

Allen Townhomes

Construction Drainage Report

Prepared for

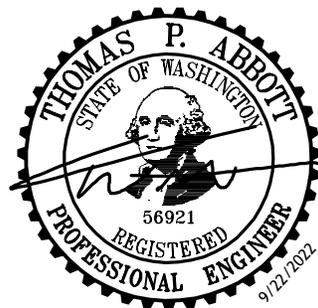
JM1 Holdings, LLC
10515 20th St SE, Suite 202
Lake Stevens, WA 98258

Prepared by

Nathaniel Martin, EIT

Reviewed by

Tom Abbott, PE



September 2022

Job No: C21-213

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APPENDICES

#	Title
1	Project Overview
3	Resource Review
4	Site Hydrology

SECTION 1: PROJECT OVERVIEW

The proposed Allen Townhomes project is comprised of parcel numbers 31052400301000 and 31052400300900 and proposes the construction of 43 townhome unit lots with associated utilities, ROW, and open spaces on a 5-acre site. There are frontage improvements proposed on the site along 172nd St NE, and access to the site will be from 172nd St NE. The site is located within the SE ¼ of the SW ¼ of Section 24, Township 31 N, Range 05 E, W.M. The project address is 8927 172nd ST NE, Arlington, WA 98223-8989. See the Vicinity Map in Appendix 1 for visual representation of the subject property.

Existing Site

The parcel 31052400301000 is currently occupied by a single-family residence, multiple storage sheds, and associated vehicles. The parcel 31052400300900 is currently occupied by a single storage shed. All structures on site will be demolished or repaired/repurposed as part of the proposed development. The site is bordered to the north, east, and west by RHC (Residential High Capacity) zoned land and to the south by GC (General Commercial) zoned land. The project parcels are currently zoned RHC. Existing ground cover is a combination of trees, grass, roof, and gravel.

The project site includes a wetland area that is along the northeasterly portion of the site. In the existing condition, the site discharges into the onsite wetland. Buffer averaging is proposed in several locations. The development will exist within the bounds of the North Basin, South Basin and the Frontage Basin along 172nd St NE. There are two distinct Threshold Discharge Areas (TDAs) onsite that will require stormwater detention, the North and South TDA Basins. See Predeveloped and Developed Hydrology Maps in Appendix 4 for a visual representation of these basins.

Site soils are classified as Tokul gravelly medial loam (where about 74% of the project site area is at 0 to 8 percent slopes and about 26% is at 15 to 30 percent slopes). See the Soils Map in Appendix 3 for visual layout of soil type areas of the subject property. The existing site slopes are generally flat to moderate, with slight sloping from the southwest to the northeast. Due to till soils present onsite, the Geotechnical Engineer does not recommend infiltration for LID BMPs to be used onsite.

Proposed Development

The proposed Allen Townhomes project will develop 43 townhome units on the two parcels with associated utilities, driveways, ROW, landscaping, and open spaces. Stormwater will be mitigated via two separate detention and water quality treatment systems. Onsite development will disturb 2.37 acres of area that will be collected to the detention vaults for flow control. Water quality treatment of stormwater runoff will be provided either prior to or following detention, depending on the detention system onsite. Frontage improvements will impact an additional 0.14 acres within the 172nd St dedicated ROW.

Proposed Drainage System

This project is subject to the requirements of the 2019 Stormwater Management Manual for Western Washington (DOE Manual). In compliance with 2019 DOE Manual, all runoff from developed/disturbed surfaces must be collected, treated, and released to natural drainage courses unless it is dispersed or infiltrated.

Proposed pollution generating impervious surfaces (PGIS) will exceed the 5,000 SF threshold and thus basic water quality treatment will be provided via three water quality treatment structures that will treat stormwater runoff from roadways and driveways.

The site contains two separate TDAs that outfall to separate downstream systems. The disturbed area of the development is contained within the North Basin, South Basin, and Frontage Bypass Basin. The North TDA Basin will be mitigated separate for its own TDA while the South and Frontage Basins will be considered within separate TDA modeling for the South TDA Basin. The basins consist of developed roof,

landscape, sidewalk, pavement and driveway. This project is required to meet flow control requirements for each TDA. Flow control requirements are achieved by two detention vaults in the north and south edges of the site. Developed condition stormwater associated with the site will be collected within the detention vaults then released to historic flowpaths. A small bypass area exists in the west end of the frontage that cannot be collected due to vertical constraints. The bypass area has been considered in the Frontage Bypass Basin modeling in WWHM. See Section 4.0 for additional discussion regarding proposed stormwater management and water quality treatment measures.

Erosion/Sedimentation Control

Erosion control measures that will be utilized during construction will include a combination of silt fence, storm drain inlet protection, interceptor swales, and sediment ponds. See Section 2.0 for discussion of how SWPPP Elements are addressed.

Minimum Requirements

Per the 2019 DOE, Minimum Requirements 1-9 apply to the proposed development.

Minimum Requirement #1: Preparation of Stormwater Site Plans

A report along with the construction plans, to be submitted at a later date, satisfies the minimum requirement.

Minimum Requirement #2: Construction Stormwater Pollution Prevention

See Section 2 of this Report for the SWPPP BMP Elements, and the SWPPP (submitted as a separate document at a later date) for a complete discussion of erosion control BMP's and their use specific to the site.

Minimum Requirement #3: Source of Pollution

Permanent source control BMPs are not applicable for the subject site since the associated activities for the new residence do not fall within the types of facilities listed within Volume IV of the DOE Manual (Residential developments are not required to implement source control BMP's). BMPs for erosion and sedimentation control are specified in the Preliminary Construction Plans.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

Flow from the site will preserve its natural drainage pattern from the southwest to the northeast as well as out to the west and north along SR-9. Runoff from both the north and south TDA basins eventually flows towards Prairie Creek, a tributary of Portage Creek, which then eventually discharges into the Stillaguamish River.

Minimum Requirement #5: On-Site Stormwater Management

The project will exceed the 10,000 SF impervious surface threshold and is required to provide an Onsite Stormwater BMP. Two TDAs exist on the site (the North and South Basins – see figure 3.0 and 4.0 for their delineation). Two detention vaults that are both controlled by flow control risers will be installed at the north and south edges of the site and will discharge at mitigated rates that will be dispersed into native vegetation in the wetland area on the north end of the site and into the city conveyance system at the southeast corner of the site.

Minimum Requirement #6: Runoff Treatment

As the project will exceed the 5,000 SF threshold of PGIS, the project is required to provide "basic" water quality treatment per the 2019 DOE manual. Three Perfilter water quality treatment units will treat runoff from PGIS surfaces prior to stormwater detention in the proposed detention vaults to meet this requirement.

Minimum Requirement #7: Flow Control

Two detention vaults are proposed onsite to control flows and release at historic, mitigated rates for each of the North and South TDA Basins. Please see Section 4.0 for additional flow control modeling and parameters for detention sizing.

Minimum Requirement #8: Wetlands Protection

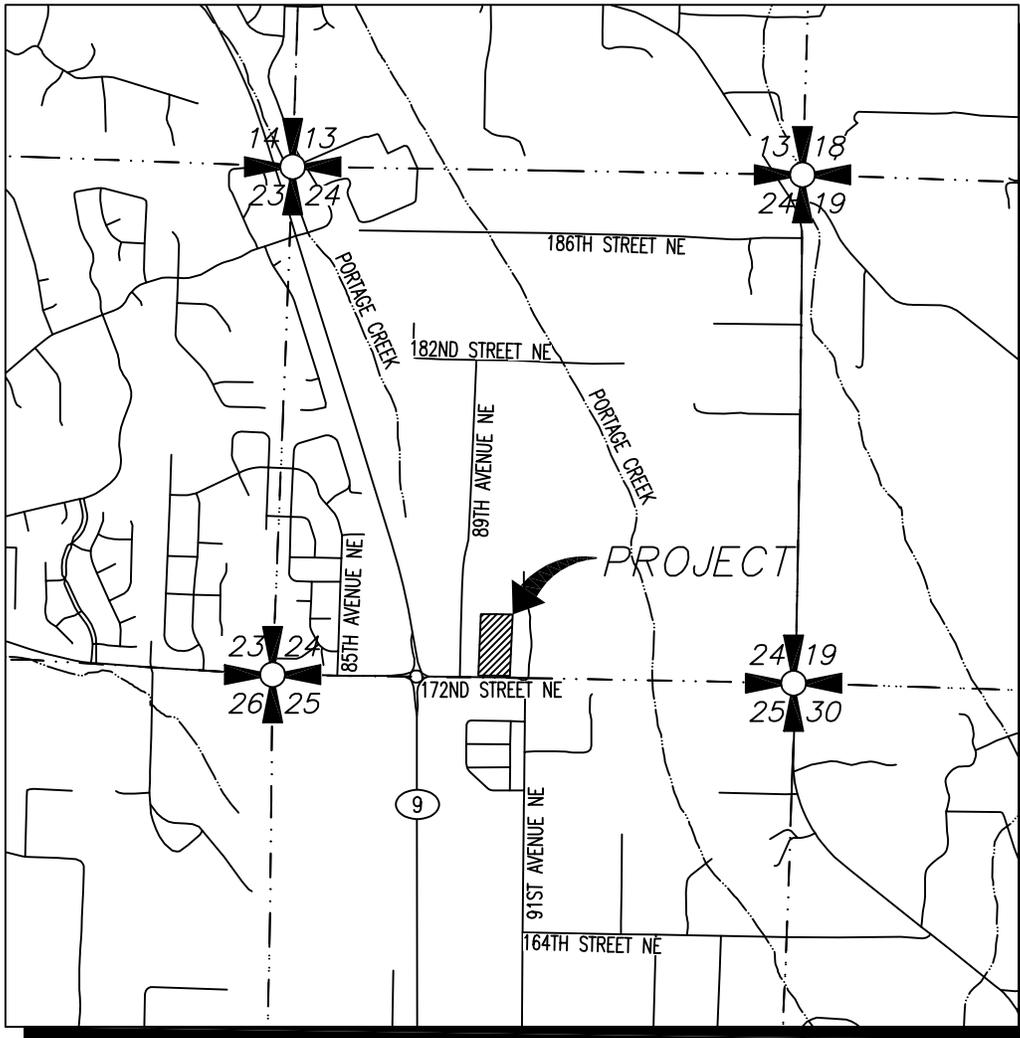
A wetland exists onsite that extends from the north property line towards the southeast corner of the site and has been given a 110' buffer. Averaging of the 110' buffer is proposed in several locations. The dispersion facility discharge from the north detention vault outfall is proposed within the outer 25% of the revised buffer. Please see sheet RD-01 of the plan set for location information. Wetland areas will not be disturbed during site construction and will be protected with silt fencing and other BMPs throughout construction.

Minimum Requirement #9: Operation and Maintenance

See Operations and Maintenance in Section 6 of this report.

Appendix 1: Project Overview

1. Figure 1.0 – Vicinity Map
2. Figure 2.0 – Existing Conditions Map
3. Proposed Development Map



VICINITY MAP

SCALE: 1"=2000'

Drawing: P:\CIVIL\2021\C21-213 Allen Townhomes\Drawings\Exhibits\C21213E-VM_20220816.dwg Plotted: Sep 15, 2022 - 3:31pm

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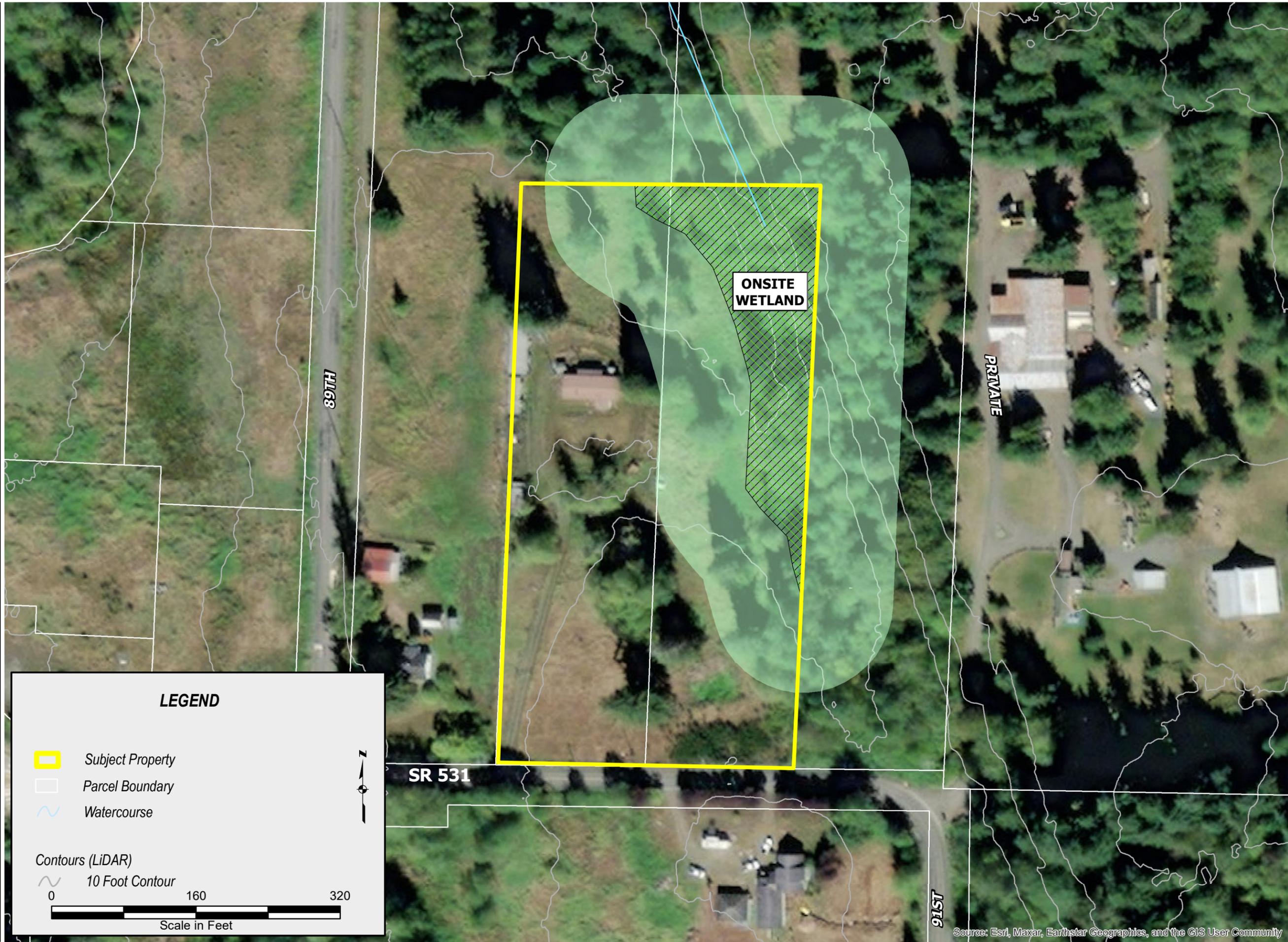
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ALLEN TOWNHOMES

VICINITY MAP



LEGEND

- Subject Property
- Parcel Boundary
- Watercourse

Contours (LiDAR)

- 10 Foot Contour

0 160 320

Scale in Feet

N

SOURCE INFORMATION	
SOURCE AGENCY	DESCRIPTION
KING COUNTY GIS	PARCEL BOUNDARY
KING COUNTY GIS	CONTOURS GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.

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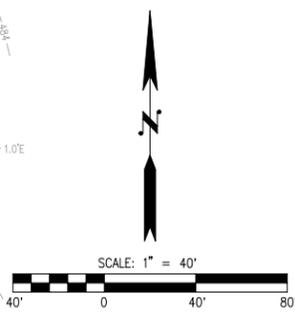
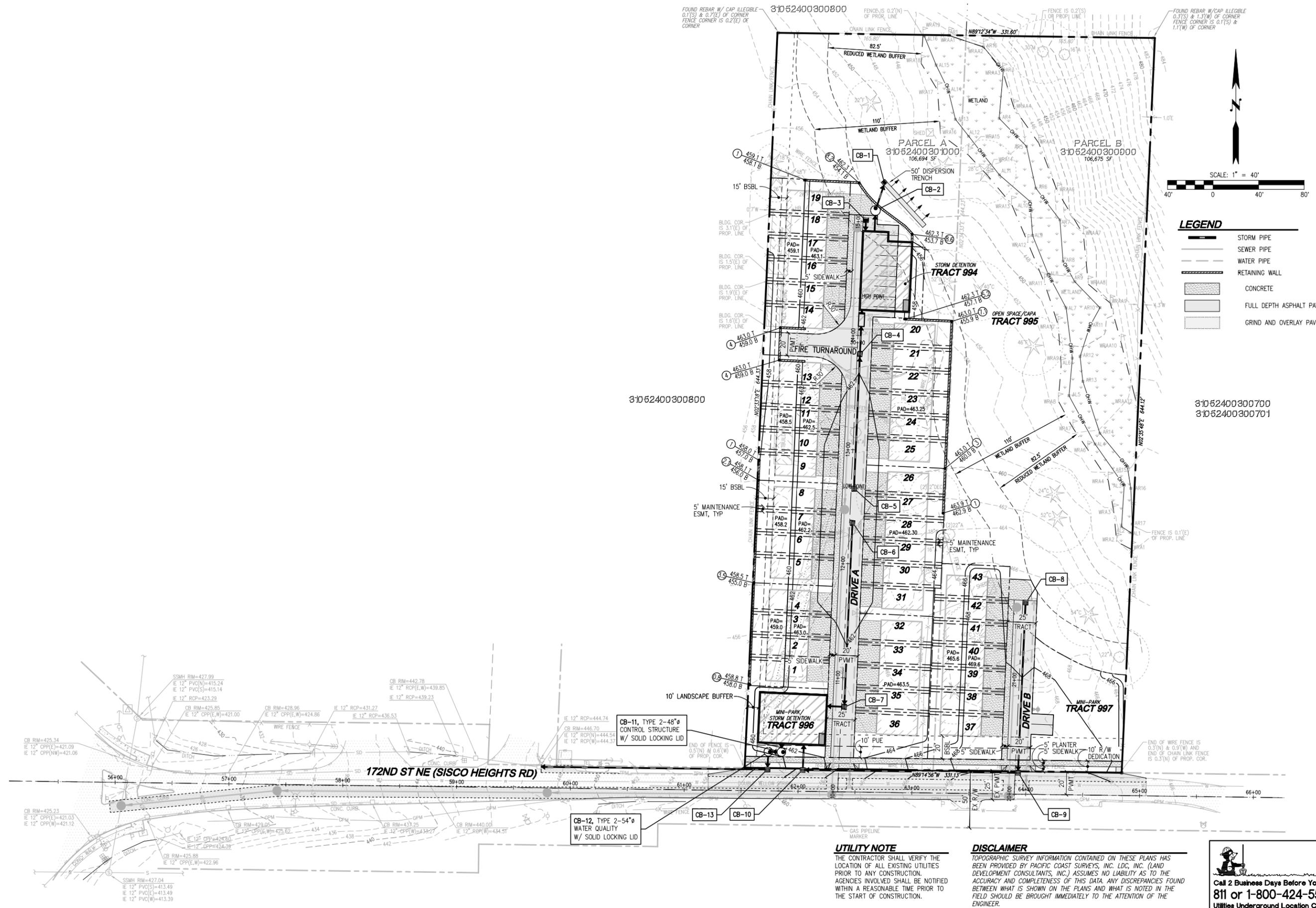
JM1 HOLDINGS, LLC

ALLEN TOWNHOMES
EXISTING CONDITIONS MAP

NAD 1983 HARN STATEPLANE WASHINGTON NORTH FIPS 4601 FEET
REVISION:
JOB NUMBER: C21-213
DRAWING NAME: C21-213-1.0
DESIGNER: NMARTIN
DRAWING BY: NMARTIN
DATE: 7/11/2022
SCALE: AS SHOWN
JURISDICTION: ARLINGTON

FIGURE:
2.0

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



- LEGEND**
- STORM PIPE
 - SEWER PIPE
 - WATER PIPE
 - RETAINING WALL
 - CONCRETE
 - FULL DEPTH ASPHALT PAVEMENT
 - GRIND AND OVERLAY PAVEMENT

NO.	DATE	DESCRIPTION

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JM1 HOLDINGS, LLC.
ALLEN TOWNHOMES
PRELIMINARY ROAD, STORM DRAINAGE AND GRADING PLAN



JOB NUMBER: C21-213
DRAWING NAME: C21213P-RD-PL
DESIGNER: TPA
DRAFTING BY: BJN
DATE: 7-18-22
SCALE: 1"=40'
JURISDICTION: ARLINGTON

RD-01
SHEET 6 OF 10

UTILITY NOTE
THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION. AGENCIES INVOLVED SHALL BE NOTIFIED WITHIN A REASONABLE TIME PRIOR TO THE START OF CONSTRUCTION.

DISCLAIMER
TOPOGRAPHIC SURVEY INFORMATION CONTAINED ON THESE PLANS HAS BEEN PROVIDED BY PACIFIC COAST SURVEYS, INC. LDC, INC. (LAND DEVELOPMENT CONSULTANTS, INC.) ASSUMES NO LIABILITY AS TO THE ACCURACY AND COMPLETENESS OF THIS DATA. ANY DISCREPANCIES FOUND BETWEEN WHAT IS SHOWN ON THE PLANS AND WHAT IS NOTED IN THE FIELD SHOULD BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER.

Call 2 Business Days Before You Dig
811 or 1-800-424-5555
Utilities Underground Location Center

Drawing: P:\City\2021\c21-213 allen townhomes\Drawings\Preliminary\C21213P-RD-PL.dwg Plotter: Sep 13, 2022 - 11:30am

SECTION 2: TEMPORARY EROSION AND SEDIMENT CONTROL DESIGN

SWPPP Design Elements

A Stormwater Pollution Prevention Plan (SWPPP) will be provided prior to construction. The SWPPP report is modeled under the guidelines of Volume II, Section 3 of the 2019 Stormwater Management Manual for Western Washington. Construction SWPPP Elements #1 through #13 are addressed below.

Element #1 – Mark Clearing Limits

All clearing limits will be delineated with high visibility plastic fence and/or silt fence. See sheets ER-01 of the preliminary plans for locations and details.

Element #2 – Establish Construction Access

Stabilized construction accesses will be installed as shown on the preliminary plans. See sheets ER-01 and ER-02 of the construction plans for locations and details.

Element #3 – Control Flow Rates

Detention of construction period runoff will be provided by means of a sediment pond located at the northern portion of the site. See sheets ER-01 of the preliminary plans for location and details for flow and sediment control BMP's.

Element #4 – Install Sediment Controls

Silt fence, catch basin protection, and the temporary sediment pond will be utilized to contain sediments within the project's clearing limits. See sheets ER-01 and ER-02 of the preliminary plans for locations and details.

Element #5 – Stabilize Soils

Exposed soils will be stabilized as specified in the Grading and Erosion Control Notes with temporary and permanent seeding, mulching, and plastic covering. See sheet ER-02 of the preliminary plans for notes.

Element #6 – Protect Slopes

Slopes are minor on the subject site. Slopes shall be protected as specified under Element #5.

Element #7 – Protect Drain Inlets

Storm drain inlet protection will be utilized to contain sediments within the project's clearing limits. See sheets ER-01 and ER-02 of the preliminary plans for locations and details.

Element #8 – Stabilize Channels and Outlets

Temporary channels shall be stabilized with check dams. See sheets ER-01 and ER-02 of the preliminary plans for locations and details.

Element #9 – Control Pollutants

Pollutants shall be controlled as specified in Volume IV of the 2019 DOE Manual—Source Control BMPs to address potential sources of pollution which may exacerbate possible soil/groundwater contamination identified onsite.

Element #10 – Control De-Watering

There will be no de-watering as a part of this project. See sheet ER-02 of the preliminary plans for notes.

Element #11 – Maintain BMPs

Maintenance of the BMPs is specified within the Construction Sequence and Grading and Erosion Control Notes. See sheets ER-01 and ER-02 of the preliminary plans for the Construction Sequence and notes.

Element #12: Manage the Project

The Grading and Erosion Control Notes specify seasonal work limitations. Maintenance of the BMPs is specified within the Construction Sequence and Grading and Erosion Control Notes. See sheets ER-01 and ER-02 of the preliminary plans for the Construction Sequence and notes.

Element #13: Protect on-site stormwater management BMPs

On-site stormwater management BMPs used for runoff from roofs and other hard surfaces are not feasible due to soil conditions and proposed project density.

SECTION 3: DOWNSTREAM ANALYSIS

Task 1. Study Area Definition and Maps

Snohomish County Bare Earth LiDAR, survey, and 2021 aerial photography were the best topographical references available for the area containing the site. The limits of the downstream analysis extend roughly 0.25 miles beyond the subject property's natural discharge location.

Task 2. Resource Review

All of the resources below have been reviewed for existing and potential issues near the project site:

Adopted Basin Plans

No Adopted Basin Plans were located that include the project site.

Drainage Basin

This site is in the Burn Hill Road Drainages sub-basin, within the Stillaguamish watershed. Discharge from the proposed development will discharge into the onsite wetland, which is tributary to Prairie Creek and then Portage Creek. Portage Creek is approximately a quarter mile from the site and eventually discharges into the Stillaguamish River. Note that there are two TDA Basins that the project will be developed within as downstream flowpaths from the North and South TDA Basins do not converge within 0.25 mile from the project site. See Figure 3.0 for flowpaths and the delineation of each TDA Basin.

Floodplain / Floodway (FEMA) maps

Per FEMA Floodplain map #53061C0415F the subject property is not within a floodplain.

Critical Areas Map

A wetland exists onsite that extends from the north property line towards the southeast corner of the site and has been given a 110' buffer. Reference the critical areas report submitted with this report for additional information regarding the wetland areas onsite.

Drainage Complaints

No relevant issues were identified near the proposed site.

Road Drainage Problems

No issues were identified near the proposed site.

Soil Survey

Site soils are classified as Tokul gravelly medial loam (where about 82% of the project site area is at 0 to 8 percent slopes and about 18% is at 15 to 30 percent slopes) which is classified as a Hydrologic Soil Group B type soil.

Wetland Inventory Maps

Wetlands are identified to be on the project site. Reference the critical areas report submitted with this report for additional information regarding the wetland areas onsite.

Migrating River Studies

Migrating River Studies are not considered applicable to the proposed development.

Section 303d List of Polluted Waters

Washington State Department of Ecology's Water Quality Assessment for Washington contains one listing for the Prairie Creek downstream of the project within one quarter mile of the site. Please refer to Appendix 3 for copies of applicable 303(d) listings.

Water Quality Problems

The Prairie Creek has been listed as a category 4A water due to bacteria concerns. No water quality problems were identified which would be exacerbated by the proposed development.

Stormwater Compliance Plans

Not applicable to the proposed project.

Task 3. Field Inspection/Downstream Analysis

On August 16th, 2022, a Downstream Analysis was performed at the site. The weather consisted of 77°F and sunny skies. The following observations were verified during the visit.

The subject property consists primarily of lawn and forested area. There is a partially developed area in the existing condition with a gravel road leading to a single-family residence in the mid-northwestern portion of the site and multiple storage sheds with varying degrees of disrepair in the mid-northwest edge of the site and other storage sheds in poor condition in the mid-southeastern and mid-northern portion of the subject property.

Flowpath 1 has been identified flowing from the southeast to the north within its own threshold discharge area. Runoff that travels north and east to the onsite wetland will travel northwest where flow is conveyed into Prairie Creek, a tributary of Portage Creek. Flow continues north and west underneath 89th Ave NE. The flow then continues north and west towards the Stillaguamish River past the ¼-mile boundary of this analysis.

Flowpath 2 is generated by runoff from the southern half of the site along the north side of 172nd St NE (Sisco Heights Rd). Runoff leaves the southwest corner of the site and enters a vegetated drainage ditch before flowing west for approximately 200 ft to a catch basin on the side of the road near the intersection of 89th Ave NE and 172nd St NE. The flowpath then enters another open ditch and follows the east side of State Route 9 north and beyond the ¼-mile buffer of analysis. See Figure 3.0, "Downstream Analysis Map" in Appendix 3 for a visual representation of current discharge.

An amount of upstream flow occurs from the western edge, northeast corner, and southeast corner of the project site, as illustrated in Images 2, 3, & 4 in Appendix 3. This upstream flow will drain into the onsite wetland area and conveys north and west. None of this upstream area will be collected or captured by project improvements.

Task 4. Drainage System Description and Problem Descriptions

Based on the information available and all the resources available including visual inspection of the downstream flow path to the ¼-mile boundary, there is no evidence of existing or anticipated downstream drainage problems. All flows are adequately carried through natural channels.

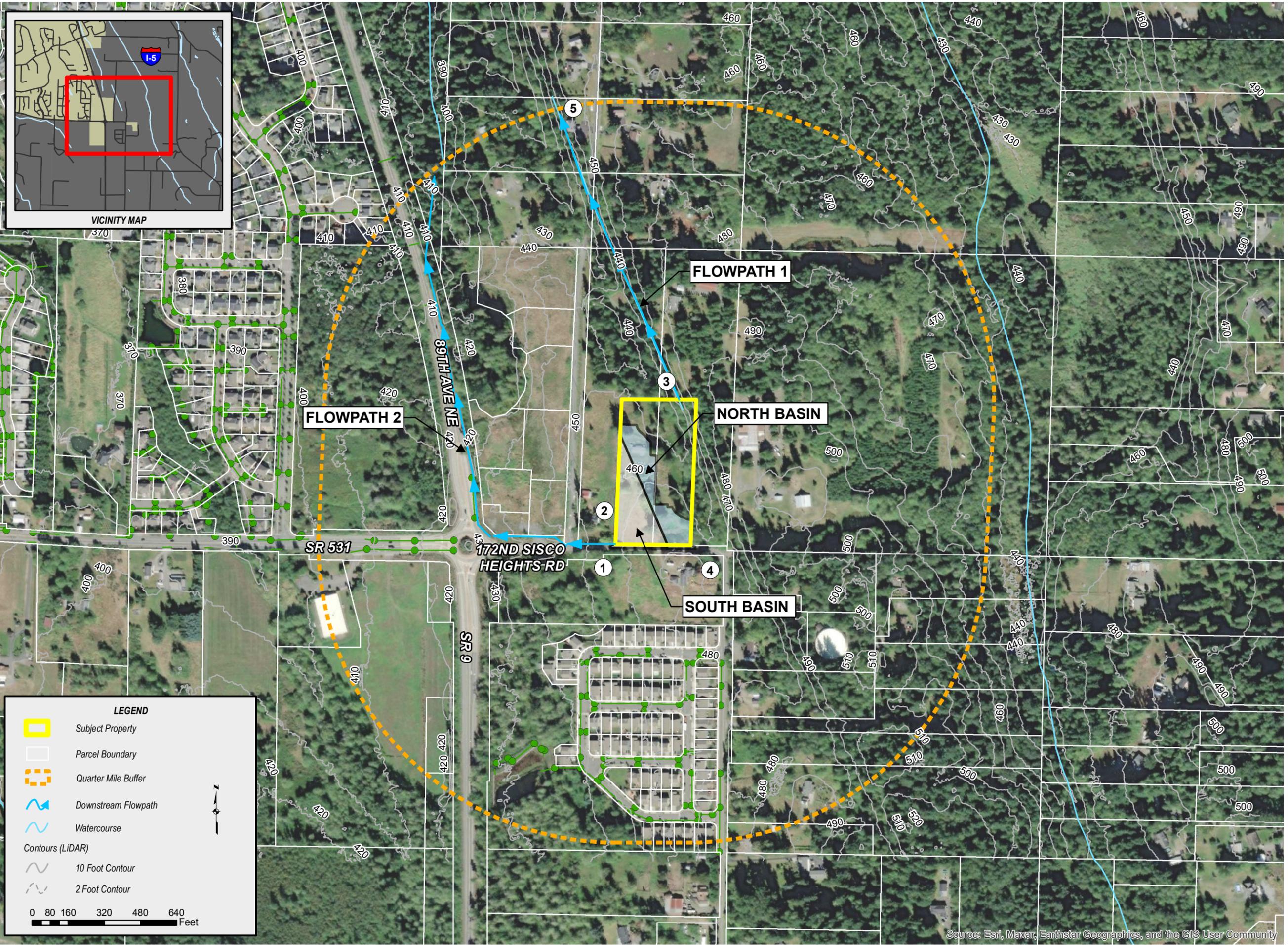
Task 5. Mitigation of Existing or Potential Drainage Problems

No evidence of existing or potential problems with downstream drainage conveyance infrastructure was found. Mitigation is not required.

Appendix 3: Resource Review

1. Figure 3.0 - Downstream Analysis Map
2. Downstream Analysis Photographs
3. USDA Soils Map & Description

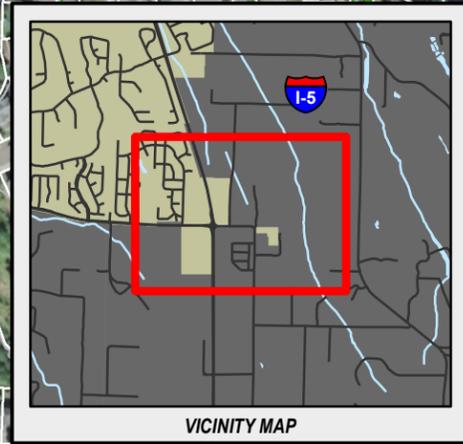
2.0 Downstream.mxd | MOD: 9/22/2022 | rferguson



LEGEND

- Subject Property
- Parcel Boundary
- Quarter Mile Buffer
- Downstream Flowpath
- Watercourse
- Contours (LiDAR)
 - 10 Foot Contour
 - 2 Foot Contour

0 80 160 320 480 640 Feet



SOURCE INFORMATION	
SOURCE AGENCY	DESCRIPTION
KING COUNTY GIS	PARCEL BOUNDARY
KING COUNTY GIS	CONTOURS GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.

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ALLEN TOWNHOMES

DOWNSTREAM MAP

NAD 1983 HARN STATEPLANE WASHINGTON NORTH FIPS 4601 FEET
REVISION:
JOB NUMBER: C21-213
DRAWING NAME: C21-213-3.0
DESIGNER: RFERGUSON
DRAWING BY: RFERGUSON
DATE: 9/22/2022
SCALE: AS SHOWN
JURISDICTION: BOTHELL

FIGURE:
3.0

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Downstream Analysis Photographs



Image 1: Facing northeast from the southwestern corner of the project site near the intersection 89th Ave NE and 172nd St NE. Onsite runoff from the near side of the hill will flow offsite to the southwest into vegetated drainage ditches, and onsite runoff from the far side of the hill will flow to the low point of the onsite wetland to the northeast.



Image 2: Facing northeasterly near the western edge of the site (edge of site border is located along sheds as seen above). Upstream runoff offsite on the far side of the hill will flow east onsite, where it will continue northeast to the onsite wetland.



Image 3: Facing southwest near the northeastern corner of the site. Upstream stormwater runoff from the east (left) will flow onto the project site to the low point of the onsite wetland. Runoff on the near side of the hill as seen on the right (west) will also flow to the low point of the onsite wetland. Runoff on the far side of the hill on the right will flow offsite. Runoff flows northwest along the wetland into Prairie Creek, a tributary of Portage Creek, and continues north and west past the ¼-mile boundary of this analysis.

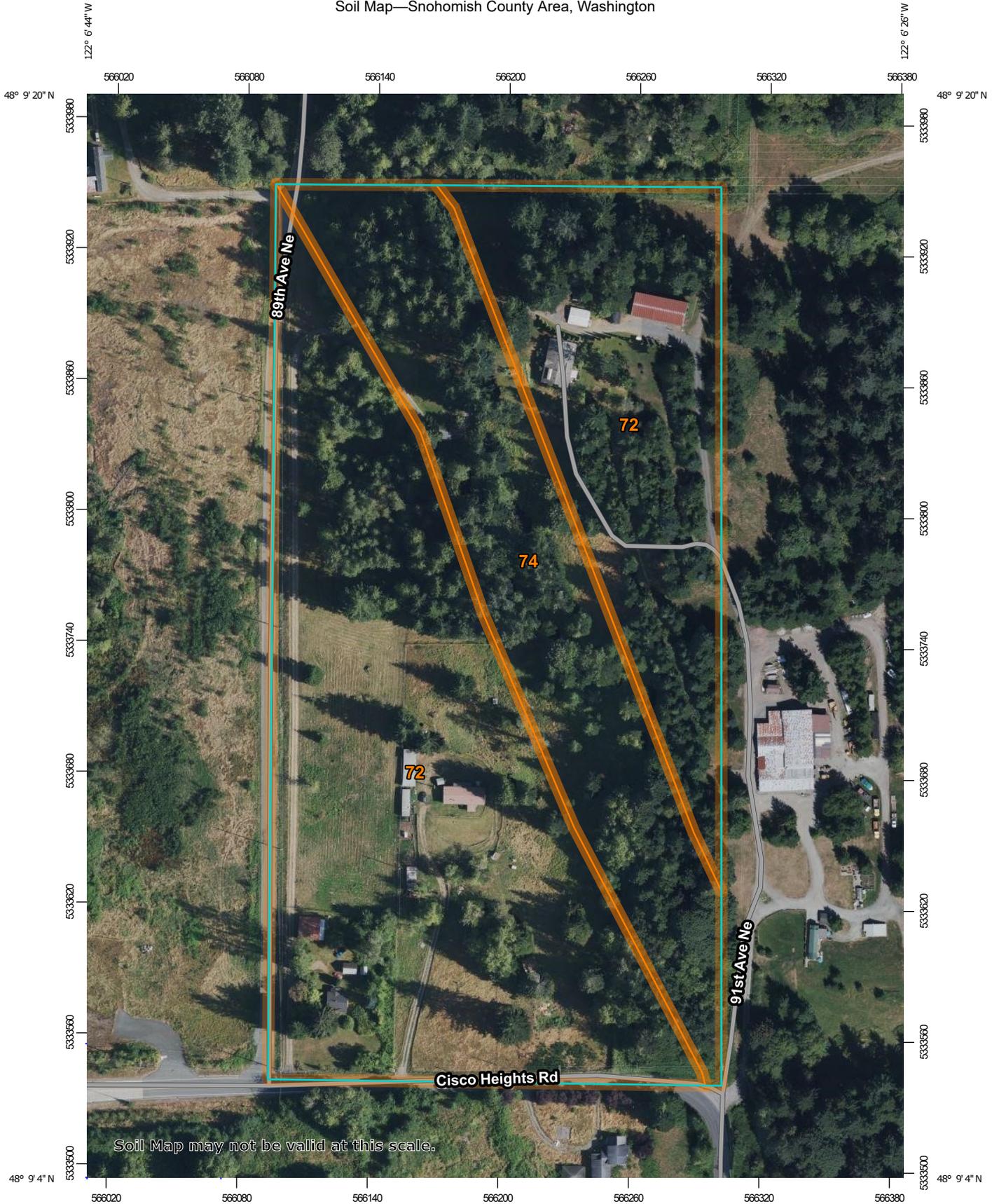


Image 4: Facing northwest near the southeastern corner of the site. Onsite runoff from the west (left) flows downhill to a low point and flows north and west into the onsite wetland. Offsite runoff from the east (right) flows downhill to the low point and flows north and west into the onsite wetland.



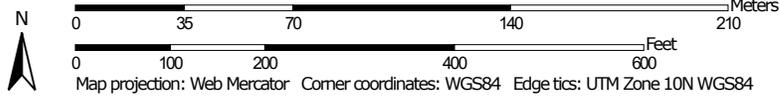
Image 5: Facing westerly near the quarter-mile boundary of analysis. Prairie Creek is located down the hill into the valley where flow travels north and west, where it discharges into Portage Creek, which feeds into the Stillaguamish River.

Soil Map—Snohomish County Area, Washington



Soil Map may not be valid at this scale.

Map Scale: 1:2,420 if printed on A portrait (8.5" x 11") sheet.



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: 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
72	Tokul gravelly medial loam, 0 to 8 percent slopes	15.6	74.3%
74	Tokul gravelly medial loam, 15 to 30 percent slopes	5.4	25.7%
Totals for Area of Interest		21.1	100.0%

Snohomish County Area, Washington

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

Map Unit Setting

National map unit symbol: 2t61k

Elevation: 160 to 1,150 feet

Mean annual precipitation: 45 to 70 inches

Mean annual air temperature: 46 to 52 degrees F

Frost-free period: 140 to 200 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Tokul and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tokul

Setting

Landform: Hillslopes, till plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Side slope, tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Volcanic ash mixed with loess over glacial till

Typical profile

O_i - 0 to 1 inches: slightly decomposed plant material

O_a - 1 to 2 inches: highly decomposed plant material

A - 2 to 6 inches: gravelly medial loam

B_{s1} - 6 to 9 inches: gravelly medial loam

B_{s2} - 9 to 17 inches: gravelly medial loam

B_{s3} - 17 to 24 inches: gravelly medial loam

BC - 24 to 33 inches: gravelly medial fine sandy loam

2B_{sm} - 33 to 62 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: 20 to 39 inches to densic material; 20 to 39 inches to cemented horizon

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (K_{sat}): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 18 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: B
Ecological site: F002XA005WA - Puget Lowlands Moist Forest
Forage suitability group: Limited Depth Soils (G002XN302WA),
Limited Depth Soils (G002XF303WA)
Other vegetative classification: Limited Depth Soils
(G002XN302WA), Limited Depth Soils (G002XF303WA)
Hydric soil rating: No

Minor Components

Pastik

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

Barneston

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

Norma

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

Mckenna

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

Data Source Information

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 23, Aug 31, 2021

Snohomish County Area, Washington

74—Tokul gravelly medial loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2t61m

Elevation: 160 to 1,640 feet

Mean annual precipitation: 45 to 70 inches

Mean annual air temperature: 46 to 52 degrees F

Frost-free period: 140 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Tokul and similar soils: 70 percent

Minor components: 30 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tokul

Setting

Landform: Till plains, hillslopes

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Side slope, tread

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Volcanic ash mixed with loess over glacial till

Typical profile

O_i - 0 to 1 inches: slightly decomposed plant material

O_a - 1 to 2 inches: highly decomposed plant material

A - 2 to 6 inches: gravelly medial loam

B_{s1} - 6 to 9 inches: gravelly medial loam

B_{s2} - 9 to 17 inches: gravelly medial loam

B_{s3} - 17 to 24 inches: gravelly medial loam

BC - 24 to 33 inches: gravelly medial fine sandy loam

2B_{sm} - 33 to 62 inches: cemented material

Properties and qualities

Slope: 15 to 30 percent

Depth to restrictive feature: 20 to 39 inches to densic material; 20 to 39 inches to cemented horizon

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (K_{sat}): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 18 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F002XA005WA - Puget Lowlands Moist Forest
Forage suitability group: Limited Depth Soils (G002XF303WA),
Unnamed (G002XN303WA)
Other vegetative classification: Limited Depth Soils
(G002XF303WA), Unnamed (G002XN303WA)
Hydric soil rating: No

Minor Components

Rinker

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Barneston

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

Vanzandt

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Pastik

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

Norma

Percent of map unit: 3 percent
Landform: Drainageways, depressions
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave

Across-slope shape: Concave
Hydric soil rating: Yes

Mckenna

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

Data Source Information

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 23, Aug 31, 2021

SECTION 4: DETENTION AND WATER QUALITY TREATMENT DESIGN

4.1 Pre-Developed Hydrology/Land Cover

The pre-developed and developed conditions were modeled in WWHM for the purpose of peak flow determination for direct discharge. The onsite wetland area and buffer was not included in the modeling as it will not be disturbed during development. Based on the site location, the WWHM used the Everett Gage and a Precipitation Scale factor of 1.2.

North Basin (modeled within the North TDA Basin):

The predeveloped condition was applied to the North Basin. For visual representation of the listed basins, see Figure 4.0, "Predeveloped Hydrology Map". The values as modeled in WWHM are as follows:

Table 1: Predeveloped Conditions: North Basin

North Basin	
Ground Cover	Area (acre)
Forest, flat	0.54
Forest, mod	0.49
Total	1.03

South Basin (modeled within the South TDA Basin):

The predeveloped condition was applied to the South Basin. For visual representation of the listed basins, see Figure 4.0, "Predeveloped Hydrology Map". The values as modeled in WWHM are as follows:

Table 2: Predeveloped Conditions: South Basin

South Basin	
Ground Cover	Area (acre)
Forest, flat	0.39
Forest, mod	1.11
Total	1.50

4.2 Developed Site Hydrology

In the developed condition, the project will develop 43 single-family lots and associated driveways and utilities. Frontage improvements, including pavement widening and construction of pedestrian facilities, will be constructed along 172nd St NE.

In compliance with the 2019 DOE Manual, all runoff from onsite developed/disturbed surfaces will be collected, treated, and discharged directly to existing/historic flow paths. The developed site is split into North and South detention systems to match the overall areas distribution of the Predeveloped North and South TDA Basins and downstream discharge locations.

North Basin (modeled within the North TDA Basin):

The developed North Basin is 1.03 acres comprised of a 20 single family lots, open spaces, and ROW. Consistent with Section 20.48.064 of the Arlington Municipal Code, the assumed maximum impervious coverage of 40% per lot was used. In the developed condition, the North Basin has been modeled using WWHM with the following areas and ground cover designations:

Table 3: Developed Conditions: North Basin

North Basin	
Ground Cover	Area (acre)
Roof Tops, flat	0.33
Roads, flat	0.19
Driveway, flat	0.17
Sidewalks, flat	0.02
Pasture, flat	0.32
Total	1.03

South Basin (modeled within the South TDA Basin):

The developed South Basin is 1.47 acres comprised of a 23 single family lots, open spaces, and ROW. Consistent with Section 20.48.064 of the Arlington Municipal Code, the assumed maximum impervious coverage of 40% per lot was used. In the developed condition, the South Basin has been modeled using WWHM with the following areas and ground cover designations:

Table 4: Developed Conditions: South Basin

South Basin	
Ground Cover	Area (acre)
Roof Tops, flat	0.38
Roads, flat	0.30
Driveway, flat	0.17
Sidewalks, flat	0.07
Pasture, flat	0.55
Total	1.47

Frontage Bypass Basin (modeled within the South TDA Basin):

The developed Frontage Bypass Basin is 0.03 acres, comprised of roadway on the west side of the frontage are that cannot be collected due to vertical constraints. In the developed condition, the Frontage Bypass Basin has been modeled using WWHM with the following areas and ground cover designations:

Table 5: Developed Conditions: Onsite Basin

Frontage Bypass Basin	
Ground Cover	Area (acre)
Road, mod	0.03
Total	0.03

4.3 Detention Facility Design

The proposed detention vault facilities used for mitigating developed condition flows were designed in compliance with 2019 DOE requirements to model hydrologic conditions and detention in a continuous runoff model (WWHM2012) where the following evaluation parameters are employed:

"Flow duration is computed by counting the number of flow values that exceed a specified flow level. The specified flow levels used by WWHM in the flow duration analysis are listed below.

1. 50% of the 2-year predevelopment peak flow.
2. 100% of the 2-year predevelopment peak flow.
3. 100% of the 50-year predevelopment peak flow.

There are three criteria by which flow duration values are compared:

1. *If the postdevelopment flow duration values exceed any of the predevelopment flow levels between 50% and 100% of the 2-year predevelopment peak flow values (100 Percent Threshold) then the flow duration requirement has not been met.*
2. *If the postdevelopment flow duration values exceed any of the predevelopment flow levels between 100% of the 2-year and 100% of the 50-year predevelopment peak flow values more than 10 percent of the time (110 Percent Threshold) then the flow duration requirement has not been met.*
3. *If more than 50 percent of the flow duration levels exceed the 100 percent threshold then the flow duration requirement has not been met."*

Detention Vault Facilities

The proposed detention facilities detain, and release collected storm water runoff from the onsite North and South Basins. The predeveloped site consists of two TDAs (North and South TDA Basins), so the proposed system will be comprised of two separate vaults that outfall at separate locations to match the predeveloped conditions. The facilities are located within the north and south edges of the site. Flows from the onsite basins are collected and conveyed to the detention vaults via a network of catch basins and storm water conveyance pipes. Detailed WWHM output is provided in Appendix 4. A summary of the detailed statistics and inputs used for modeling the system in WWHM2012 can be found below.

Table 6: North Detention Vault Design Summary

WWHM Modeled North Detention Vault	
Live Storage Bottom Area	2,500 SF
Vault Dimensions	50'x50'
Riser Height	8.00'
Volume (modeled)	20,000 CF

Detailed North Detention Vault	
Live Storage Bottom Area (provided)	2,600 SF
Number of Cells	2
Cell Dimensions	20.0' x 68.0' & 20.0' x 60.0'
Begin Live Storage Elevation	451.25
Riser Height	8.00'
Volume (provided)	20,800 CF
Top of Riser Elevation	459.25
Top Outside of Vault Elevation	460.75

Table 7: South Detention Vault Design Summary

WWHM Modeled South Detention Vault	
Live Storage Bottom Area	4,620 SF
Vault Dimensions	48'x49'
Riser Height	10.00'
Volume (modeled)	23,520 CF

Detailed South Detention Vault	
Live Storage Bottom Area (provided)	2,436 SF
Number of Cells	2
Cell Dimensions	21.0' x 58.0'
Begin Live Storage Elevation	447.90
Riser Height	10.00'
Volume (provided)	24,360 CF
Top of Riser Elevation	457.90
Top Outside of Vault Elevation	459.40

See tables below for the flow rates and water surface elevations by storm event for the detention vaults.

Table 8: North Vault Flow Rates and Water Surface Elevations by Storm Event

Storm Event	Predeveloped Rate (cfs)	Mitigated Rates (cfs)	Water Surface Elevation (ft)
2-Year	0.0362	0.0157	456.56
10-Year	0.0728	0.0331	457.00
50-Year	0.1155	0.0582	458.16
100-Year	0.1371	0.0726	459.01

Table 9: South Vault Flow Rates and Water Surface Elevations by Storm Event

Storm Event	Predeveloped Rate (cfs)	Mitigated Rates (cfs)	Water Surface Elevation (ft)
2-Year	0.0541	0.0340	455.16
10-Year	0.1105	0.0552	455.44
50-Year	0.1774	0.0799	456.03
100-Year	0.2114	0.0924	456.32

4.4 Water Quality Treatment

Perkfilter-1

Water Quality Treatment for PGIS within the north half of the North Basin is accomplished through a Perkfilter Catch Basin located upstream of the detention vault. A summary of design criteria is provided below:

Table 6: Perkfilter-1 Design Summary

Perkfilter 1 – Concrete Catch Basin	
Tributary Area	0.34 AC
Tributary PGIS Area	0.11 AC
Water Quality Flow Rate (91% of runoff vol.)	0.0072 cfs
Number of Cartridges	1
Cartridge Height	12"
Internal Drop	1.83'
Peak Flow Rate	0.3286 cfs
Peak Flow Storm Event	100-Year

Perkfilter-2

Water Quality Treatment for PGIS within the south half of the North Basin is accomplished through a Perkfilter Manhole located upstream of the detention vault. A summary of design criteria is provided below:

Table 7: Perkfilter 2 Design Summary

Perkfilter 2 – 72" Ø Concrete Manhole	
Tributary Area	0.69 AC
Tributary PGIS Area	0.24 AC
Water Quality Flow Rate (91% of runoff vol.)	0.0917 cfs
Number of Cartridges	4
Cartridge Height	18"
Internal Drop	2.3'
Peak Flow Rate	0.7004 cfs
Peak Flow Storm Event	100-year

Perkfilter-3

Water Quality Treatment for the PGIS within the South Basin is accomplished through a Perkfilter Manhole located downstream of the detention vault. A summary of design criteria is provided below:

Table 7: Perkfilter 2 Design Summary

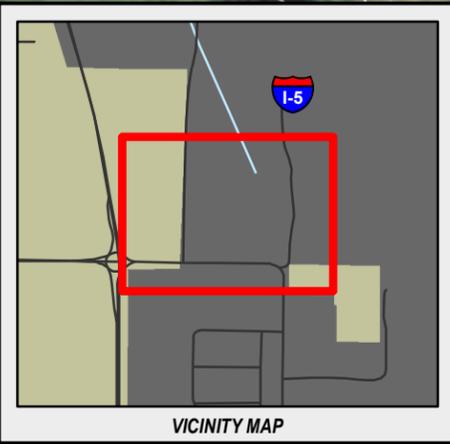
Perkfilter 3 – 60" Ø Concrete Manhole	
Tributary Area	1.47 AC
Tributary PGIS Area	0.47 AC
Water Quality Flow Rate (2-yr mitigated peak)	0.0340 cfs
Number of Cartridges	3
Cartridge Height	12"
Internal Drop	1.7'
Peak Flow Rate	1.3940 cfs
Peak Flow Storm Event	100-year

Appendix 4: Detention and Water Quality Design Analysis

1. Figure 4.0: Predeveloped Hydrology Map
2. Figure 5.0: Developed Hydrology Map
3. Perkfilter Details
4. WWHM2012 Output – North Vault Detention Model
5. WWHM2012 Output – South Vault Detention Model
6. WWHM2012 Output – Perkfilter 1 – Concrete Catch Basin
7. WWHM2012 Output – Perkfilter 2 – 72" Ø Concrete Manhole
8. WWHM2012 Output – Perkfilter 3 – 60" Ø Concrete Manhole



PREDEVELOPED BASIN AREAS	
NORTH BASIN	
FOREST	1.03 AC
TOTAL	1.03 AC
SOUTH BASIN	
FOREST	1.50 AC
TOTAL	1.50 AC



LEGEND

- Subject Property
- Parcel Boundary
- ~ Watercourse
- Contours (LiDAR)
- ~ 10 Foot Contour
- ~ 2 Foot Contour

1 inch = 100 feet

JM1 HOLDINGS, LLC

ALLEN TOWNHOMES

PREDEVELOPED HYDROLOGY MAP

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601 FEET

REVISION:
JOB NUMBER: C21-213
DRAWING NAME: C21-213-4.0
DESIGNER: RFERGUSON
DRAWING BY: RFERGUSON
DATE: 9/15/2022
SCALE: AS SHOWN
JURISDICTION: BOTHELL

FIGURE:

4.0

SOURCE INFORMATION

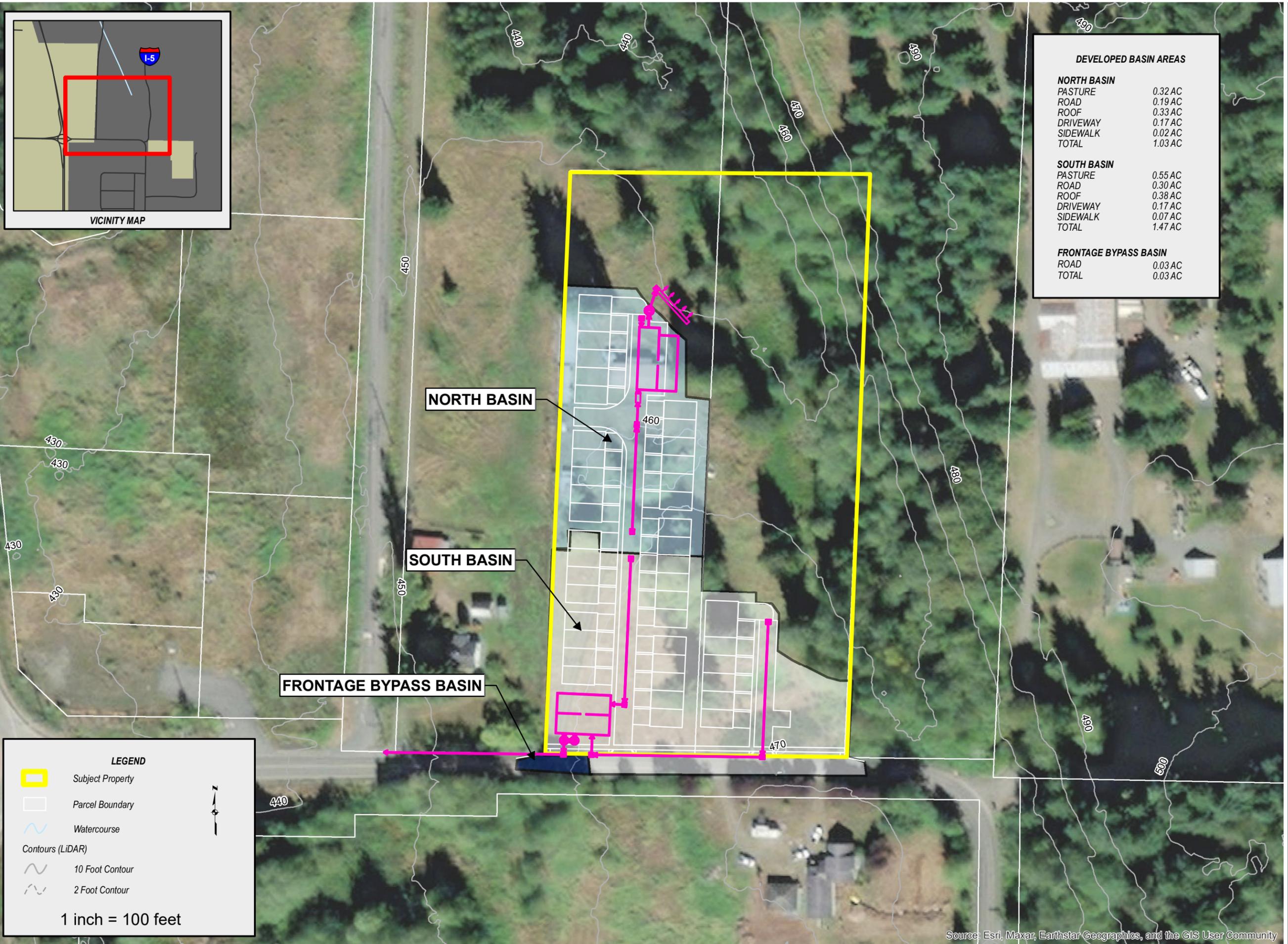
SOURCE AGENCY	DESCRIPTION
KING COUNTY GIS	PARCEL BOUNDARY
KING COUNTY GIS	CONTOURS GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.

LDC

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Engineering
Planning

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Woodinville, WA 98072
T: 425.386.1869

Kent
1851 Central Pl S, #101
Kent, WA 98030
www.LDCcorp.com
F: 425.482.2893



DEVELOPED BASIN AREAS	
NORTH BASIN	
PASTURE	0.32 AC
ROAD	0.19 AC
ROOF	0.33 AC
DRIVEWAY	0.17 AC
SIDEWALK	0.02 AC
TOTAL	1.03 AC
SOUTH BASIN	
PASTURE	0.55 AC
ROAD	0.30 AC
ROOF	0.38 AC
DRIVEWAY	0.17 AC
SIDEWALK	0.07 AC
TOTAL	1.47 AC
FRONTAGE BYPASS BASIN	
ROAD	0.03 AC
TOTAL	0.03 AC

SOURCE INFORMATION	
SOURCE AGENCY	DESCRIPTION
KING COUNTY GIS	PARCEL BOUNDARY
KING COUNTY GIS	CONTOURS GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.

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JM1 HOLDINGS, LLC

ALLEN TOWNHOMES

DEVELOPED HYDROLOGY MAP

NAD 1983 HARN STATEPLANE WASHINGTON NORTH FIPS 4601 FEET
REVISION:
JOB NUMBER: C21-213
DRAWING NAME: C21-213-5.0
DESIGNER: RFERGUSON
DRAWING BY: RFERGUSON
DATE: 9/15/2022
SCALE: AS SHOWN
JURISDICTION: BOTHELL

FIGURE:
5.0

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

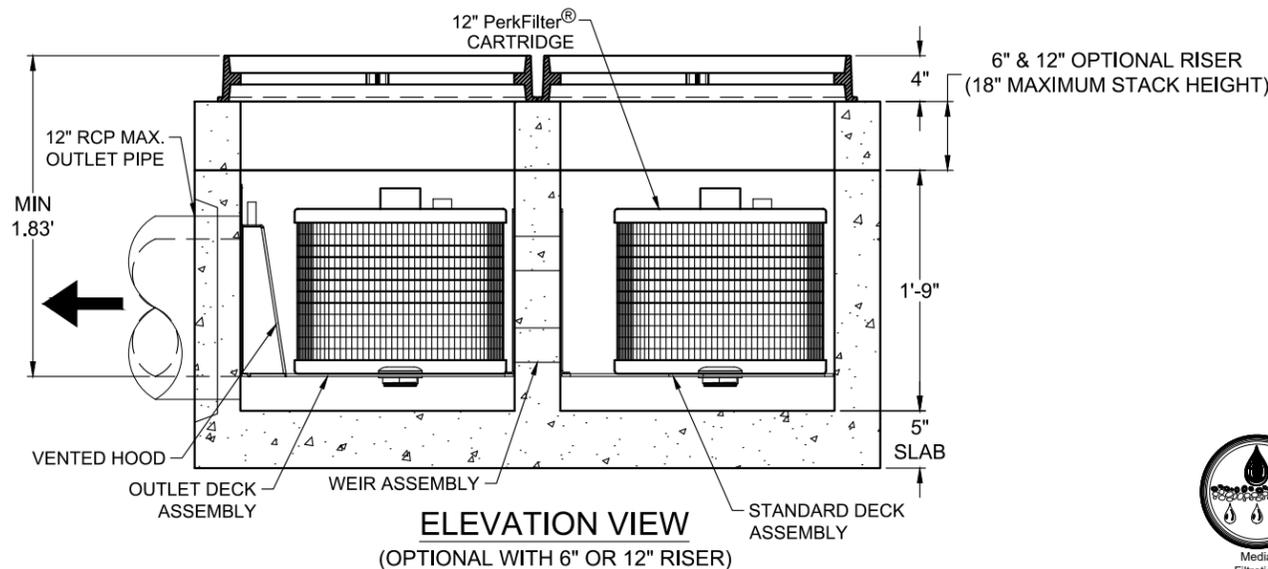
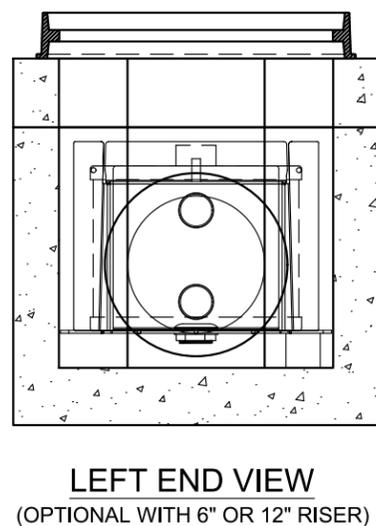
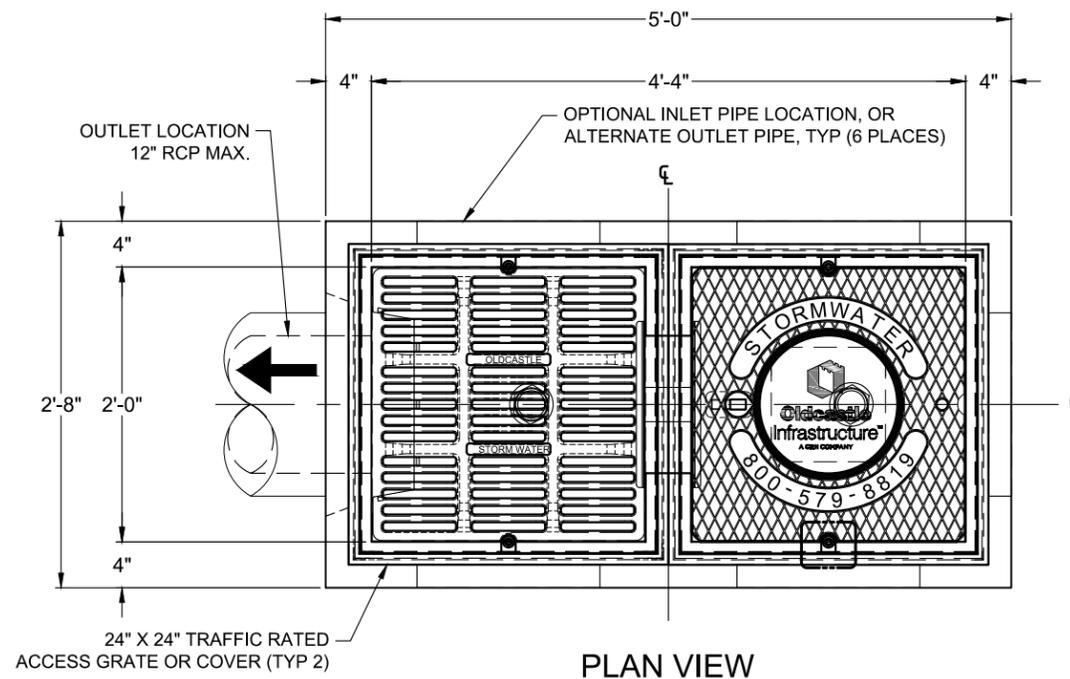
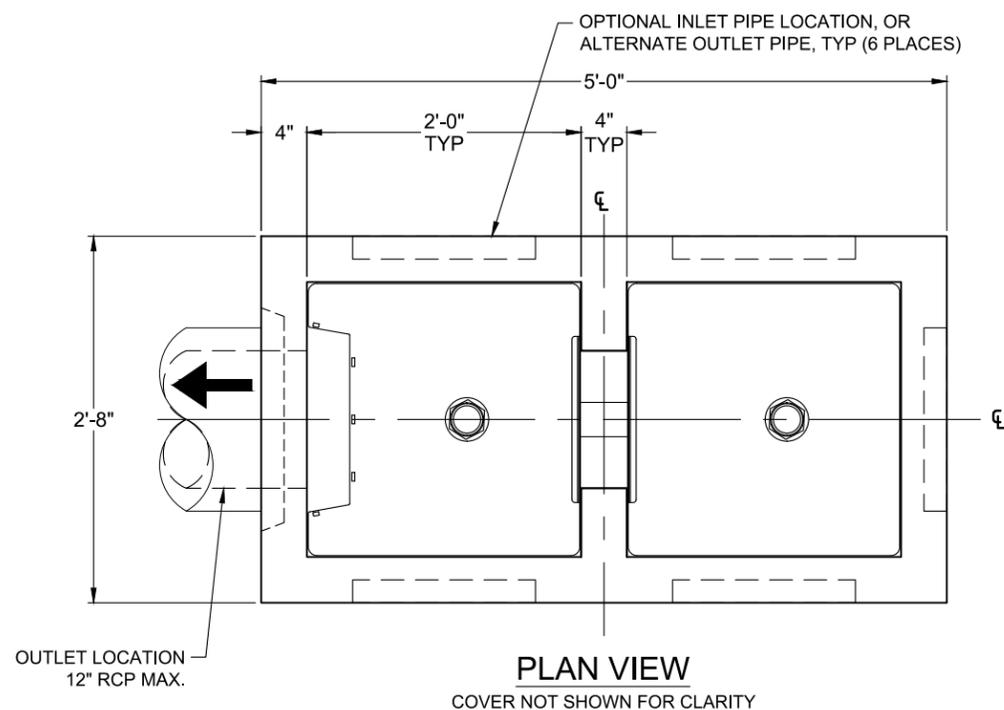
SITE SPECIFIC DATA				
Structure ID	ID			
Treatment Flow Rate (cfs)	-			
Peak Flow Rate (cfs)	1.3 cfs			
Rim Elevation	X.XX'			
Pipe Data	Pipe Location	Pipe Size	Pipe Type	Invert Elevation
Outlet	XXX	XX"	XXX	X.XX'
Inlet	XXX	XX"	XXX	X.XX'
Notes: -				

PERFORMANCE SPECIFICATIONS	
Treatment Flow Capacities:*	
NJDEP 80% Removal, 75 micron	0.054 cfs
WA Ecology GULD - Basic & Phosphorus	0.030 cfs
*Contact Oldcastle for alternative treatment flow capacities.	

NORTH BASIN PERKFILTER 1

NOTES:

- DESIGN LOADINGS:
 - AASHTO HS-20-44 W/ IMPACT.
 - STANDARD DESIGN FILL: MAX TOP OF STRUCTURE.
 - ASSUMED WATER TABLE: BELOW STRUCTURE.
 - DRY LATERAL EARTH PRESSURE (EFP) = 45 PCF.
 - LATERAL LIVE LOAD SURCHARGE = 80 PSF (APPLIED TO 8' BELOW GRADE).
 - NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
- CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 5,000 PSI MINIMUM.
- STEEL REINFORCEMENT: REBAR, ASTM A-615 OR A-706, GRADE 60.
- CEMENT: ASTM C-150 SPECIFICATION.
- REQUIRED ALLOWABLE SOIL BEARING PRESSURE = 2,500 PSF. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED AND LEVEL PER PROJECT SPECIFICATIONS).
- REFERENCE STANDARD:
 - ASTM C 890
 - ASTM C 913
 - ACI 318-14
- OUTLET HOLES WILL BE FACTORY CORED/CAST PER PLANS/CUSTOMER REQUIREMENTS. OUTLET LOCATIONS CAN BE CHANGED.
- MAXIMUM PICK WEIGHT (COMBINED WEIGHT OF BASE, CARTRIDGE & ACCESS COVER) = TBD.
- FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT OLDCASTLE INFRASTRUCTURE.



- PRELIMINARY -
NOT FOR CONSTRUCTION

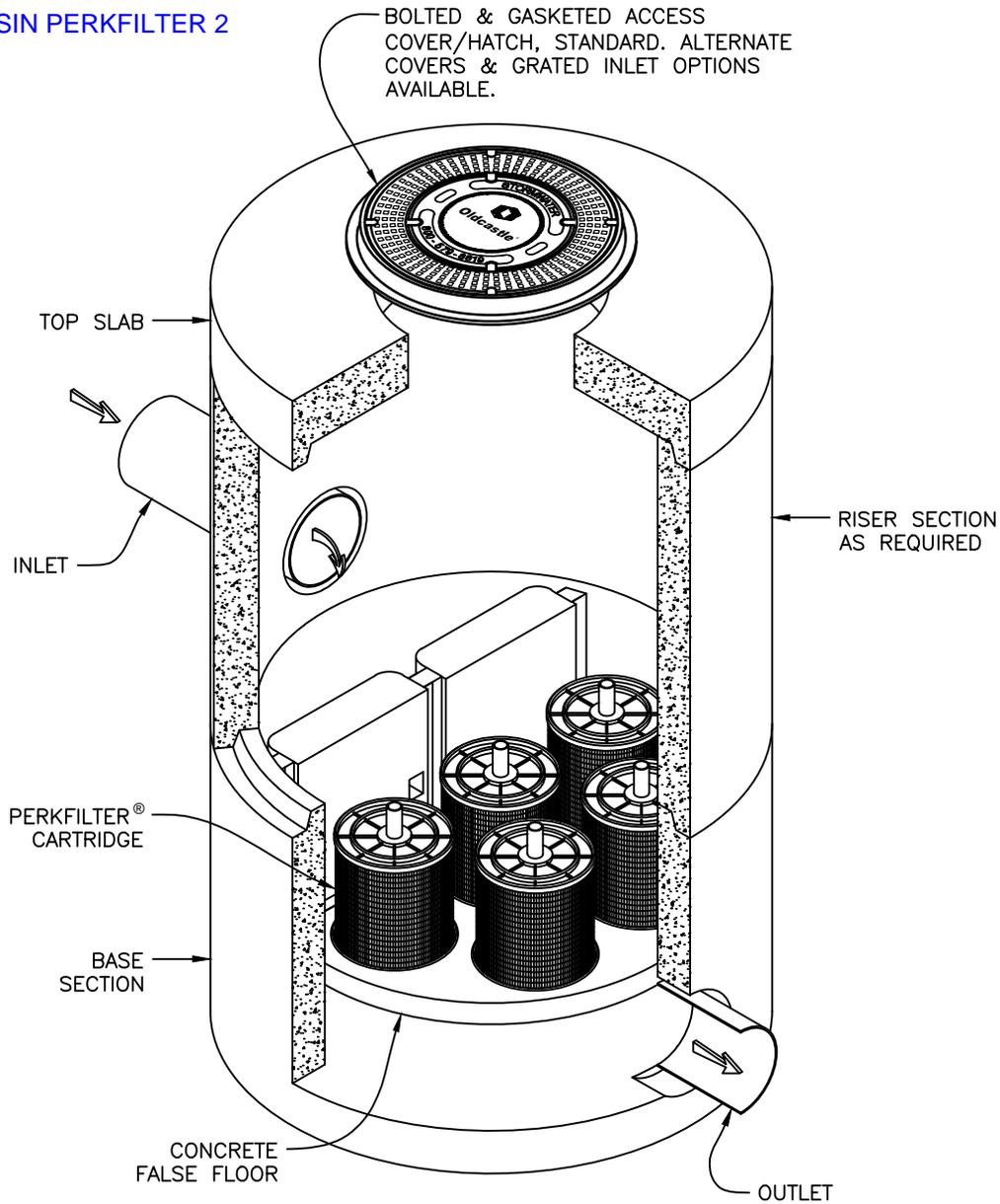


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PerkFilter® Concrete Catch Basin 12" Cartridge					
CUSTOMER					
PROJECT NAME					
DATE	MFG	DRAWN	ENGINEER	CHECKED	SALES ORDER
--/--/22	-	-	-	-	-
SHEET NAME				REVISION	SHEET
Specifier Drawing				-	1 OF 1
PFCB-25-1x12				REV DATE	



NORTH BASIN PERKFILTER 2



Notes:

1. Precast concrete structure shall be manufactured in accordance with ASTM Designation C478.
2. Filter system shall be supplied with traffic rated (H20) bolted & gasketed Ø36" circular access covers with risers as required. Field poured concrete collar required, by others.
3. Inlet & outlet pipe(s) are to be Ø24" maximum. Inlet pipes must enter the structure in the inlet chamber.
4. Inlet chamber shall be supplied with drain-down device designed to remove standing water between storm events.
5. Minimum separation between invert in & invert out is outlet pipe diameter plus 4.00".
6. For depths less than specified minimums contact Oldcastle Infrastructure for engineering assistance.



Media
Filtration

PerkFilter®

Ø72" Manhole

One to Five Cartridges / Stacks



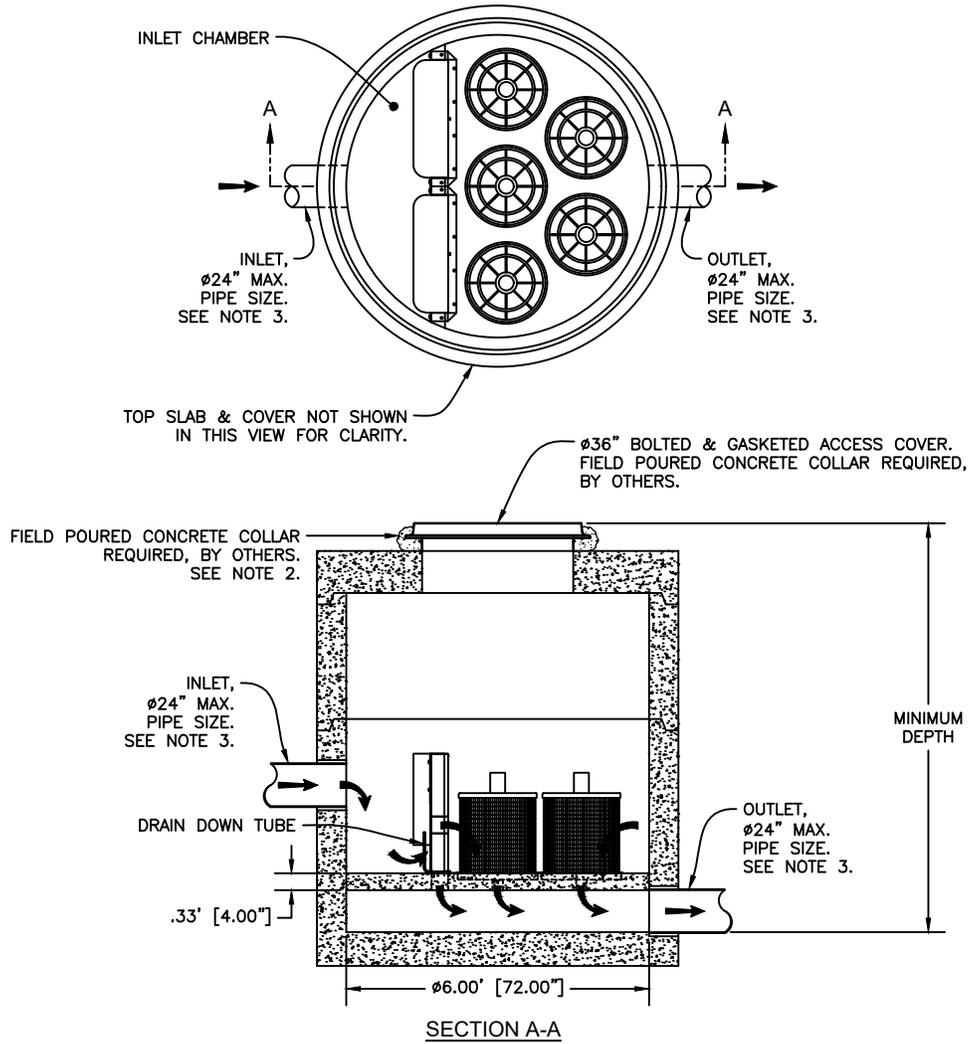
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DRAWING NO. PF-MH-72	REV A	ECO ECO-0168 ARG 1/22/2020	DATE PPS 1/23/20	SHEET 1 OF 2
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Minimum Depth								
PIPE SIZE	Ø6"	Ø8"	Ø10"	Ø12"	Ø15"	Ø18"	Ø21"	Ø24"
CARTRIDGE TYPE	MINIMUM DEPTH RIM TO OUTLET							
12"	4.08' [49.00"]	4.08' [49.00"]	4.33' [52.00"]	4.58' [55.00"]	4.83' [58.00"]	5.08' [61.00"]	5.33' [64.00"]	5.58' [67.00"]
18"	4.83' [58.00"]	4.83' [58.00"]	5.08' [61.00"]	5.33' [64.00"]	5.58' [67.00"]	5.83' [70.00"]	6.08' [73.00"]	6.33' [76.00"]
12" + 12"	5.58' [67.00"]	5.83' [70.00"]	6.08' [73.00"]	6.33' [76.00"]	6.58' [79.00"]	6.83' [82.00"]	7.08' [85.00"]	7.33' [88.00"]
12" + 18"	6.08' [73.00"]	6.33' [76.00"]	6.58' [79.00"]	6.83' [82.00"]	7.08' [85.00"]	7.33' [88.00"]	7.58' [91.00"]	7.83' [94.00"]

Ø72" PERKFILTER MANHOLE TREATMENT FLOW RATES, TOTAL FLOW CAPACITIES & MAXIMUM HEAD LOSS								
CARTRIDGE STACK QUANTITY	CARTRIDGE STACK CONFIGURATION							
	12"		18"		12" & 12"		12" & 18"	
	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)
1	12 / 0.03	4.94	18 / 0.04	6.10	24 / 0.05	6.90	30 / 0.07	7.24
2	24 / 0.05	4.94	36 / 0.08	6.10	48 / 0.11	6.90	60 / 0.13	7.24
3	36 / 0.08	4.94	54 / 0.12	6.10	72 / 0.16	6.90	90 / 0.20	7.24
4	48 / 0.11	4.94	72 / 0.16	6.10	96 / 0.21	6.90	120 / 0.27	7.24
5	60 / 0.13	4.94	90 / 0.20	6.10	120 / 0.27	6.90	150 / 0.33	7.24
MAXIMUM HEAD LOSS	1.7 FEET		2.3 FEET		2.9 FEET		3.5 FEET	



PerkFilter®

Ø72" Manhole

One to Five Cartridges / Stacks

Media Filtration



Oldcastle Infrastructure™

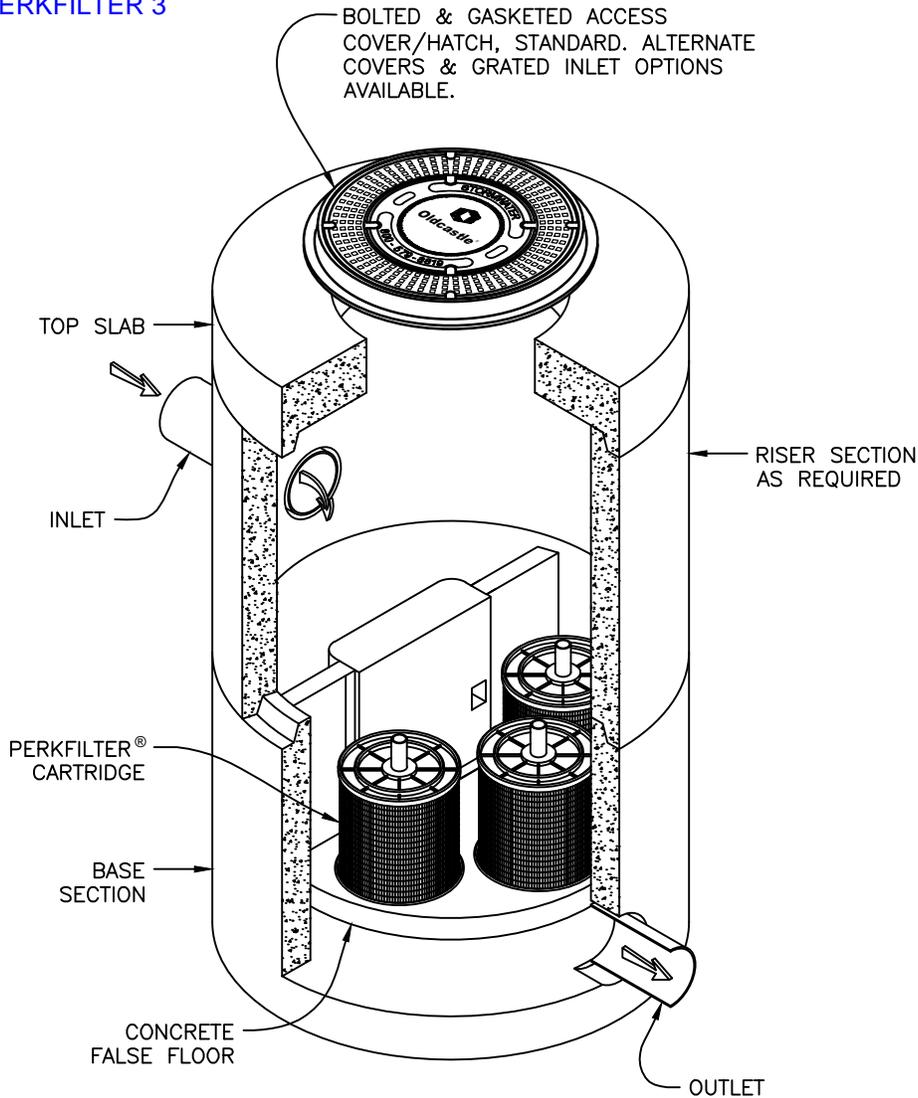
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DRAWING NO. PF-MH-72	REV A	ECO ECO-0168 ARG 1/22/2020	DATE PPS 1/23/20	SHEET 2 OF 2
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SOUTH BASIN PERKFILTER 3



Notes:

1. Precast concrete structure shall be manufactured in accordance with ASTM Designation C478.
2. Filter system shall be supplied with traffic rated (H20) bolted & gasketed Ø36" circular access covers with risers as required. Field poured concrete collar required, by others.
3. Inlet & outlet pipe(s) are to be Ø18" maximum. Inlet pipes must enter the structure in the inlet chamber.
4. Inlet chamber shall be supplied with drain-down device designed to remove standing water between storm events.
5. Minimum separation between invert in & invert out is outlet pipe diameter plus 4.00".
6. For depths less than specified minimums contact Oldcastle Infrastructure for engineering assistance.



Media
Filtration

PerkFilter®

Ø60" Manhole

One to Three Cartridges / Stacks

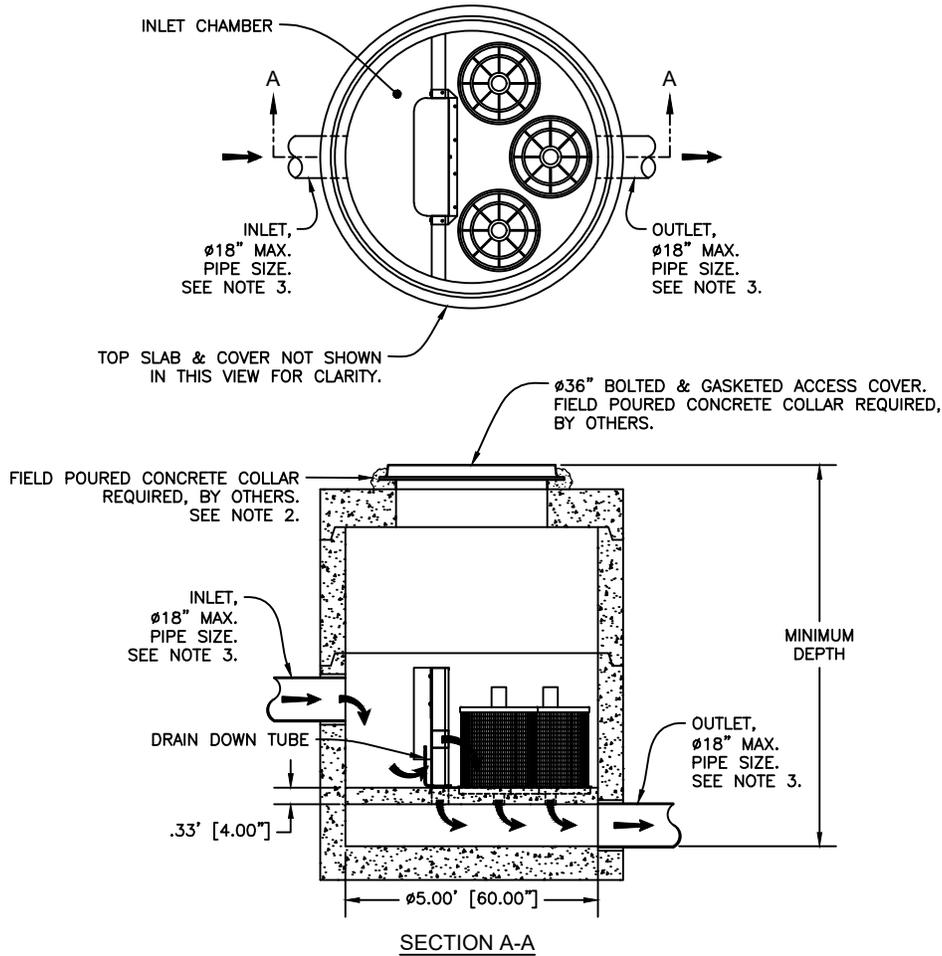


Oldcastle Infrastructure™
A CRH COMPANY

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DRAWING NO. PF-MH-60	REV A	ECO ECO-0168 ARG 1/22/2020	DATE PPS 1/23/20	SHEET 1 OF 2
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Minimum Depth						
PIPE SIZE	Ø6"	Ø8"	Ø10"	Ø12"	Ø15"	Ø18"
CARTRIDGE TYPE	MINIMUM DEPTH RIM TO OUTLET					
12"	4.08' [49.00"]	4.08' [49.00"]	4.33' [52.00"]	4.58' [55.00"]	4.83' [58.00"]	5.08' [61.00"]
18"	4.83' [58.00"]	4.83' [58.00"]	5.08' [61.00"]	5.33' [64.00"]	5.58' [67.00"]	5.83' [70.00"]
12" + 12"	5.58' [67.00"]	5.83' [70.00"]	6.08' [73.00"]	6.33' [76.00"]	6.58' [79.00"]	6.83' [82.00"]
12" + 18"	6.08' [73.00"]	6.33' [76.00"]	6.58' [79.00"]	6.83' [82.00"]	7.08' [85.00"]	7.33' [88.00"]

Ø60" PERKFILTER MANHOLE TREATMENT FLOW RATES, TOTAL FLOW CAPACITIES & MAXIMUM HEAD LOSS								
CARTRIDGE STACK QUANTITY	CARTRIDGE STACK CONFIGURATION							
	12"		18"		12" & 12"		12" & 18"	
	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)	TREATMENT FLOW RATE (GPM / CFS)	TOTAL FLOW CAPACITY (CFS)
1	12 / 0.03	2.47	18 / 0.04	3.05	24 / 0.05	3.45	30 / 0.07	3.62
2	24 / 0.05	2.47	36 / 0.08	3.05	48 / 0.11	3.45	60 / 0.13	3.62
3	36 / 0.08	2.47	54 / 0.12	3.05	72 / 0.16	3.45	90 / 0.20	3.62
MAXIMUM HEAD LOSS	1.7 FEET		2.3 FEET		2.9 FEET		3.5 FEET	



PerkFilter®

Ø60" Manhole

One to Three Cartridges / Stacks



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DRAWING NO. PF-MH-60	REV A	ECO ECO-0168 ARG 1/22/2020	DATE PPS 1/23/20	SHEET 2 OF 2
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GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Lawn, Flat	.32
Pervious Total	0.32
<u>Impervious Land Use</u>	<u>acre</u>
ROADS FLAT	0.19
ROOF TOPS FLAT	0.33
DRIVEWAYS FLAT	0.17
SIDEWALKS FLAT	0.02
Impervious Total	0.71
Basin Total	1.03

Element Flows To:		
Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Vault 1
Width : 50 ft.
Length : 50 ft.
Depth : 9 ft.
Discharge Structure
Riser Height: 8 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.5 in. **Elevation**: 0 ft.
Orifice 2 Diameter: 1 in. **Elevation**: 5.34 ft.
Orifice 3 Diameter: 0.625 in. **Elevation**: 6.53 ft.

Element Flows To:	
Outlet 1	Outlet 2

Vault Hydraulic Table				
<u>Stage(feet)</u>	<u>Area(ac.)</u>	<u>Volume(ac-ft.)</u>	<u>Discharge(cfs)</u>	<u>Infilt(cfs)</u>
0.0000	0.057	0.000	0.000	0.000
0.1000	0.057	0.005	0.002	0.000
0.2000	0.057	0.011	0.003	0.000
0.3000	0.057	0.017	0.003	0.000
0.4000	0.057	0.023	0.004	0.000
0.5000	0.057	0.028	0.004	0.000
0.6000	0.057	0.034	0.005	0.000
0.7000	0.057	0.040	0.005	0.000
0.8000	0.057	0.045	0.006	0.000

0.9000	0.057	0.051	0.006	0.000
1.0000	0.057	0.057	0.006	0.000
1.1000	0.057	0.063	0.007	0.000
1.2000	0.057	0.068	0.007	0.000
1.3000	0.057	0.074	0.007	0.000
1.4000	0.057	0.080	0.008	0.000
1.5000	0.057	0.086	0.008	0.000
1.6000	0.057	0.091	0.008	0.000
1.7000	0.057	0.097	0.008	0.000
1.8000	0.057	0.103	0.009	0.000
1.9000	0.057	0.109	0.009	0.000
2.0000	0.057	0.114	0.009	0.000
2.1000	0.057	0.120	0.009	0.000
2.2000	0.057	0.126	0.010	0.000
2.3000	0.057	0.132	0.010	0.000
2.4000	0.057	0.137	0.010	0.000
2.5000	0.057	0.143	0.010	0.000
2.6000	0.057	0.149	0.010	0.000
2.7000	0.057	0.155	0.011	0.000
2.8000	0.057	0.160	0.011	0.000
2.9000	0.057	0.166	0.011	0.000
3.0000	0.057	0.172	0.011	0.000
3.1000	0.057	0.177	0.011	0.000
3.2000	0.057	0.183	0.012	0.000
3.3000	0.057	0.189	0.012	0.000
3.4000	0.057	0.195	0.012	0.000
3.5000	0.057	0.200	0.012	0.000
3.6000	0.057	0.206	0.012	0.000
3.7000	0.057	0.212	0.013	0.000
3.8000	0.057	0.218	0.013	0.000
3.9000	0.057	0.223	0.013	0.000
4.0000	0.057	0.229	0.013	0.000
4.1000	0.057	0.235	0.013	0.000
4.2000	0.057	0.241	0.013	0.000
4.3000	0.057	0.246	0.014	0.000
4.4000	0.057	0.252	0.014	0.000
4.5000	0.057	0.258	0.014	0.000
4.6000	0.057	0.264	0.014	0.000
4.7000	0.057	0.269	0.014	0.000
4.8000	0.057	0.275	0.014	0.000
4.9000	0.057	0.281	0.015	0.000
5.0000	0.057	0.287	0.015	0.000
5.1000	0.057	0.292	0.015	0.000
5.2000	0.057	0.298	0.015	0.000
5.3000	0.057	0.304	0.015	0.000
5.4000	0.057	0.309	0.022	0.000
5.5000	0.057	0.315	0.026	0.000
5.6000	0.057	0.321	0.029	0.000
5.7000	0.057	0.327	0.032	0.000
5.8000	0.057	0.332	0.034	0.000
5.9000	0.057	0.338	0.036	0.000
6.0000	0.057	0.344	0.038	0.000
6.1000	0.057	0.350	0.040	0.000
6.2000	0.057	0.355	0.042	0.000
6.3000	0.057	0.361	0.043	0.000

6.4000	0.057	0.367	0.045	0.000
6.5000	0.057	0.373	0.046	0.000
6.6000	0.057	0.378	0.050	0.000
6.7000	0.057	0.384	0.053	0.000
6.8000	0.057	0.390	0.056	0.000
6.9000	0.057	0.396	0.058	0.000
7.0000	0.057	0.401	0.060	0.000
7.1000	0.057	0.407	0.062	0.000
7.2000	0.057	0.413	0.063	0.000
7.3000	0.057	0.419	0.065	0.000
7.4000	0.057	0.424	0.067	0.000
7.5000	0.057	0.430	0.068	0.000
7.6000	0.057	0.436	0.070	0.000
7.7000	0.057	0.441	0.072	0.000
7.8000	0.057	0.447	0.073	0.000
7.9000	0.057	0.453	0.074	0.000
8.0000	0.057	0.459	0.076	0.000
8.1000	0.057	0.464	0.579	0.000
8.2000	0.057	0.470	1.483	0.000
8.3000	0.057	0.476	2.581	0.000
8.4000	0.057	0.482	3.713	0.000
8.5000	0.057	0.487	4.722	0.000
8.6000	0.057	0.493	5.485	0.000
8.7000	0.057	0.499	5.977	0.000
8.8000	0.057	0.505	6.425	0.000
8.9000	0.057	0.510	6.810	0.000
9.0000	0.057	0.516	7.175	0.000
9.1000	0.057	0.522	7.522	0.000
9.2000	0.000	0.000	7.854	0.000

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1

Total Pervious Area:1.03

Total Impervious Area:0

Mitigated Landuse Totals for POC #1

Total Pervious Area:0.32

Total Impervious Area:0.71

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.036224
5 year	0.056713
10 year	0.072759
25 year	0.095993

50 year 0.115545
 100 year 0.137101

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.015726
5 year	0.024944
10 year	0.033056
25 year	0.046083
50 year	0.058155
100 year	0.072582

Stream Protection Duration

Annual Peaks for Predeveloped and Mitigated. POC #1

<u>Year</u>	<u>Predeveloped</u>	<u>Mitigated</u>
1949	0.038	0.012
1950	0.039	0.015
1951	0.034	0.012
1952	0.027	0.012
1953	0.022	0.012
1954	0.131	0.013
1955	0.045	0.037
1956	0.040	0.041
1957	0.052	0.015
1958	0.041	0.014
1959	0.036	0.014
1960	0.033	0.014
1961	0.068	0.030
1962	0.033	0.011
1963	0.056	0.013
1964	0.042	0.010
1965	0.030	0.014
1966	0.018	0.012
1967	0.036	0.013
1968	0.043	0.014
1969	0.122	0.013
1970	0.025	0.013
1971	0.043	0.042
1972	0.029	0.013
1973	0.028	0.015
1974	0.068	0.015
1975	0.026	0.011
1976	0.028	0.014
1977	0.022	0.012
1978	0.025	0.012
1979	0.077	0.011
1980	0.036	0.012
1981	0.025	0.011
1982	0.033	0.015
1983	0.063	0.013
1984	0.034	0.043
1985	0.043	0.034
1986	0.099	0.053
1987	0.046	0.043

1988	0.024	0.015
1989	0.027	0.012
1990	0.032	0.015
1991	0.033	0.015
1992	0.025	0.014
1993	0.023	0.010
1994	0.023	0.015
1995	0.034	0.015
1996	0.061	0.015
1997	0.120	0.105
1998	0.021	0.013
1999	0.028	0.015
2000	0.022	0.023
2001	0.008	0.009
2002	0.031	0.031
2003	0.025	0.013
2004	0.041	0.015
2005	0.029	0.013
2006	0.088	0.033
2007	0.067	0.028
2008	0.085	0.045
2009	0.026	0.015

Stream Protection Duration

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1309	0.1051
2	0.1224	0.0526
3	0.1202	0.0455
4	0.0991	0.0431
5	0.0875	0.0425
6	0.0852	0.0418
7	0.0773	0.0406
8	0.0682	0.0368
9	0.0678	0.0339
10	0.0668	0.0334
11	0.0627	0.0305
12	0.0605	0.0305
13	0.0555	0.0279
14	0.0516	0.0234
15	0.0461	0.0154
16	0.0451	0.0153
17	0.0434	0.0152
18	0.0431	0.0151
19	0.0429	0.0151
20	0.0420	0.0150
21	0.0414	0.0150
22	0.0413	0.0148
23	0.0396	0.0147
24	0.0390	0.0146
25	0.0381	0.0146
26	0.0362	0.0146
27	0.0362	0.0146
28	0.0357	0.0145

29	0.0339	0.0144
30	0.0339	0.0142
31	0.0338	0.0140
32	0.0333	0.0139
33	0.0332	0.0138
34	0.0330	0.0135
35	0.0330	0.0135
36	0.0323	0.0134
37	0.0314	0.0134
38	0.0300	0.0134
39	0.0290	0.0132
40	0.0288	0.0132
41	0.0279	0.0131
42	0.0277	0.0130
43	0.0275	0.0130
44	0.0272	0.0128
45	0.0269	0.0127
46	0.0260	0.0125
47	0.0259	0.0124
48	0.0254	0.0120
49	0.0254	0.0120
50	0.0253	0.0118
51	0.0249	0.0118
52	0.0246	0.0118
53	0.0239	0.0117
54	0.0230	0.0116
55	0.0225	0.0114
56	0.0224	0.0113
57	0.0216	0.0112
58	0.0215	0.0111
59	0.0211	0.0104
60	0.0176	0.0103
61	0.0083	0.0087

Stream Protection Duration

POC #1

The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0181	17197	3454	20	Pass
0.0191	14630	3275	22	Pass
0.0201	12470	3121	25	Pass
0.0211	10513	2984	28	Pass
0.0220	8947	2860	31	Pass
0.0230	7636	2678	35	Pass
0.0240	6519	2449	37	Pass
0.0250	5527	2280	41	Pass
0.0260	4768	2133	44	Pass
0.0270	4111	2001	48	Pass
0.0280	3536	1853	52	Pass
0.0289	3080	1708	55	Pass
0.0299	2676	1587	59	Pass

0.0309	2336	1469	62	Pass
0.0319	2025	1349	66	Pass
0.0329	1746	1234	70	Pass
0.0339	1555	1122	72	Pass
0.0348	1396	1030	73	Pass
0.0358	1267	943	74	Pass
0.0368	1155	845	73	Pass
0.0378	1063	771	72	Pass
0.0388	996	713	71	Pass
0.0398	929	642	69	Pass
0.0407	859	570	66	Pass
0.0417	798	499	62	Pass
0.0427	751	422	56	Pass
0.0437	693	381	54	Pass
0.0447	652	332	50	Pass
0.0457	625	283	45	Pass
0.0467	601	270	44	Pass
0.0476	575	258	44	Pass
0.0486	553	248	44	Pass
0.0496	527	239	45	Pass
0.0506	503	227	45	Pass
0.0516	481	209	43	Pass
0.0526	464	198	42	Pass
0.0535	445	187	42	Pass
0.0545	425	182	42	Pass
0.0555	410	178	43	Pass
0.0565	391	174	44	Pass
0.0575	378	170	44	Pass
0.0585	358	157	43	Pass
0.0594	347	151	43	Pass
0.0604	339	144	42	Pass
0.0614	327	136	41	Pass
0.0624	319	126	39	Pass
0.0634	306	114	37	Pass
0.0644	294	100	34	Pass
0.0654	284	95	33	Pass
0.0663	275	90	32	Pass
0.0673	264	85	32	Pass
0.0683	245	79	32	Pass
0.0693	236	72	30	Pass
0.0703	226	64	28	Pass
0.0713	214	57	26	Pass
0.0722	202	49	24	Pass
0.0732	193	44	22	Pass
0.0742	184	37	20	Pass
0.0752	173	22	12	Pass
0.0762	163	9	5	Pass
0.0772	156	4	2	Pass
0.0781	148	4	2	Pass
0.0791	138	4	2	Pass
0.0801	128	4	3	Pass
0.0811	121	4	3	Pass
0.0821	108	3	2	Pass
0.0831	96	3	3	Pass
0.0841	79	3	3	Pass

0.0850	66	3	4	Pass
0.0860	60	3	5	Pass
0.0870	57	3	5	Pass
0.0880	49	3	6	Pass
0.0890	40	3	7	Pass
0.0900	39	2	5	Pass
0.0909	37	2	5	Pass
0.0919	35	2	5	Pass
0.0929	29	2	6	Pass
0.0939	26	2	7	Pass
0.0949	22	2	9	Pass
0.0959	17	2	11	Pass
0.0968	15	1	6	Pass
0.0978	8	1	12	Pass
0.0988	6	1	16	Pass
0.0998	5	1	20	Pass
0.1008	4	1	25	Pass
0.1018	4	1	25	Pass
0.1028	4	1	25	Pass
0.1037	4	1	25	Pass
0.1047	4	1	25	Pass
0.1057	4	0	0	Pass
0.1067	3	0	0	Pass
0.1077	3	0	0	Pass
0.1087	3	0	0	Pass
0.1096	3	0	0	Pass
0.1106	3	0	0	Pass
0.1116	3	0	0	Pass
0.1126	3	0	0	Pass
0.1136	3	0	0	Pass
0.1146	3	0	0	Pass
0.1155	3	0	0	Pass

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	Total Volume	Volume	Infiltration	Cumulative
Percent	Water Quality	Percent	Through	Volume	Volume
Volume	Water Quality	Treatment	Facility	(ac-ft.)	Infiltration
Infiltrated	Treated	(ac-ft)	(ac-ft)	(ac-ft.)	Credit
Vault 1 POC	N	156.59			N
0.00					
Total Volume Infiltrated		156.59	0.00	0.00	
0.00	0.00	0%	No Treat.	Credit	
Compliance with LID Standard 8					
Duration Analysis Result = Failed					

PerlnD and ImplnD Changes

No changes have been made.

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WVHM2012
PROJECT REPORT

Project Name: South Vault
Site Name:
Site Address:
City :
Report Date: 9/6/2022
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20
Version Date: 2021/08/18
Version : 4.2.18

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : South Basin
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Forest, Flat	.39
C, Forest, Mod	1.11

Pervious Total 1.5

<u>Impervious Land Use</u>	<u>acre</u>
Impervious Total	0

Basin Total 1.5

Element Flows To:			
Surface	Interflow	Groundwater	

MITIGATED LAND USE

Name : South Basin
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Pasture, Flat	.55
Pervious Total	0.55
<u>Impervious Land Use</u>	<u>acre</u>
ROADS FLAT	0.25
ROADS MOD	0.05
ROOF TOPS FLAT	0.38
DRIVEWAYS FLAT	0.17
SIDEWALKS FLAT	0.07
Impervious Total	0.92
Basin Total	1.47

Element Flows To:	Interflow	Groundwater
Surface		
Vault 1	Vault 1	

Name : Vault 1
Width : 49 ft.
Length : 48 ft.
Depth : 11 ft.
Discharge Structure
Riser Height: 10 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.625 in. **Elevation**: 0 ft.
Orifice 2 Diameter: 1.3437 in. **Elevation**: 7.25 ft.
Orifice 3 Diameter: 0.71875 in. **Elevation**: 8.02 ft.

Element Flows To:	
Outlet 1	Outlet 2

Vault Hydraulic Table				
<u>Stage(feet)</u>	<u>Area(ac.)</u>	<u>Volume(ac-ft.)</u>	<u>Discharge(cfs)</u>	<u>Infilt(cfs)</u>
0.0000	0.054	0.000	0.000	0.000
0.1222	0.054	0.006	0.003	0.000
0.2444	0.054	0.013	0.005	0.000
0.3667	0.054	0.019	0.006	0.000
0.4889	0.054	0.026	0.007	0.000
0.6111	0.054	0.033	0.008	0.000
0.7333	0.054	0.039	0.009	0.000
0.8556	0.054	0.046	0.009	0.000

0.9778	0.054	0.052	0.010	0.000
1.1000	0.054	0.059	0.011	0.000
1.2222	0.054	0.066	0.011	0.000
1.3444	0.054	0.072	0.012	0.000
1.4667	0.054	0.079	0.012	0.000
1.5889	0.054	0.085	0.013	0.000
1.7111	0.054	0.092	0.013	0.000
1.8333	0.054	0.099	0.014	0.000
1.9556	0.054	0.105	0.014	0.000
2.0778	0.054	0.112	0.015	0.000
2.2000	0.054	0.118	0.015	0.000
2.3222	0.054	0.125	0.016	0.000
2.4444	0.054	0.132	0.016	0.000
2.5667	0.054	0.138	0.017	0.000
2.6889	0.054	0.145	0.017	0.000
2.8111	0.054	0.151	0.017	0.000
2.9333	0.054	0.158	0.018	0.000
3.0556	0.054	0.165	0.018	0.000
3.1778	0.054	0.171	0.018	0.000
3.3000	0.054	0.178	0.019	0.000
3.4222	0.054	0.184	0.019	0.000
3.5444	0.054	0.191	0.020	0.000
3.6667	0.054	0.198	0.020	0.000
3.7889	0.054	0.204	0.020	0.000
3.9111	0.054	0.211	0.021	0.000
4.0333	0.054	0.217	0.021	0.000
4.1556	0.054	0.224	0.021	0.000
4.2778	0.054	0.231	0.021	0.000
4.4000	0.054	0.237	0.022	0.000
4.5222	0.054	0.244	0.022	0.000
4.6444	0.054	0.250	0.022	0.000
4.7667	0.054	0.257	0.023	0.000
4.8889	0.054	0.264	0.023	0.000
5.0111	0.054	0.270	0.023	0.000
5.1333	0.054	0.277	0.024	0.000
5.2556	0.054	0.283	0.024	0.000
5.3778	0.054	0.290	0.024	0.000
5.5000	0.054	0.297	0.024	0.000
5.6222	0.054	0.303	0.025	0.000
5.7444	0.054	0.310	0.025	0.000
5.8667	0.054	0.316	0.025	0.000
5.9889	0.054	0.323	0.025	0.000
6.1111	0.054	0.330	0.026	0.000
6.2333	0.054	0.336	0.026	0.000
6.3556	0.054	0.343	0.026	0.000
6.4778	0.054	0.349	0.027	0.000
6.6000	0.054	0.356	0.027	0.000
6.7222	0.054	0.363	0.027	0.000
6.8444	0.054	0.369	0.027	0.000
6.9667	0.054	0.376	0.028	0.000
7.0889	0.054	0.382	0.028	0.000
7.2111	0.054	0.389	0.028	0.000
7.3333	0.054	0.396	0.042	0.000
7.4556	0.054	0.402	0.051	0.000
7.5778	0.054	0.409	0.057	0.000

7.7000	0.054	0.415	0.062	0.000
7.8222	0.054	0.422	0.066	0.000
7.9444	0.054	0.429	0.070	0.000
8.0667	0.054	0.435	0.077	0.000
8.1889	0.054	0.442	0.083	0.000
8.3111	0.054	0.448	0.088	0.000
8.4333	0.054	0.455	0.093	0.000
8.5556	0.054	0.462	0.097	0.000
8.6778	0.054	0.468	0.101	0.000
8.8000	0.054	0.475	0.104	0.000
8.9222	0.054	0.481	0.108	0.000
9.0444	0.054	0.488	0.111	0.000
9.1667	0.054	0.494	0.114	0.000
9.2889	0.054	0.501	0.118	0.000
9.4111	0.054	0.508	0.121	0.000
9.5333	0.054	0.514	0.124	0.000
9.6556	0.054	0.521	0.126	0.000
9.7778	0.054	0.527	0.129	0.000
9.9000	0.054	0.534	0.132	0.000
10.022	0.054	0.541	0.187	0.000
10.144	0.054	0.547	1.006	0.000
10.267	0.054	0.554	2.263	0.000
10.389	0.054	0.560	3.652	0.000
10.511	0.054	0.567	4.882	0.000
10.633	0.054	0.574	5.739	0.000
10.756	0.054	0.580	6.309	0.000
10.878	0.054	0.587	6.791	0.000
11.000	0.054	0.593	7.240	0.000
11.122	0.054	0.600	7.663	0.000
11.244	0.000	0.000	8.064	0.000

Name : Bypass
Bypass: Yes

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
Pervious Total	0
<u>Impervious Land Use</u>	<u>acre</u>
ROADS MOD	0.03
Impervious Total	0.03
Basin Total	0.03

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1

Total Pervious Area:1.5

Total Impervious Area:0

Mitigated Landuse Totals for POC #1

Total Pervious Area:0.55

Total Impervious Area:0.95

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.054106
5 year	0.085615
10 year	0.11049
25 year	0.146736
50 year	0.177403
100 year	0.211357

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.033972
5 year	0.045933
10 year	0.055219
25 year	0.068618
50 year	0.079893
100 year	0.092351

Stream Protection Duration

Annual Peaks for Predeveloped and Mitigated. POC #1

<u>Year</u>	<u>Predeveloped</u>	<u>Mitigated</u>
1949	0.058	0.030
1950	0.060	0.032
1951	0.051	0.031
1952	0.041	0.032
1953	0.034	0.029
1954	0.205	0.039
1955	0.066	0.036
1956	0.058	0.034
1957	0.078	0.036
1958	0.065	0.051
1959	0.054	0.029
1960	0.050	0.032
1961	0.105	0.063

1962	0.051	0.030
1963	0.085	0.033
1964	0.066	0.027
1965	0.044	0.027
1966	0.026	0.025
1967	0.052	0.045
1968	0.063	0.032
1969	0.192	0.051
1970	0.036	0.028
1971	0.065	0.038
1972	0.042	0.040
1973	0.041	0.030
1974	0.105	0.038
1975	0.040	0.031
1976	0.043	0.031
1977	0.032	0.028
1978	0.037	0.028
1979	0.119	0.039
1980	0.056	0.033
1981	0.037	0.024
1982	0.048	0.036
1983	0.097	0.032
1984	0.049	0.042
1985	0.064	0.037
1986	0.146	0.094
1987	0.067	0.064
1988	0.035	0.030
1989	0.042	0.030
1990	0.047	0.031
1991	0.048	0.029
1992	0.037	0.029
1993	0.034	0.027
1994	0.034	0.033
1995	0.049	0.030
1996	0.090	0.034
1997	0.180	0.138
1998	0.031	0.033
1999	0.040	0.027
2000	0.033	0.051
2001	0.012	0.023
2002	0.046	0.029
2003	0.036	0.026
2004	0.060	0.047
2005	0.042	0.028
2006	0.136	0.047
2007	0.102	0.039
2008	0.124	0.087
2009	0.038	0.032

Stream Protection Duration

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.2051	0.1375
2	0.1918	0.0944

3	0.1796	0.0871
4	0.1464	0.0641
5	0.1362	0.0634
6	0.1241	0.0513
7	0.1192	0.0512
8	0.1055	0.0508
9	0.1047	0.0473
10	0.1021	0.0467
11	0.0967	0.0450
12	0.0905	0.0423
13	0.0854	0.0403
14	0.0778	0.0389
15	0.0671	0.0388
16	0.0660	0.0388
17	0.0660	0.0383
18	0.0654	0.0376
19	0.0651	0.0368
20	0.0644	0.0361
21	0.0633	0.0358
22	0.0603	0.0355
23	0.0597	0.0336
24	0.0582	0.0336
25	0.0579	0.0332
26	0.0558	0.0329
27	0.0537	0.0329
28	0.0520	0.0325
29	0.0512	0.0325
30	0.0509	0.0321
31	0.0496	0.0321
32	0.0495	0.0321
33	0.0492	0.0319
34	0.0484	0.0317
35	0.0480	0.0309
36	0.0470	0.0308
37	0.0457	0.0308
38	0.0437	0.0308
39	0.0428	0.0304
40	0.0422	0.0304
41	0.0420	0.0300
42	0.0419	0.0299
43	0.0414	0.0299
44	0.0410	0.0295
45	0.0403	0.0294
46	0.0401	0.0292
47	0.0378	0.0291
48	0.0375	0.0290
49	0.0370	0.0290
50	0.0369	0.0283
51	0.0362	0.0283
52	0.0358	0.0281
53	0.0348	0.0278
54	0.0340	0.0273
55	0.0338	0.0270
56	0.0336	0.0266
57	0.0331	0.0266

58	0.0320	0.0262
59	0.0307	0.0253
60	0.0256	0.0241
61	0.0121	0.0234

Stream Protection Duration

POC #1

The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0271	15939	3600	22	Pass
0.0286	13488	1712	12	Pass
0.0301	11270	1140	10	Pass
0.0316	9490	922	9	Pass
0.0331	7987	794	9	Pass
0.0346	6746	734	10	Pass
0.0362	5677	694	12	Pass
0.0377	4845	659	13	Pass
0.0392	4143	630	15	Pass
0.0407	3538	617	17	Pass
0.0422	3050	601	19	Pass
0.0438	2639	588	22	Pass
0.0453	2280	575	25	Pass
0.0468	1957	564	28	Pass
0.0483	1679	551	32	Pass
0.0498	1505	541	35	Pass
0.0514	1351	528	39	Pass
0.0529	1218	512	42	Pass
0.0544	1119	501	44	Pass
0.0559	1030	488	47	Pass
0.0574	957	475	49	Pass
0.0589	883	459	51	Pass
0.0605	807	435	53	Pass
0.0620	762	409	53	Pass
0.0635	704	387	54	Pass
0.0650	658	371	56	Pass
0.0665	627	343	54	Pass
0.0681	604	322	53	Pass
0.0696	575	311	54	Pass
0.0711	551	299	54	Pass
0.0726	517	290	56	Pass
0.0741	500	282	56	Pass
0.0757	479	269	56	Pass
0.0772	458	263	57	Pass
0.0787	438	252	57	Pass
0.0802	422	243	57	Pass
0.0817	401	235	58	Pass
0.0832	384	210	54	Pass
0.0848	366	196	53	Pass
0.0863	352	180	51	Pass
0.0878	341	171	50	Pass
0.0893	329	162	49	Pass

0.0908	319	153	47	Pass
0.0924	309	145	46	Pass
0.0939	295	138	46	Pass
0.0954	283	129	45	Pass
0.0969	274	126	45	Pass
0.0984	263	124	47	Pass
0.0999	243	120	49	Pass
0.1015	236	113	47	Pass
0.1030	222	105	47	Pass
0.1045	210	99	47	Pass
0.1060	197	93	47	Pass
0.1075	189	85	44	Pass
0.1091	177	81	45	Pass
0.1106	166	77	46	Pass
0.1121	158	74	46	Pass
0.1136	150	71	47	Pass
0.1151	141	68	48	Pass
0.1167	131	65	49	Pass
0.1182	121	61	50	Pass
0.1197	107	55	51	Pass
0.1212	89	52	58	Pass
0.1227	76	50	65	Pass
0.1242	65	45	69	Pass
0.1258	60	41	68	Pass
0.1273	56	35	62	Pass
0.1288	46	29	63	Pass
0.1303	41	25	60	Pass
0.1318	40	20	50	Pass
0.1334	38	13	34	Pass
0.1349	32	6	18	Pass
0.1364	27	1	3	Pass
0.1379	22	0	0	Pass
0.1394	17	0	0	Pass
0.1410	15	0	0	Pass
0.1425	9	0	0	Pass
0.1440	6	0	0	Pass
0.1455	6	0	0	Pass
0.1470	4	0	0	Pass
0.1485	4	0	0	Pass
0.1501	4	0	0	Pass
0.1516	4	0	0	Pass
0.1531	4	0	0	Pass
0.1546	4	0	0	Pass
0.1561	4	0	0	Pass
0.1577	3	0	0	Pass
0.1592	3	0	0	Pass
0.1607	3	0	0	Pass
0.1622	3	0	0	Pass
0.1637	3	0	0	Pass
0.1653	3	0	0	Pass
0.1668	3	0	0	Pass
0.1683	3	0	0	Pass
0.1698	3	0	0	Pass
0.1713	3	0	0	Pass
0.1728	3	0	0	Pass

0.1744	3	0	0	Pass
0.1759	3	0	0	Pass
0.1774	3	0	0	Pass

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	Total Volume	Volume	Infiltration	Cumulative
Percent	Water Quality	Percent	Through	Volume	Volume
Volume	Water Quality	Needs	Facility	(ac-ft.)	Infiltration
Infiltrated	Treated	Treatment	(ac-ft)	(ac-ft)	Credit
Vault 1 POC		N	200.06		N
0.00					
Total Volume Infiltrated			200.06	0.00	0.00
0.00	0.00	0%	No Treat.		Credit
Compliance with LID Standard 8					
Duration Analysis Result = Failed					

PerlnD and ImplnD Changes

No changes have been made.

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GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Pasture, Flat	.12
Pervious Total	0.12
<u>Impervious Land Use</u>	<u>acre</u>
ROADS FLAT	0.06
ROOF TOPS FLAT	0.1
DRIVEWAYS FLAT	0.05
SIDEWALKS FLAT	0.01
Impervious Total	0.22
Basin Total	0.34

Element Flows To:		
Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
 Total Pervious Area:0.34
 Total Impervious Area:0

Mitigated Landuse Totals for POC #1
 Total Pervious Area:0.12
 Total Impervious Area:0.22

Flow Frequency Return Periods for Predeveloped. POC #1	
<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.011424
5 year	0.017525
10 year	0.02223
25 year	0.028962
50 year	0.034568
100 year	0.0407

Flow Frequency Return Periods for Mitigated. POC #1	
<u>Return Period</u>	<u>Flow(cfs)</u>

2 year	0.120448
5 year	0.165222
10 year	0.198996
25 year	0.246639
50 year	0.285923
100 year	0.328618

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 BMP Flow and Volume for POC #1

On-line facility volume: 0.0292 acre-feet

On-line facility target flow: 0.0408 cfs.

Adjusted for 15 min: 0.0408 cfs. WQDFR

Off-line facility target flow: 0.0231 cfs.

Adjusted for 15 min: 0.0231 cfs.

LID Report

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

PerlnD and ImplnD Changes

No changes have been made.

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WVHM2012
PROJECT REPORT

Project Name: **North Vault Perkfilter 72" Manhole**
Site Name:
Site Address:
City :
Report Date: 9/15/2022
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20
Version Date: 2021/08/18
Version : 4.2.18

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : WQ2
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Forest, Flat	.69
Pervious Total	0.69
<u>Impervious Land Use</u>	<u>acre</u>
Impervious Total	0
Basin Total	0.69

Element Flows To:		
Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : WQ2
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Pasture, Flat	.2
Pervious Total	0.2
<u>Impervious Land Use</u>	<u>acre</u>
ROADS FLAT	0.13
ROOF TOPS FLAT	0.23
DRIVEWAYS FLAT	0.11
SIDEWALKS FLAT	0.02
Impervious Total	0.49
Basin Total	0.69

Element Flows To:		
Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
 Total Pervious Area:0.69
 Total Impervious Area:0

Mitigated Landuse Totals for POC #1
 Total Pervious Area:0.2
 Total Impervious Area:0.49

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.023184
5 year	0.035565
10 year	0.045114
25 year	0.058776
50 year	0.070153
100 year	0.082597

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
----------------------	------------------

2 year	0.267519
5 year	0.364676
10 year	0.436136
25 year	0.534878
50 year	0.614799
100 year	0.700366

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 BMP Flow and Volume for POC #1

On-line facility volume: 0.0627 acre-feet

On-line facility target flow: 0.0917 cfs.

Adjusted for 15 min: 0.0917 cfs. WQDFR

Off-line facility target flow: 0.0519 cfs.

Adjusted for 15 min: 0.0519 cfs.

LID Report

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

PerlnD and ImplnD Changes

No changes have been made.

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WVHM2012
PROJECT REPORT

Project Name: South Vault Perkfilter 60" Manhole
Site Name:
Site Address:
City :
Report Date: 9/6/2022
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20
Version Date: 2021/08/18
Version : 4.2.18

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : South Basin
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Forest, Flat	.39
C, Forest, Mod	1.11

Pervious Total 1.5

<u>Impervious Land Use</u>	<u>acre</u>
Impervious Total	0

Basin Total 1.5

Element Flows To:			
Surface	Interflow	Groundwater	

MITIGATED LAND USE

Name : South Basin
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Pasture, Flat	.55
Pervious Total	0.55
<u>Impervious Land Use</u>	<u>acre</u>
ROADS FLAT	0.25
ROADS MOD	0.05
ROOF TOPS FLAT	0.38
DRIVEWAYS FLAT	0.17
SIDEWALKS FLAT	0.07
Impervious Total	0.92
Basin Total	1.47

Element Flows To:	Interflow	Groundwater
Surface		
Vault 1	Vault 1	

Name : Vault 1
Width : 49 ft.
Length : 48 ft.
Depth : 11 ft.
Discharge Structure
Riser Height: 10 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.625 in. **Elevation**: 0 ft.
Orifice 2 Diameter: 1.3437 in. **Elevation**: 7.25 ft.
Orifice 3 Diameter: 0.71875 in. **Elevation**: 8.02 ft.

Element Flows To:	
Outlet 1	Outlet 2

Name : Bypass
Bypass: Yes

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
Pervious Total	0
<u>Impervious Land Use</u>	<u>acre</u>
ROADS MOD	0.03

Impervious Total 0.03

Basin Total 0.03

Element Flows To:

Surface	Interflow	Groundwater
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ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1

Total Pervious Area:1.5

Total Impervious Area:0

Mitigated Landuse Totals for POC #1

Total Pervious Area:0.55

Total Impervious Area:0.95

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.054106
5 year	0.085615
10 year	0.11049
25 year	0.146736
50 year	0.177403
100 year	0.211357

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.033972 WQDFR
5 year	0.045933
10 year	0.055219
25 year	0.068618
50 year	0.079893
100 year	0.092351

SECTION 5: CONVEYANCE DESIGN

Conveyance analysis and design will be included in the construction drainage report to be submitted at a later date.

SECTION 6: OPERATIONS AND MAINTENANCE MANUAL

The proposed storm drainage system consists of buried pipes, catch basins, detention vaults, a Perfilter vault and a Perfilter catch basin structure. These facilities will require periodic maintenance and inspection. Inspection and maintenance procedures are contained on the following pages.

NO. 5 – CATCH BASINS AND MANHOLES			
Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds 1/3 the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		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 catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and is structurally sound.
		Cracks wider than ½ 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.	No cracks more than 1/4 inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.
Trash and debris		Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
Damaged		Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 5 – CATCH BASINS AND MANHOLES			
Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $\frac{7}{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate. Any open structure requires urgent maintenance.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. Any open structure requires urgent maintenance.	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 6 – CONVEYANCE PIPES AND DITCHES			
Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.

SECTION 7: SPECIAL REPORTS AND STUDIES

The following studies were conducted in preparation of this Report:

- Geotechnical Investigation, Cobalt Geosciences, November 16, 2021