.0008 | 109 | 2 | 1 | Pass |
| 0.0009 | 94 | 2 | 2 | Pass |
| 0.0010 | 79 | 2 | 2 | Pass |
| 0.0010 | 68 | 2 | 2 | Pass |
| 0.0011 | 61 | 2 | 3 | Pass |
| 0.0012 | 59 | 2 | 3 | Pass |
| 0.0013 | 54 | 2 | 3 | Pass |
| 0.0014 | 51 | 2 | 3 | Pass |
| 0.0015 | 49 | 2 | 4 | Pass |
| 0.0016 | 47 | 2 | 4 | Pass |
| 0.0016 | 43 | 2 | 4 | Pass |
| 0.0017 | 40 | 2 | 5 | Pass |
| 0.0018 | 36 | 2 | 5 | Pass |
| 0.0019 | 36 | 2 | 5 | Pass |
| 0.0020 | 31 | 2 | 6 | Pass |
| 0.0021 | 31 | 2 | 6 | Pass |
| 0.0022 | 29 | 2 | 6 | Pass |
| 0.0023 | 29 | 2 | 6 | Pass |
| 0.0023 | 29 | 2 | 6 | Pass |
| 0.0024 | 26 | 2 | 7 | Pass |
| 0.0025 | 26 | 2 | 7 | Pass |
| 0.0026 | 26 | 2 | 7 | Pass |
| 0.0027 | 25 | 2 | 8 | Pass |
| 0.0028 | 23 | 2 | 8 | Pass |
| 0.0029 | 23 | 2 | 8 | Pass |
| 0.0030 | 23 | 2 | 8 | Pass |
| 0.0030 | 23 | 2 | 8 | Pass |
| 0.0031 | 22 | 2 | 9 | Pass |
| 0.0032 | 20 | 2 | 10 | Pass |
| 0.0033 | 19 | 2 | 10 | Pass |
| 0.0034 | 17 | 2 | 11 | Pass |
| 0.0035 | 16 | 2 | 12 | Pass |
| 0.0036 | 16 | 2 | 12 | Pass |
| 0.0036 | 15 | 2 | 13 | Pass |
| 0.0037 | 15 | 2 | 13 | Pass |
| 0.0038 | 15 | 2 | 13 | Pass |
| 0.0039 | 15 | 2 | 13 | Pass |
| 0.0040 | 13 | 2 | 15 | Pass |
| 0.0041 | 13 | 2 | 15 | Pass |
| 0.0042 | 13 | 2 | 15 | Pass |
| 0.0043 | 13 | 2 | 15 | Pass |
| 0.0043 | 13 | 2 | 15 | Pass |
| 0.0044 | 13 | 2 | 15 | Pass |
| 0.0045 | 13 | 2 | 15 | Pass |
| 0.0046 | 11 | 2 | 18 | Pass |
| 0.0047 | 11 | 2 | 18 | Pass |
| 0.0048 | 11 | 2 | 18 | Pass |
| 0.0049 | 11 | 2 | 18 | Pass |
| 0.0050 | 11 | 2 | 18 | Pass |

| | | | | |
|---|---|---|---|---|
| 0.0050 | 11 | 2 | 18 | Pass |
| 0.0051 | 11 | 2 | 18 | Pass |
| 0.0052 | 11 | 2 | 18 | Pass |
| 0.0053 | 11 | 2 | 18 | Pass |
| 0.0054 | 11 | 2 | 18 | Pass |
| 0.0055 | 11 | 2 | 18 | Pass |
| 0.0056 | 11 | 2 | 18 | Pass |
| 0.0057 | 11 | 2 | 18 | Pass |
| 0.0057 | 11 | 2 | 18 | Pass |
| 0.0058 | 11 | 2 | 18 | Pass |
| 0.0059 | 9 | 2 | 22 | Pass |
| 0.0060 | 9 | 2 | 22 | Pass |
| 0.0061 | 9 | 2 | 22 | Pass |
| 0.0062 | 9 | 2 | 22 | Pass |
| 0.0063 | 9 | 2 | 22 | Pass |
| 0.0063 | 9 | 2 | 22 | Pass |
| 0.0064 | 9 | 2 | 22 | Pass |
| 0.0065 | 8 | 2 | 25 | Pass |
| 0.0066 | 8 | 2 | 25 | Pass |
| 0.0067 | 8 | 2 | 25 | Pass |
| 0.0068 | 8 | 2 | 25 | Pass |
| 0.0069 | 8 | 2 | 25 | Pass |
| 0.0070 | 7 | 2 | 28 | Pass |
| 0.0070 | 7 | 2 | 28 | Pass |
| 0.0071 | 7 | 2 | 28 | Pass |
| 0.0072 | 7 | 2 | 28 | Pass |
| 0.0073 | 7 | 2 | 28 | Pass |
| 0.0074 | 7 | 2 | 28 | Pass |
| 0.0075 | 7 | 2 | 28 | Pass |
| 0.0076 | 7 | 2 | 28 | Pass |
| 0.0077 | 7 | 2 | 28 | Pass |
| 0.0077 | 7 | 2 | 28 | Pass |
| 0.0078 | 7 | 2 | 28 | Pass |
| 0.0079 | 7 | 2 | 28 | Pass |
| 0.0080 | 6 | 2 | 33 | Pass |
| 0.0081 | 6 | 2 | 33 | Pass |
| 0.0082 | 6 | 2 | 33 | Pass |
| 0.0083 | 6 | 2 | 33 | Pass |
| 0.0084 | 6 | 2 | 33 | Pass |
| 0.0084 | 6 | 2 | 33 | Pass |
| 0.0085 | 6 | 2 | 33 | Pass |
| 0.0086 | 6 | 2 | 33 | Pass |
| 0.0087 | 6 | 2 | 33 | Pass |
| 0.0088 | 5 | 2 | 40 | Pass |
| 0.0089 | 5 | 2 | 40 | Pass |
| 0.0090 | 5 | 2 | 40 | Pass |
| 0.0090 | 5 | 2 | 40 | Pass |

## 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 |
|---|---|---|---|---|---|---|---|---|---|
| Gravel Trench Bed 1 POC | ☐ | 88.64 | | | ☐ | 100.00 | | | |
| Gravel Trench Bed 2 POC | ☐ | 6.01 | | | ☐ | 100.00 | | | |
| Gravel Trench Bed 3 POC | ☐ | 23.44 | | | ☐ | 100.00 | | | |
| Total Volume Infiltrated | | 118.10 | 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 = Passed |
| | | | | | | | | | |

# Model Default Modifications

Total of 0 changes have been made.

## PERLND Changes

No PERLND changes have been made.

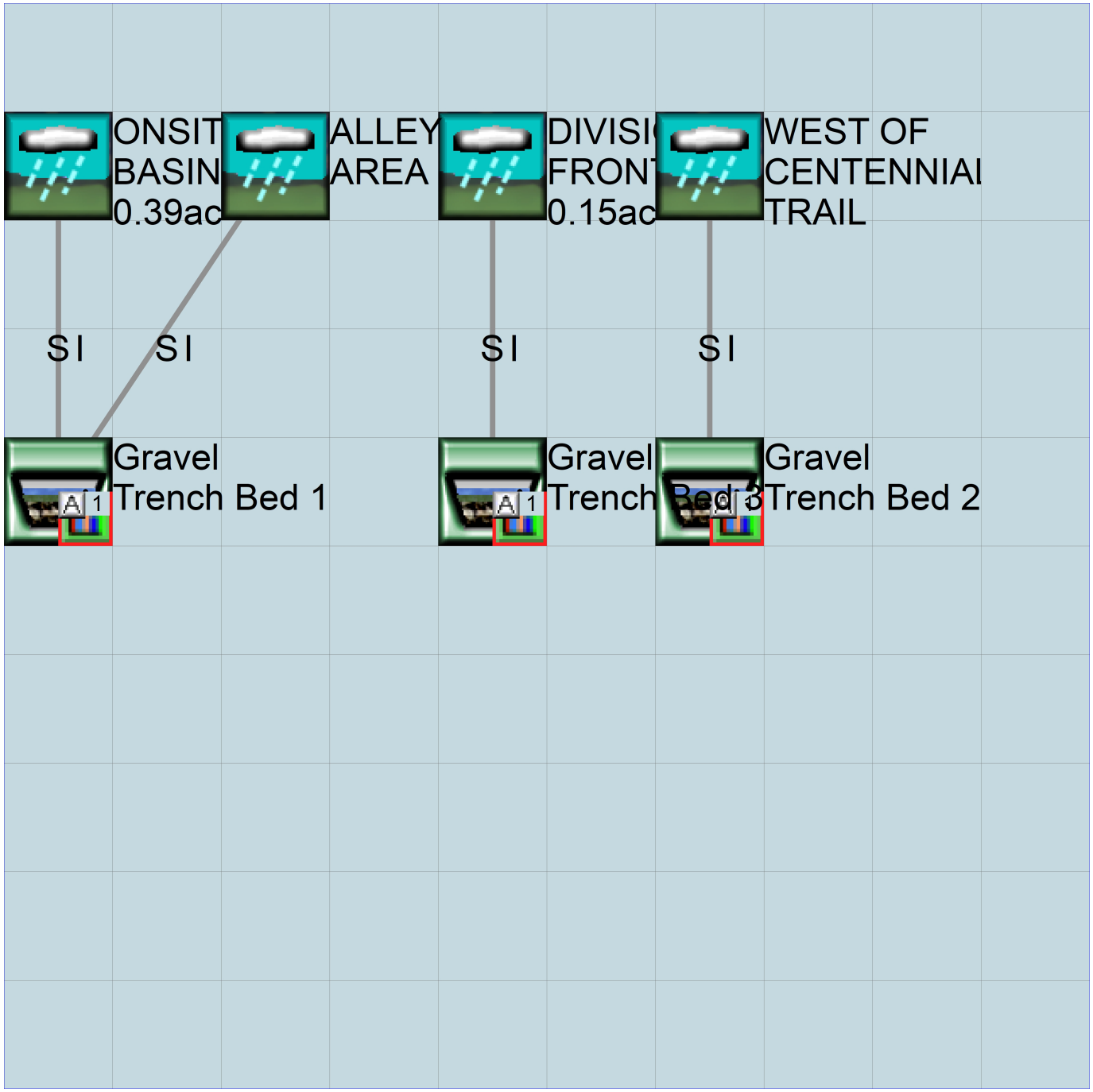
## IMPLND Changes

No IMPLND changes have been made.

# *Appendix*

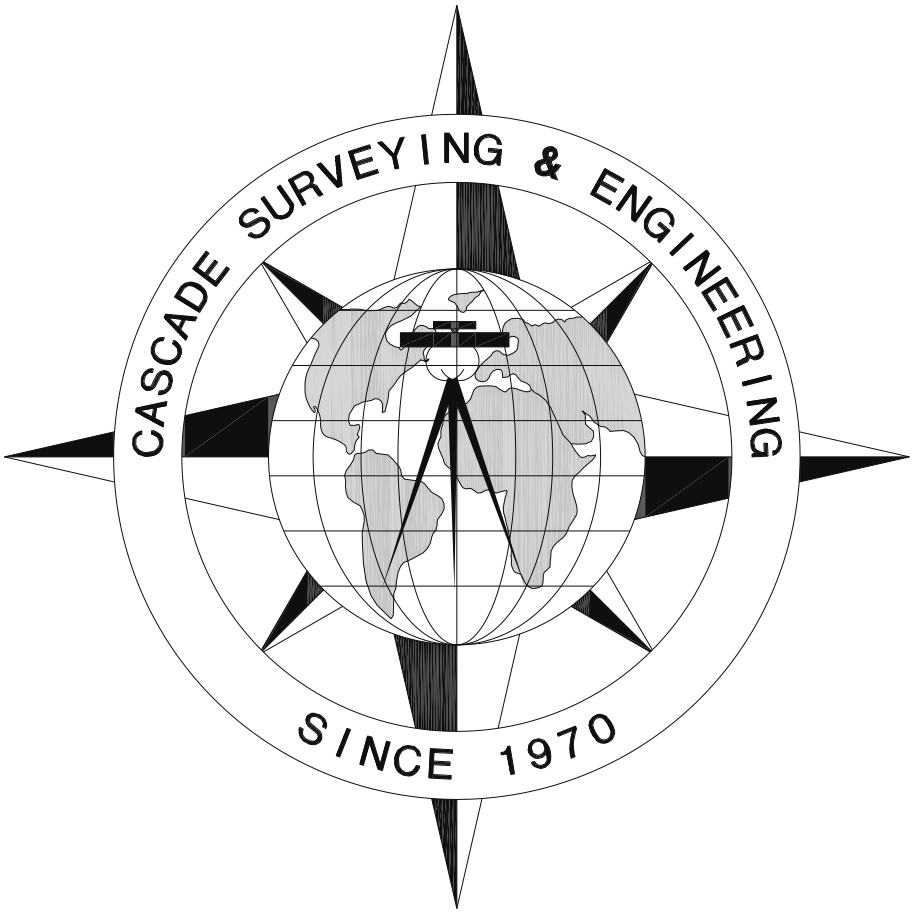
## *Predeveloped Schematic*

## *Mitigated Schematic*



# APPENDIX C – OPERATION AND MAINTENANCE MANUAL

# STORMWATER FACILITY MAINTENANCE MANUAL




## FOR PUBLIC & PRIVATELY OWNED STORMWATER FACILITIES

**PREPARED BY:**
**CASCADE SURVEYING & ENGINEERING, INC.**

**December 2021**

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# INTRODUCTION

## Background

All residential, commercial, and industrial developments have some form of stormwater drainage facilities. Stormwater facilities generally drain to roadside ditches, underground storm pipe systems, streams, lakes, or to groundwater from infiltration facilities. Stormwater facilities generally consist of pipes, catch basins, swales, ditches, ponds, oil/water separators, underground infiltration trenches, and any other structure that collects, conveys, controls, and treats stormwater.

Stormwater facilities are either privately owned or publicly owned. Private stormwater facility owners consist of individual residential property owners, a home owners' association, commercial and industrial land owners. Privately owned stormwater facilities are generally installed on private property within the bounds of the private land, in a separate tract, or in an easement on land owned by others.

Publicly owned stormwater facilities are usually owned and operated by a city, county, state, or federal entities. In either case, the owner of the system is responsible for operating and maintaining all elements of the facility.

## Purpose

The objective of this manual is to ensure that stormwater control facilities are adequately maintained and operated properly.

Storm system maintenance is necessary to protect streams, lakes, wetlands, and groundwater. Proper maintenance assures that storm systems operate as they were designed, and that they are cleaned of pollutants that they trap, such as sediment and oils, so that the storm system is not overwhelmed and becomes a pollutant source.

## Stormwater System Inspection Schedule

The drainage system should be monitored periodically. For the first year after completion of construction, the system should be monitored after every large storm event (> 1-in in 24-hrs), and, during the period Oct. 1- Mar. 31 inspections should be conducted monthly. From April 1- Sept. 30, the facility should be monitored on a quarterly basis. Once the performance characteristics of the facility have been verified, the monitoring schedule can be reduced to an annual basis unless the performance data indicate that a more frequent schedule is required.

# Catch Basin

A catch basin is an underground concrete structure typically fitted with a slotted grate to collect stormwater runoff and route it through underground pipes. Catch basins can also be used as a junction in a pipe system and may have a solid lid. There are two types.

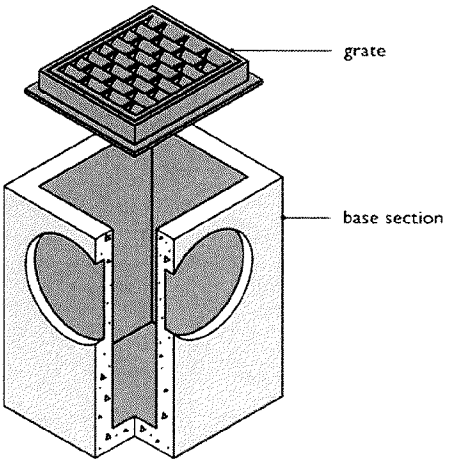
A Type 1 catch basin is a rectangular box with approximate dimensions of 3'x2'x5'. Type 1 catch basins are utilized when the connected conveyance pipes are less than 18 inches in diameter and the depth from the gate to the bottom of the pipe is less than 5 feet.

Type 2 catch basins, also commonly referred to as storm manholes, are round concrete structures ranging in diameter from 4 feet to 8 feet. Type 2 catch basins are used when the connecting conveyance pipe is 18 inches or greater or the depth from grate to pipe bottom exceeds 5 feet. Type 2 catch basins typically have manhole steps mounted on the side of the structure to allow access.

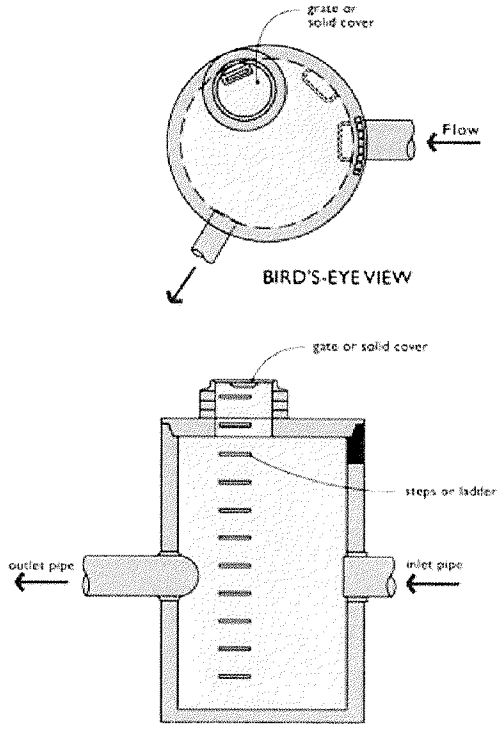
Both types typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some catch basins are also fitted with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or oils.

The most common tool for cleaning catch basins is a truck with a tank and vacuum hose (vactor truck) to remove sediment and debris from the sump. A catch basin may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a catch basin, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

Catch basins are typically associated with all stormwater facilities.




Type 1




Type 2

| Catch Basins | | | |
|---|---|---|---|
| **Drainage System Feature** | **Potential Defect** | **Conditions When Maintenance Is Needed** | **Results Expected When Maintenance Is Performed Or Not Needed** |
| General | Trash and Debris | Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. | No Trash or debris located immediately in front of catch basin or on grate opening. |
| | | Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. | No trash or debris in the catch basin. |
| | | Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. | Inlet and outlet pipes free of trash or debris. |
| | | Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane). | No dead animals or vegetation present within the catch basin. |
| | Sediment | Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe. | No sediment in the catch basin |
| | Structure Damage to Frame and/or Top Slab | Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch<br><br>(Intent is to make sure no material is running into basin). | Top slab is free of holes and cracks. |
| | | Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached | Frame is sitting flush on the riser rings or top slab and firmly attached. |
| | Fractures or Cracks in Basin Walls/ Bottom | Maintenance person judges that structure is unsound. | Basin replaced or repaired to design standards. |
| | | Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks. | Pipe is regrouted and secure at basin wall. |
| | Settlement/ Misalignment | If failure of basin has created a safety, function, or design problem. | Basin replaced or repaired to design standards. |
| | Vegetation | Vegetation growing across and blocking more than 10% of the basin opening. | No vegetation blocking opening to basin. |
| | | Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart. | No vegetation or root growth present. |
| | Contaminants and Pollution | Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency). | No contaminants or pollutants present. |

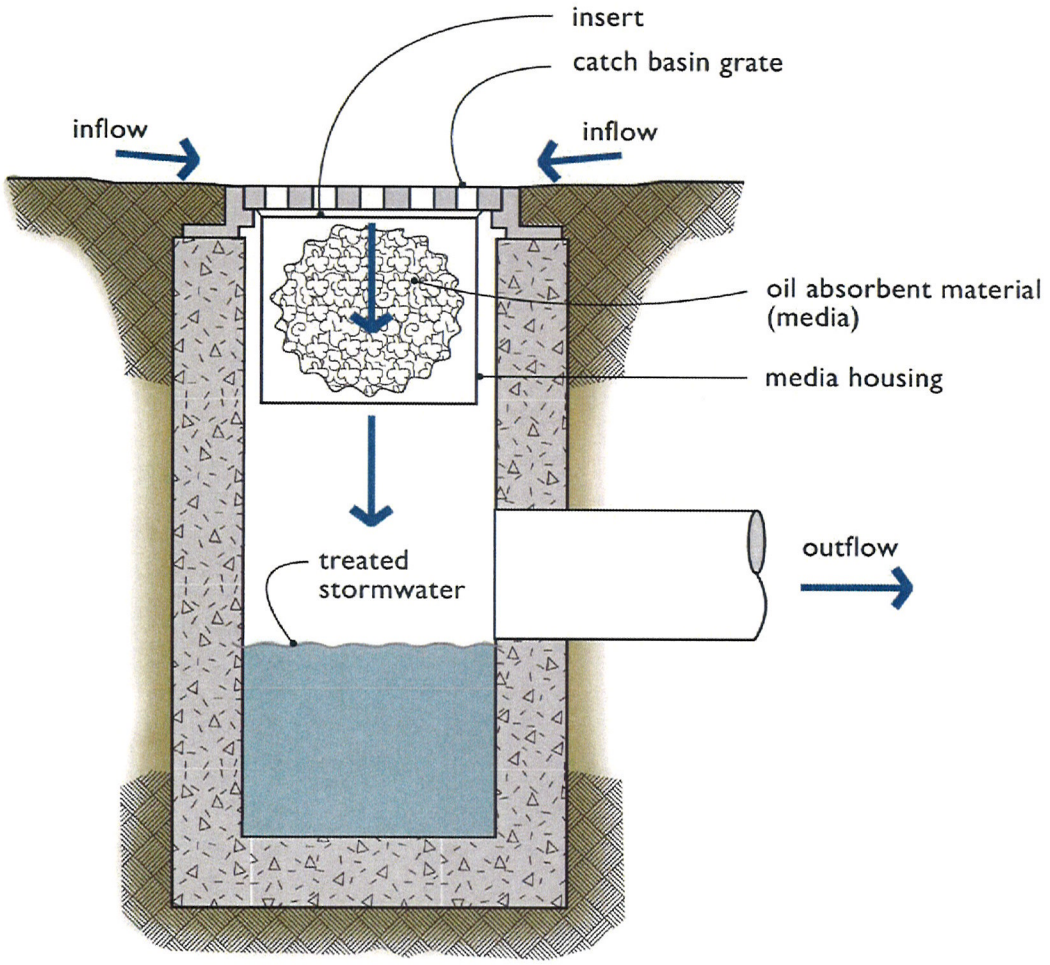
| Catch Basins (Continued) | | | |
|---|---|---|---|
| **Drainage System Feature** | **Potential Defect** | **Conditions When Maintenance Is Needed** | **Results Expected When Maintenance Is Performed Or Not Needed** |
| Catch Basin Cover | Cover Not in Place | Cover is missing or only partially in place. Any open catch basin requires maintenance. | Catch basin cover is closed |
| | Locking Mechanism Not Working | Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread. | Mechanism opens with proper tools. |
| | Cover Difficult to Remove | One maintenance person cannot remove lid after applying normal lifting pressure (Intent is to keep cover from sealing off access to maintenance). | Cover can be removed by one maintenance person. |
| Ladder | Ladder Rungs Unsafe | Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges. | Ladder meets design standards and allows maintenance person safe access. |
| Metal Grates (If Applicable) | Grate opening Unsafe | Grate with opening wider than 7/8 inch. | Grate opening meets design standards. |
| | Trash and Debris | Trash and debris that is blocking more than 20% of grate surface inletting capacity. | Grate free of trash and debris. |
| | Damaged or Missing. | Grate missing or broken member(s) of the grate. | Grate is in place and meets design standards. |

# Catch Basin Insert

Catch basin inserts are becoming more widely used to trap sediment and oil entering catch basins. Most involve some type of filter media and oil-absorbent pads. Filters avoid flooding by overflowing when they become clogged or when there are high storm flows.

Catch basin inserts typically consist of the following components:

- A structure (screened box, brackets, etc.) which contains a pollutant removal medium
- A means of suspending the structure in a catch basin
- A filter medium such as sand, carbon, fabric, etc.
- A primary inlet and outlet for the stormwater
- A secondary outlet for bypassing flows that exceed design flow



| Catch Basin Insert | | | |
|---|---|---|---|
| **Drainage System Feature** | **Potential Defect** | **Conditions When Maintenance Is Needed** | **Results Expected When Maintenance Is Performed Or Not Needed** |
| General | Sediment Accumulation | When sediment forms a cap over the insert media of the insert and/or unit. | No sediment cap on the insert media and its unit. |
| | Trash and Debris Accumulation | Trash and debris accumulates on insert unit creating a blockage/restriction. | Trash and debris removed from insert unit. Runoff freely flows into catch basin. |
| | Media Insert Not Removing Oil | Effluent water from media insert has a visible sheen. | Effluent water from media insert is free of oils and has no visible sheen. |
| | Media Insert Water Saturated | Catch basin insert is saturated with water and no longer has the capacity to absorb. | Remove and replace media insert |
| | Media Insert-Oil Saturated | Media oil saturated due to petroleum spill that drains into catch basin. | Remove and replace media insert. |
| | Media Insert Use Beyond Normal Product Life | Media has been used beyond the typical average life of media insert product. | Remove and replace media at regular intervals, depending on insert product. |

# Conveyance Stormwater Pipe

Inlet and outlet stormwater pipes convey stormwater in, through, and out of stormwater facilities.

Storm sewer pipes convey stormwater. Pipes are built from many materials and are sometimes perforated to allow stormwater to infiltrate into the ground. Stormwater pipes are cleaned to remove sediment or blockages when problems are identified. Stormwater pipes must be clear of obstructions and breaks to prevent localized flooding. All stormwater pipes should be in proper working order and free of the possible defects listed below.

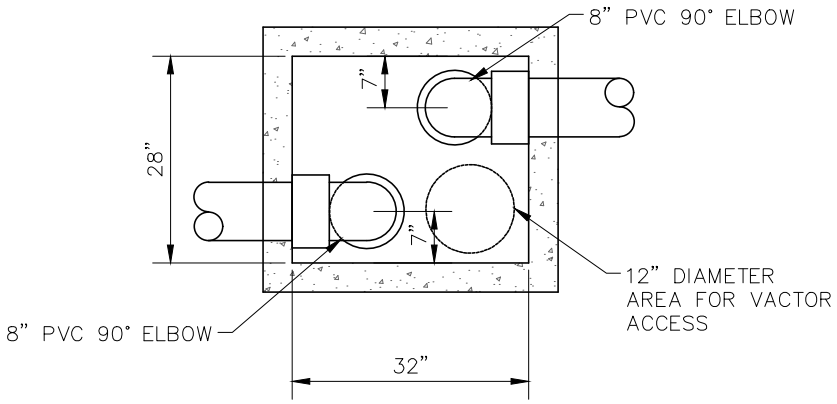
| Conveyance Storm Pipe | | | |
|---|---|---|---|
| **Drainage System Feature** | **Potential Defect** | **Conditions When Maintenance Is Needed** | **Results Expected When Maintenance Is Performed Or Not Needed** |
| General | Obstructions, Including Roots | Root enters or deforms pipe, reducing flow. | Use mechanical methods to remove root. Do not put root-dissolving chemicals in storm sewer pipes. If necessary, remove the vegetation over the line. |
| | Pipe Dented or Broken | Inlet/outlet piping damaged or broken and in need of repair. | Pipe repaired and/or replaced. |
| | Pipe Rusted or Deteriorated | Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping. | Pipe repaired and/or replaced. |
| | Sediment & Debris | Sediment depth is greater than 20% of pipe diameter. | Install upstream debris traps (where applicable) then clean pipe and remove material |
| | Debris barrier or Trash Rack Missing | Stormwater pipes > than 18 inches need debris barrier | Debris barrier present on all stormwater pipes 18 inches and greater |

# **Oil/Water Separator** (CATCH BASIN)

An oil/water separator is an underground vault that treats stormwater by mechanically separating oil from water. The oil rises to the surface and floats on the water and sediment settles to the bottom. Oil/water separators are typically utilized in locations where high oil concentrations in the stormwater runoff are anticipated (e.g. service and fuel stations). Oil/water separators are most commonly used as the first pre-treatment facility in a series of stormwater management facilities.

Facility objects that are typically associated with an oil/water separator include:

- access road or easement
- control structure/flow restrictor




NOTE:
REFER TO
ARLINGTON
STANDARD DETAIL
SD-120 FOR
VARIATION OF OIL/
WATER SEPARATOR

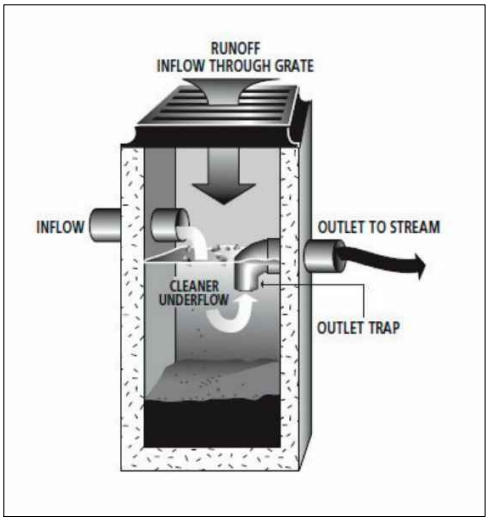



IMAGE FROM KING COUNTY STORMWATER POLLUTION PREVENTION MANUAL

## Baffle Oil/Water Separator (API Type)

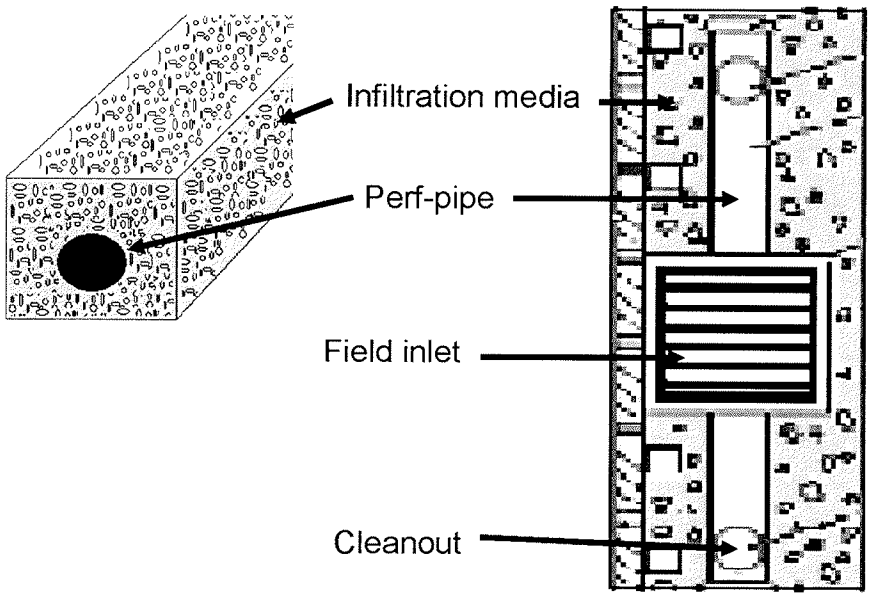
| Drainage System Feature | Potential Defect | Conditions When Maintenance Is Needed | Results Expected When Maintenance Is Performed Or Not Needed |
|---|---|---|---|
| General | Monitoring | Inspection of discharge water for obvious signs of poor water quality (i.e. obvious oil or other contaminants present) | Effluent discharge from vault should be clear with out thick visible sheen. |
| | Sediment Accumulation | Sediment depth in bottom of vault exceeds 6-inches in depth. | No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency. |
| | Trash and Debris Accumulation | Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables. | Trash and debris removed from vault, and inlet/outlet piping. |
| | Oil Accumulation | Oil accumulations that exceed 1-inch, at the surface of the water. | Extract oil from vault by vactoring. Disposal in accordance with state and local rules and regulations. |
| | Damaged Pipes | Inlet or outlet piping damaged or broken and in need of repair. | Pipe repaired or replaced. |
| | Access Cover Damaged/Not Working | Cover cannot be opened, corrosion/deformation of cover. | Cover repaired to proper working specifications or replaced. |
| | Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab | | |
| | | Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached | Frame is sitting flush on the riser rings or top slab and firmly attached. |
| | | Maintenance person judges that structure is unsound. | Vault replaced or repairs made so that vault meets design specifications and is structurally sound. |
| | | Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks. | Pipe is regrouted and secure at basin wall. |
| | | Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks. | Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe. |
| | Baffles | Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person. | Baffles repaired or replaced to specifications. |
| | Access Ladder Damaged | Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned. | Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel. |

# Infiltration Trench

A stormwater infiltration trench is a closed basin built by excavating below existing ground. Infiltration trenches temporarily store stormwater runoff during rain events. Infiltration trenches do not discharge to a downstream conveyance system or nearby surface water. Instead, infiltration trenches rely on the ability of the site's soils to infiltrate the stormwater into the ground.

Facility objects that are typically associated with an infiltration trench include:

- access road or easement
- fence, gate, and water quality sign
- bioswale
- sediment trap
- field inlet



| Infiltration Trench | | | |
|---|---|---|---|
| **Drainage System Feature** | **Potential Defect** | **Conditions When Maintenance Is Needed** | **Results Expected When Maintenance Is Performed Or Not Needed** |
| General | Contaminants and Pollution | Any evidence of oil, gasoline, contaminants or other pollutants in or around facility.<br><br>• Identify and remove source | No contaminants or pollutants present. |
| | Observation Well | Sediment depth greater than one foot above stone aggregate or the surface inlet. | No sediment in infiltration trench. |
| | Drainage Slow | Decreased capacity that indicates slow drainage. | Verify facility design rate.<br>Clean perforated drain pipe.<br>Do not allow removed sediment and water to discharge back into the storm sewer. |

# Yard Drain & Cleanout

## What is a Yard Drain?

A Yard Drain is similar to a Type 1 Catch Basin but smaller (most are 12 to 18 inches in diameter).

- Currently, the most frequently used type of yard drain is a high density polyethylene (HDPE) pipe:
  - set vertically on end,
  - with the bell end up fitted with a grate, and
  - the bottom end resting on washed drain rock.
- There are older versions which are made of either polyvinylchloride (PVC) or Concrete Pipe.

## How does a Yard Drain work?

Yard Drain systems usually consist of several yard drains and 6”-8” diameter HDPE pipe between them. They are designed for use in private residential or commercial property and not for use in public or private streets and roads.

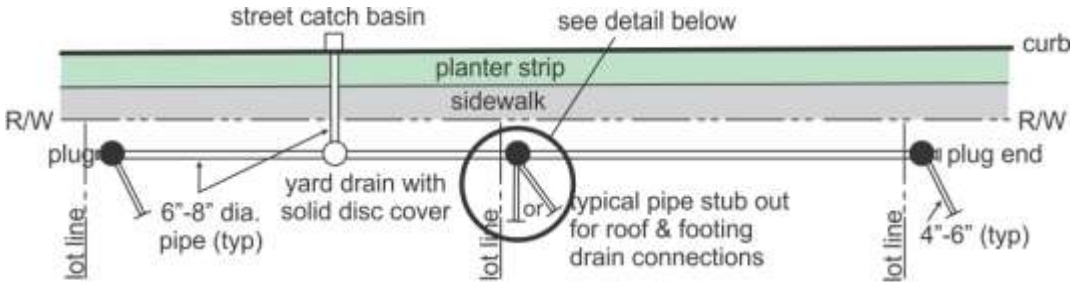
- They function as an intermediary stormwater conveyance system that connects roof and building foundation footing drains (4”-6” diameter HDPE pipe) to the main stormwater conveyance system of:
  - **Type 1 or 2 Catch Basins**, and
  - 12” and larger diameter HDPE pipe.
- Typically, in residential subdivisions these systems can be located along lot lines.
- Yard Drains also have commercial property applications, often being installed to connect building roof and footing drains To the parking area and driveway drainage systems.

NOTE: If Yard Drains are not visible, it is possible that Cleanouts were installed as a substitute. This is generally the case when the depth from the top of the **Yard Drain** grate to what would be the top of the washed drain rock exceeds 42”. (See drawings below.)

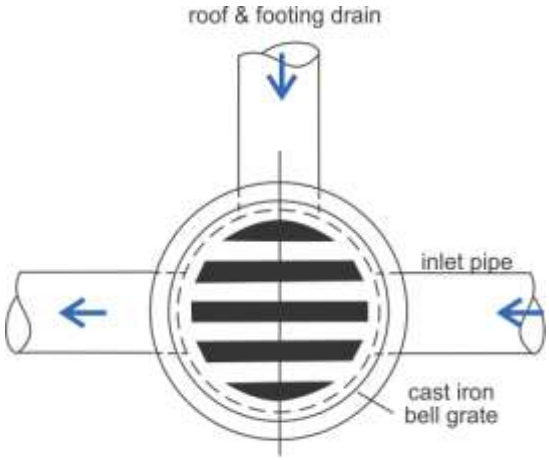
## Common maintenance needs

The most common tool for cleaning Yard Drains or Cleanouts is a yard hose. Cleaning by a vactor truck with its very high pressure and volume washing and vacuum system can destroy both the older Yard Drains or Cleanouts and pipe. It is better to use a low pressure washing system and scoop out by hand any mud and debris collecting in the Yard Drains or Cleanouts.

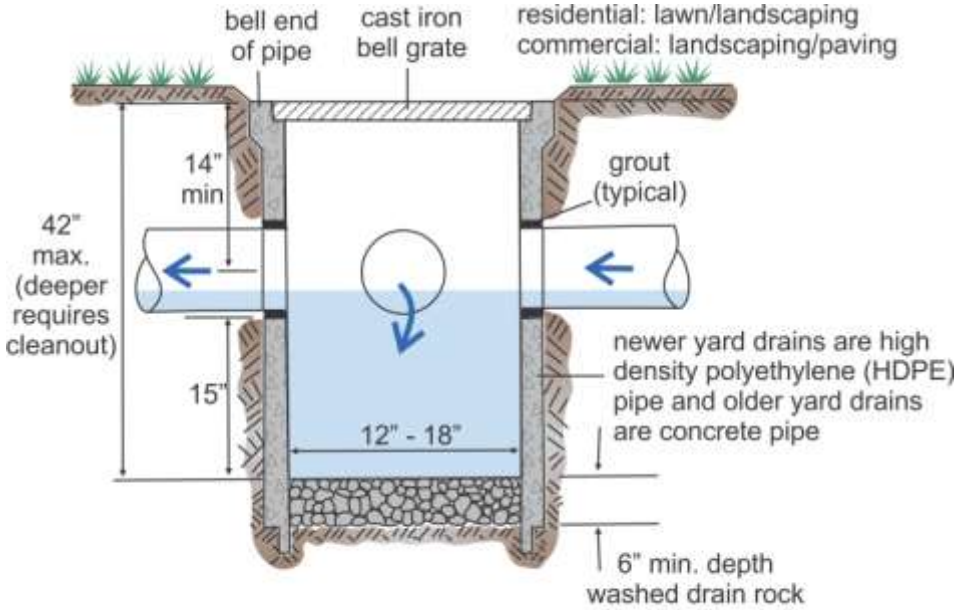
# Yard Drain




**BIRD'S-EYE VIEW**
**TYPICAL YARD DRAIN PLACEMENT FOR RESIDENTIAL LOTS**

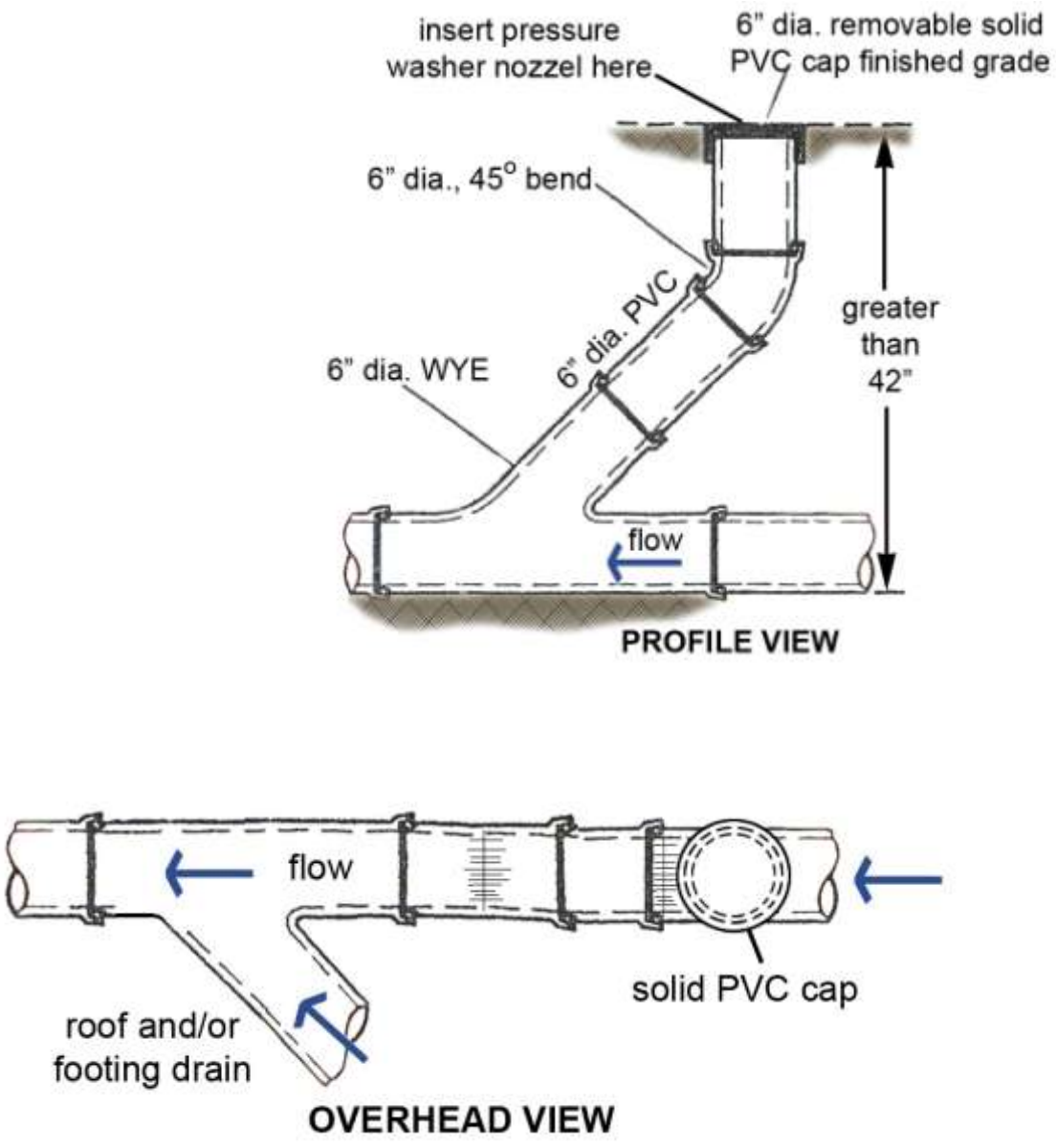



**BIRD'S-EYE VIEW**




**SECTION VIEW**

# Cleanout


insert pressure
washer nozzel here
6" dia. removable solid
PVC cap finished grade
6" dia., 45° bend
6" dia. PVC
6" dia. WYE
greater
than
42"
flow
PROFILE VIEW
flow
solid PVC cap
roof and/or
footing drain
OVERHEAD VIEW

## Yard Drain & Cleanout

| Drainage system feature | Potential defect | Conditions when maintenance is needed | Results expected when maintenance is performed or not needed |
|---|---|---|---|
| Metal Grates | Excessive accumulation of trash, debris, sediment and vegetation | • Obstruction Immediately in front of the drain grate or covering it is reducing flow causing ponding or partial flow bypass. | • Obstruction removed. |
| | | • Obstructing more than 1/3 of inlet or outlet pipe diameter. | • Obstruction removed. |
| | | • Decaying and generating odors that could cause complaints or dangerous gases (e.g., methane). | • Vegetation removed. |
| | Not in place | • Missing or only partially in place. | • Grate in place, repaired or replaced. |
| | Damaged | • Broken | • Grate repaired or replaced. |
| Sump | Sediment, accumulation | • Sediment exceeds 60 percent of the sump depth.<br>• Measure from bottom of basin to invert of the lowest, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe. | • Sediment removed. |
| Structure | Cracks in wall | • Cracks in wall | • Basin repaired or replaced.<br>• Pipe is re-grouted and secure at basin wall. |
| | Settlement or misalignment | • Settlement or misalignment | • Basin raised, realigned, repaired or replaced. |
| | Pollutants in water or sediment | • Most commonly occurring are herbicides and insecticides.<br>• Identify and remove source. | • Pollutants removed. |