Preliminary Drainage Report

for

Rosewood Court

Prepared for

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Prepared by

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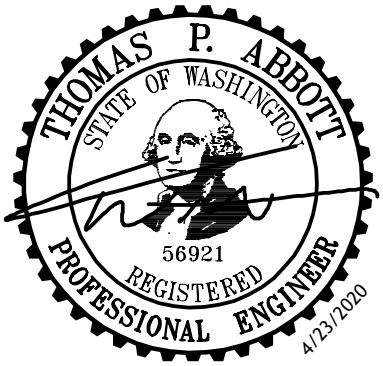

April 2020
Job No: C19-104

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1.0 PROJECT OVERVIEW

The Rosewood Court project includes parcels #1246700090, #1246700100 and #1246700080 and is addressed at 10428/10612 134th Ave NE, Redmond, WA within the North Rose Hill neighborhood. The project site is located within the southeast quarter of the southwest quarter of Section 34, Township 26 N, Range 5 E, W.M. See the Vicinity Map, Figure 1, for the exact location of the site.

The site covers three parcels totaling approximately 10.53 acres. See Figure 2.0 for additional overview information and areas. The on-site area includes approximately 8.71 acres which will be disturbed during development, and 1.82 acres that will not be disturbed which includes steep slopes, wetland buffer area, and area within PSE and Olympic Gas Pipeline easements. The project proposes to construct 51 single-family lots with associated infrastructure, submitted under City of Redmond code and vested to the 2019 Stormwater Technical Notebook and the 2014 DOE Manual.

According to the Geotechnical Report provided by Terra & Associates, the site is underlain with medium dense to dense silty sands with gravel (Till soils). The site has an overall relief of 15 feet. Along the northerly property boundary there are steep slopes. Section 3.4.2 of the Geotechnical Report discusses the steep slopes and recommends a buffer of 10 feet with a 15-foot building setback. Additionally, Section 4.3 of the Geotechnical Report discusses slope stability of the onsite steep slopes along the eastern property boundary and off-site steep slopes east of the site. According to the Report, "site stormwater can be discharged at the top of the offsite steep slopes." Please refer to Section 6.0 for detailed soil information and report by Terra & Associates.

Runoff currently exits the site via overland flow across the eastern property boundary within two threshold discharge basins, refer to Section 3.0 for further description of onsite TDAs. Flows continue easterly down a steep grade where they enter the City of Redmond storm drainage network in the Willows Creek Corporate Center office complex at the base of the slope. Flows eventually reach the Sammamish River. Per King County I-map due diligence research, drainage complaints have been filed for two parcels in the vicinity of the site. The parcels associated with these complaints all lie generally upstream of the site and will not be affected by proposed development activities or resulting changes in post-development hydrology. For a visual depiction of drainage complaints in the vicinity of the site, refer to Appendix 3-D.

According to City of Redmond Erosion Hazard Area Map (see Appendix E), Landslide Hazard Area Map (see Appendix F), Stream Classification Map (see Appendix G), and Wetland Map (see Appendix H) the

project site fall withing some hazard and critical areas. The northeastern border of the site is located within an erosion hazard area and landslide hazard area. There are steep slope areas on the southeast region of the site. The geotechnical engineer has reviewed these areas and has provided analysis and recommendations in their report. Per the critical areas report, there is a class IV stream leading up to a Category III wetland. The class IV stream has been proposed a 25' buffer along with an 80' buffer that is proposed to be reduced to 60'.

Flow control will be achieved by means of a single public Combined Detention/Wetvault located at the eastern end of the site and will split flows to both TDA discharge points via a flow splitter. The proposed public Combined Detention/Wetvault will comply with flow control requirements found in the City of Redmond 2019 Stormwater Management Technical Notebook and the 2014 DOE Manual. Water quality will be achieved through the use of dead storage within the Combined Detention/Wetvault facility. For more detail refer to Section 4 of this Report.

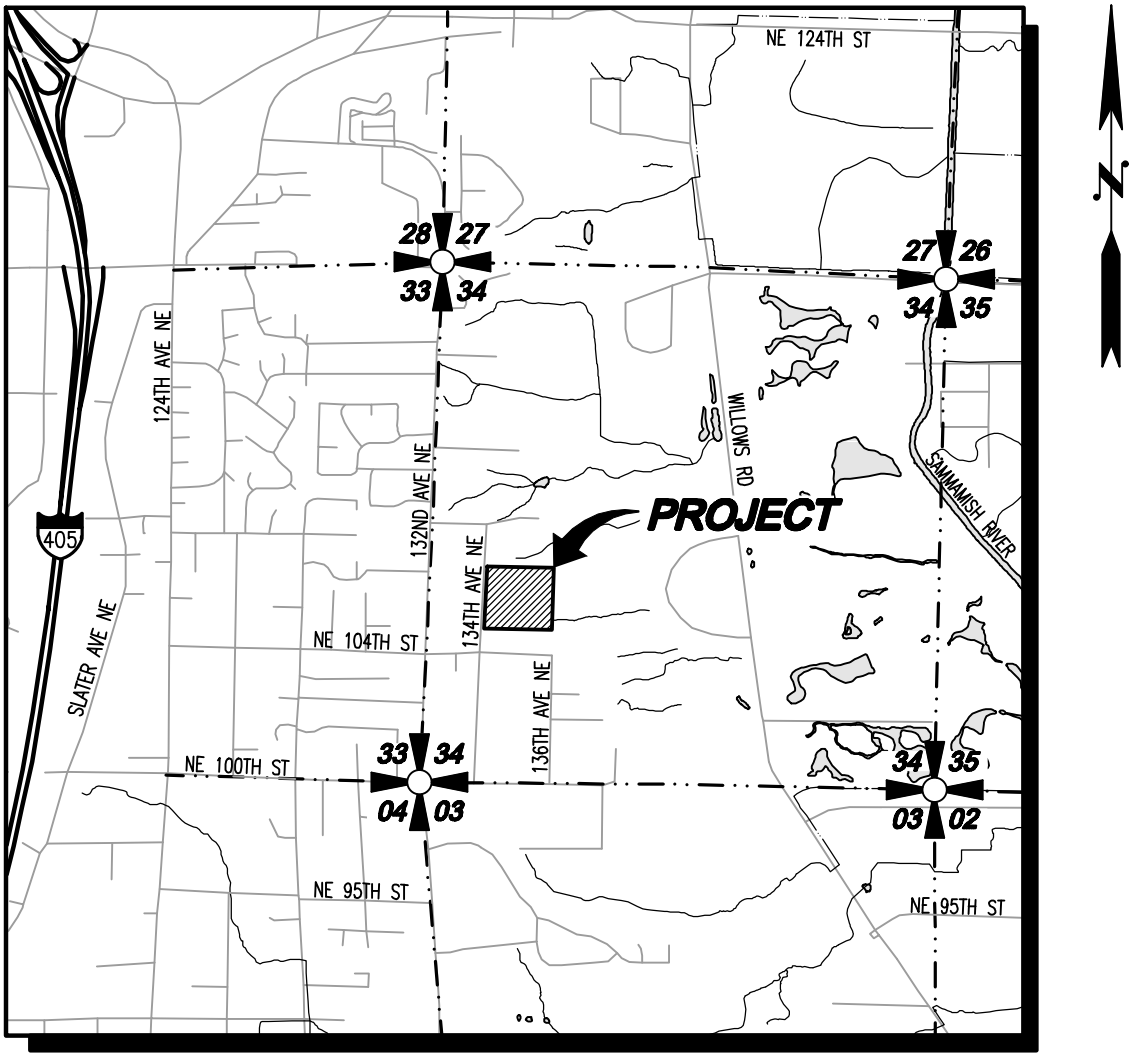
Per Redmond Municipal Code Section 13.20, neighborhood areas are subject to sub-basin specific capital facilities charges. These funds are collected and used to pay for design, property acquisition, and construction of stormwater facilities as identified in the City's Regional Stormwater Facilities Plan. The Citywide stormwater capital facilities charge, as identified in RMC 13.20.040, is required for all parcel-based development projects and are subject to a charge of $1,342 per impervious unit as of July 7th, 2018. Additionally, there is an extra fee if the project falls within either of the Citywide sub-basins: Overlake and Downtown. Rosewood Court does not fall within either the Overlake nor Downtown sub-basins and therefore is only required to pay the minimum fee of $1,342 per impervious unit. The Rosewood Court development proposes 51 impervious units. Per RMC 13.20.040, calculation of the total project charges equals out to $68,442.

APPENDIX 1-A

FIGURE 1.0 VICINITY MAP

FIGURE 2.0 EXISTING CONDITIONS MAP

FIGURE 3.0 PROPOSED CONDITIONS MAP



VICINITY MAP

SCALE: 1"=2000'

Drawing: P:\Civil\2019\C19-104 LWSD Redmond\Drawings\Exhibits\19104E-VM.dwg Plotted: Aug 22, 2019 - 9:07am

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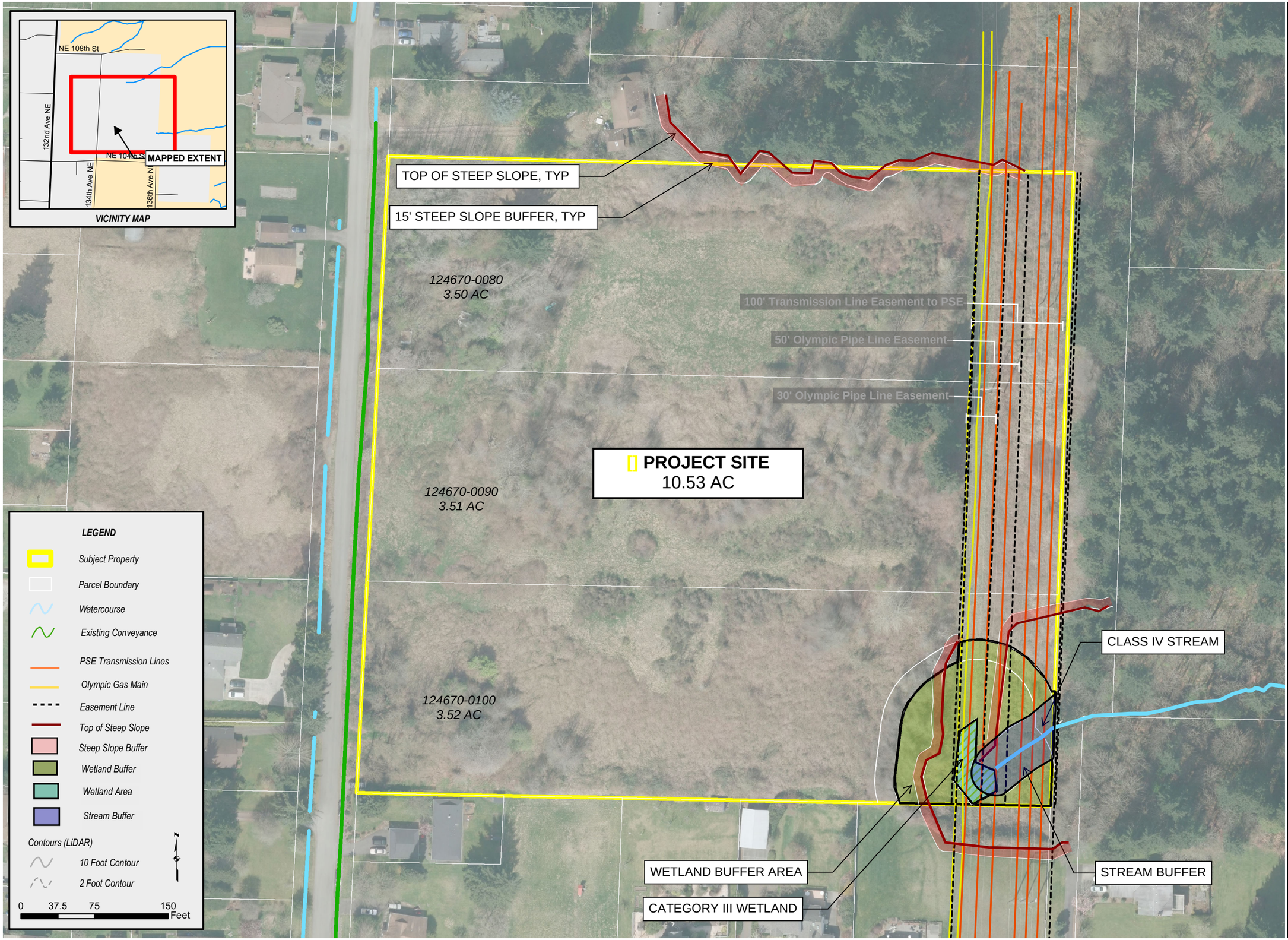
ROSEWOOD COURT

VICINITY MAP



Existing Conditions Map.mxd | MOD: 3/18/2020 | mjurewicz

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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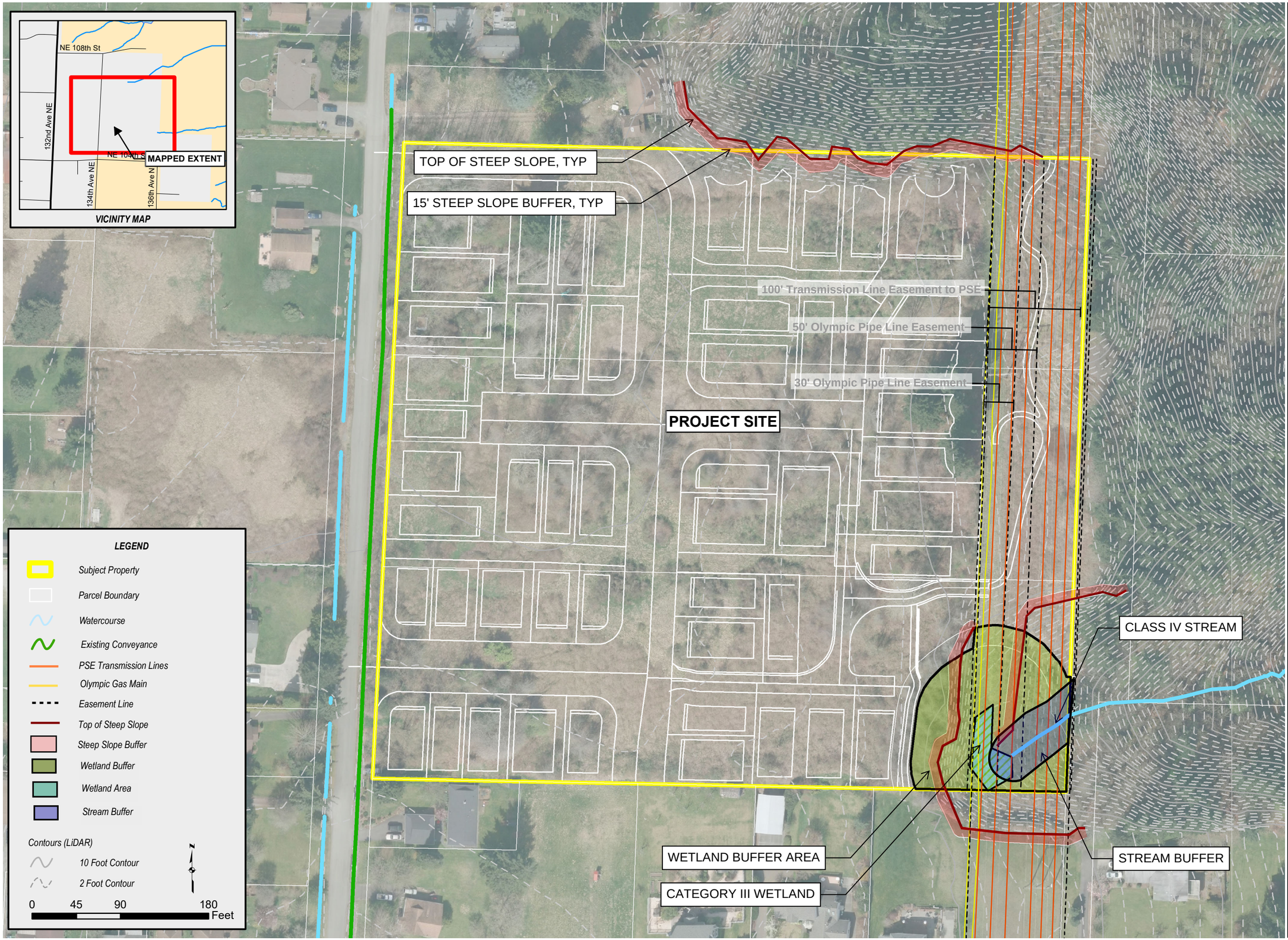
EXISTING CONDITIONS MAP

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601

REVISION:
JOB NUMBER: C19-104
DRAWING NAME: C19-104-2.0
DESIGNER: CDANBY
DRAWING BY: MJUREWICZ
DATE: 3/18/2020
SCALE: AS SHOWN
JURISDICTION: REDMOND

FIGURE:
2.0



Proposed Development Map.mxd | MOD: 4/7/2020 | mjurewicz

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ROSEWOOD COURT
DEVELOPED CONDITIONS MAP

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601

REVISION:
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DRAWING NAME: C19-104-3.0
DESIGNER: CDANBY
DRAWING BY: MJUREWICZ
DATE: 4/7/2020
SCALE: AS SHOWN
JURISDICTION: REDMOND

FIGURE:
3.0

2.0 CONDITIONS AND REQUIREMENTS SUMMARY

This project is vested under the Redmond Municipal Code (RMC), Redmond Zoning Code (RZC), specific zoning code referenced RIN, and the 2019 Redmond Stormwater Technical Notebook. The 2014 Ecology Manual as modified by the Western Washington Phase II Municipal Stormwater Permit regulates issues not addressed by the RMC, RZC and Stormwater Notebook. There is no existing construction on the properties; as such, this project will be considered new development per Section 2.4 of the 2019 City of Redmond Stormwater Technical Notebook, which notes that all single-family developments including the subdivision of property will be classified as such. Figure I-2.4.1 of the 2019 Redmond Stormwater Technical Notebook was utilized to determine the applicability minimum requirements for the project. The project proposes to add more than 10,000 square feet of new impervious surface and more than 5,000 SF of new PGIS, designating the project as "New Development" per Figure I-2.4.1. See copy of Figure I-2.4.1 in Appendix 2-A for the highlighted assumptions of the project designation based on proposed landcover quantities. All minimum requirements apply to the new impervious surfaces and converted pervious surfaces. The minimum requirements are addressed as follows.

Requirement #1: Preparation of Stormwater Site Plans

This drainage report and associated plans contains all information and requirements for Stormwater Site Plans listed in Chapter 3, Volume I of the 2014 Ecology Manual.

Requirement #2: Construction Stormwater Pollution Prevention Plan (SWPPP)

The Construction Stormwater Pollution Prevention Plan will be included as a separate document at a future submittal.

Requirement #3: Source Control of Pollution

Source control BMPs are not required for residential development per the 2014 Ecology Manual.

Requirement #4: Preservation of Natural Drainage System and Outfalls

Natural drainage patterns will be maintained onsite and discharge from the project site will occur in historical patterns across the easterly property line. There are two threshold discharge basins observed that direct flows east. The ravines that begin each of the respective downstream paths will remain hydrated by discharge from the proposed flow splitter device downstream of the detention

vault. The proposed discharge of the site's runoff will not cause significant adverse impact to downstream receiving waters or downgradient properties. Mitigated flows will be released at required rates and durations.

The Technical Notebook references the 2014 SMWWM Section 2.5.4 which states that "if the 100-year peak discharge rate is less than or equal to 0.5 cfs (0.75 cfs using 15 minute time steps) under existing conditions and will remain less than or equal to 0.5 cfs under developed conditions, then concentrated runoff may be discharged to a dispersal trench." And " if the 100-year peak discharge is less than or equal to 0.2 cfs (0.3 cfs using 15 minute time steps) under existing conditions and will remain less than or equal to 0.2 cfs under developed conditions, then the concentrated runoff may be discharged into a rock pad or to any other system that serves to disperse flows." After a flow splitter, mitigated vault flow is discharge to a dispersion trench in the northeast corner at a rate of 0.53 cfs (in the 100-year peak flow) and a point discharge to a bubble up structure in the southeast portion of the site at a rate of 0.30 cfs (in the 100-year peak flow). Refer to Section 4 for further analysis of onsite TDAs.

Requirement #5: On-Site Stormwater Management

See Section 4 of this report for how this minimum requirement is addressed. Onsite stormwater management will include application of soil augmentation per COR Det. 632 on all disturbed area to be landscaped. BMP T5.10C Perforated Stub-out connections shall be proposed and implemented to max extent feasible for lot roof runoff.

Requirement #6: Runoff Treatment

As per Section 2.5.6 of the 2019 City of Redmond Stormwater Management Technical Notebook, "Basic" treatment facilities are required by this project. See Section 4 of this report for how this minimum requirement is addressed. A Combined Detention/Wetvault will be utilized to address basic water quality treatment requirements.

Requirement #7: Flow Control

See Section 4 of this report for how this minimum requirement is addressed. Flow Control requirements will be met for the project with a single Combined Detention/Wetvault that will release flow at required, mitigated rates based an approved continuous runoff model (WWHM 2012). Mitigated rates will be split by a flow splitter downstream of detention that will direct runoff to both

onsite TDA discharge locations. Flow control credits have been awarded per BMP T5.16 Tree Retention and Tree Planting for existing retained and newly proposed site trees. The vault will have compliant setbacks from the wetland buffer and Olympic gas line.

Requirement #8: Wetlands Protection

The critical areas study has revealed a Category III wetland on the easterly portion of the site within the PSE and Olympic easements. The wetland has been provided an 80-foot buffer that has been reduced to 60-feet. The project directs lot pervious, roof, and tract to the onsite wetland for wetland hydration. See Section 4.3 for additional discussion of wetland protection and hydration.

Requirement #9: Operations and Maintenance

A Maintenance and Operations Manual will be created for this project. Please refer to Appendix 10-A in Section 10 for this document.

APPENDIX 2-A

FLOW CHART FOR DETERMINING REQUIREMENTS OF NEW DEVELOPMENTS

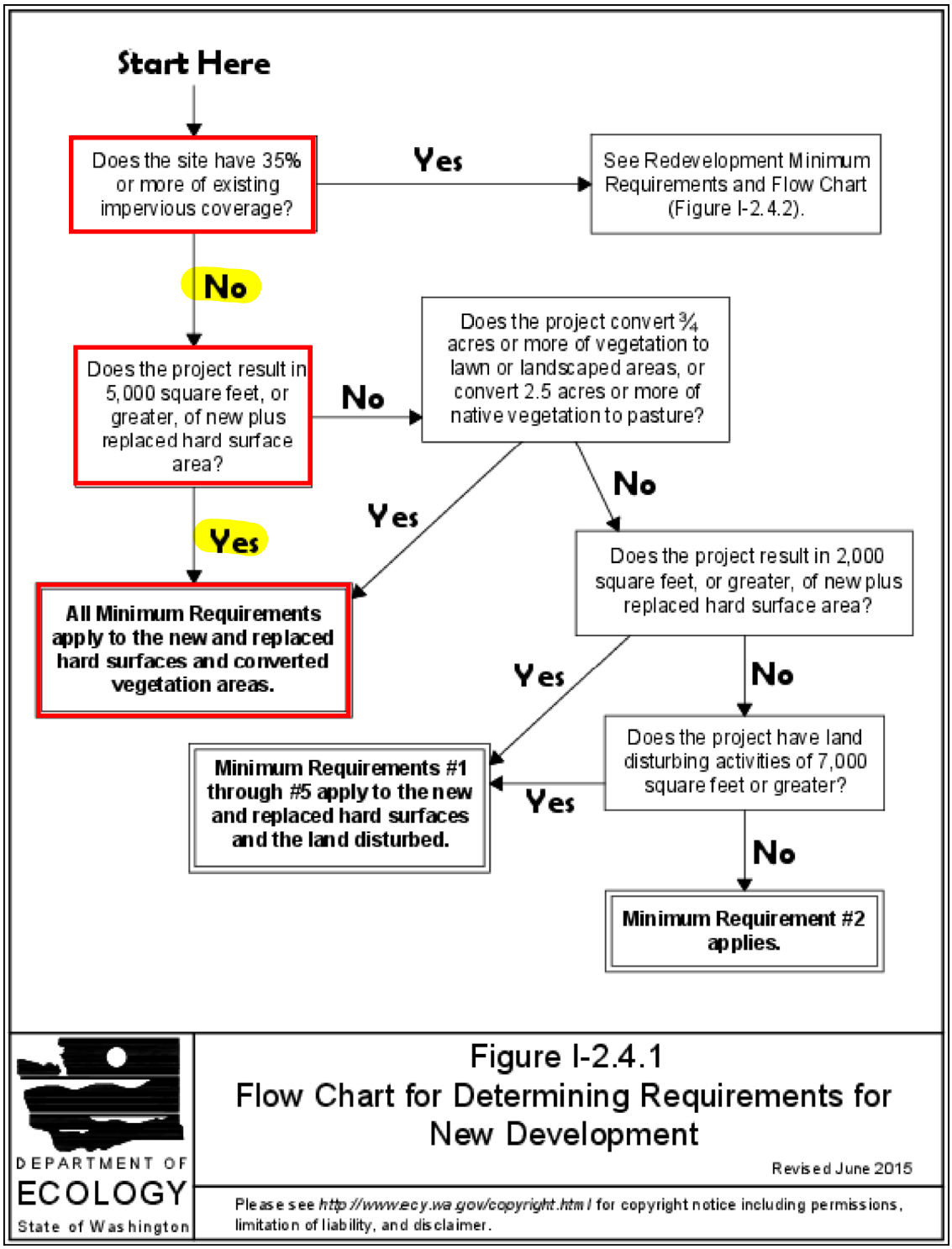


Figure 1 1.2.4.1 Flowchart for Determining Requirements for New Development

3.0 OFF-SITE ANALYSIS

On Monday September 30, 2019, a site visit was made. The weather was dry and approximately 62°F. The ground was damp due to continual rain over the previous days, no overland flow or pooling was observed. Per the City of Redmond due diligence research, two offsite drainage complaints were found adjacent to the site within a 0.25-mile analysis.

3.1 King County LiDAR vs Field Inspection

According to King County LiDAR, there are two onsite threshold discharge areas (TDAs) associated with site runoff. Two flow paths are produced, exiting the site east then entering separate ravines that do not converge within the quarter mile boundary of analysis, creating the North and South TDAs. Additionally, in Appendix 3-C, the City of Redmond's drainage basins indicates that a portion of the site drains south as part of Basin 60. Refer to Figure 4-A for Downstream analysis map.

Through onsite inspection, it has been determined that site area does <u>not</u> drain south along 134th Ave NE. Existing site grades slope runoff easterly and away from 134th Ave NE. Microtopography along the southern property boundary does not indicate onsite runoff exits the southern property line but rather is directed east and follows Flowpath #2, discharging to the South TDA. Through several onsite visits to confirm, it has been determined that the site contains only two TDAs. The project has been designed to reflect this observation. Refer to the onsite analysis imagery 1a and 1b in Appendix 3-A to support assessments.

3.2 Upstream Analysis

From the site inspection, portions of 134th Ave NE frontage area flows onto the site and is directed east. Approximately 0.46 AC (20,037 square feet) of existing 134th Ave NE ROW runoff is directed towards the site. Areas include a mixture of existing pavement and lawn area. There are 3 primary upstream flow paths onsite (Upstream Flowpath 1A, 2A, and 2B) that site eventually converge onsite with the downstream flow paths 1 and 2. Refer to Section 3.3 Downstream Analysis for the flow path description and Figure 4-B in Appendix 3-A for upstream areas and flow direction.

3.3 Downstream Analysis

Refer to Appendix 3-A for Figure 4.0A Downstream Analysis Map which show with location of image markers (e.g. ⑤) and site visit photos. Per Section 2.6 of the 2019 Stormwater Technical Notebook, the minimum length of initial qualitative analysis shall extend up to a mile offsite or to the receiving water body, whichever is less. The downstream flow path enters the Sammamish River at the one-mile boundary of analysis.

Flow path #1 (North Ravine):

Onsite stormwater runoff flows generally west to east. On the east side of the property there are two flow paths that carry runoff from the site; one that flows to the northeast and one to the east. Flow path #1 is conveyed to the northeast away from the site via overland flow ①. After approximately 1,400 feet from the property line, Flow Path #1 enters a closed conveyance system② and are conveyed through solid locking lid catch basins and conveyance pipe in the City of Redmond storm drainage network on parcel #9428100060. Flows are then conveyed south across parcels #9428100040 and #9428100030 for approximately 700 feet ③ before being conveyed through the closed storm drainage system to the east after converging with Flow Path #2 ④. Flows then travel through the storm network for approximately 360 feet⑥. Flows then travel to the north for approximately 450 feet ⑦where flows are then conveyed to the east across Willows Road ⑧ and are conveyed east to the Sammamish River ⑨ one mile past the project site.

Flow path #2 (South Ravine):

Flow path #2 is conveyed to the east from the southern portion of the eastern property boundary of the site⑩. Flows are conveyed to the east away from the site for roughly 1,400 feet via overland flow down steep slopes. Flows then enter the closed network conveyance system⑪ on parcel #9428100010 where they are then conveyed to the north and then to the east again for approximately 250 feet⑫ before converging with Flow Path #1⑤.

3.4 Drainage Complaints

Two drainage complaints were located within a quarter mile of the site. The complaints were filed on parcel 124670012 and 1246700022. The parcels are located on 134th Ave NE uphill and adjacent to the project site. Parcel 1246700012 reported localized flooding onsite. The complaint was closed on 2/08/1999. Parcel 1246700022 reported onsite drainage problems of sheet flow ponding at low point

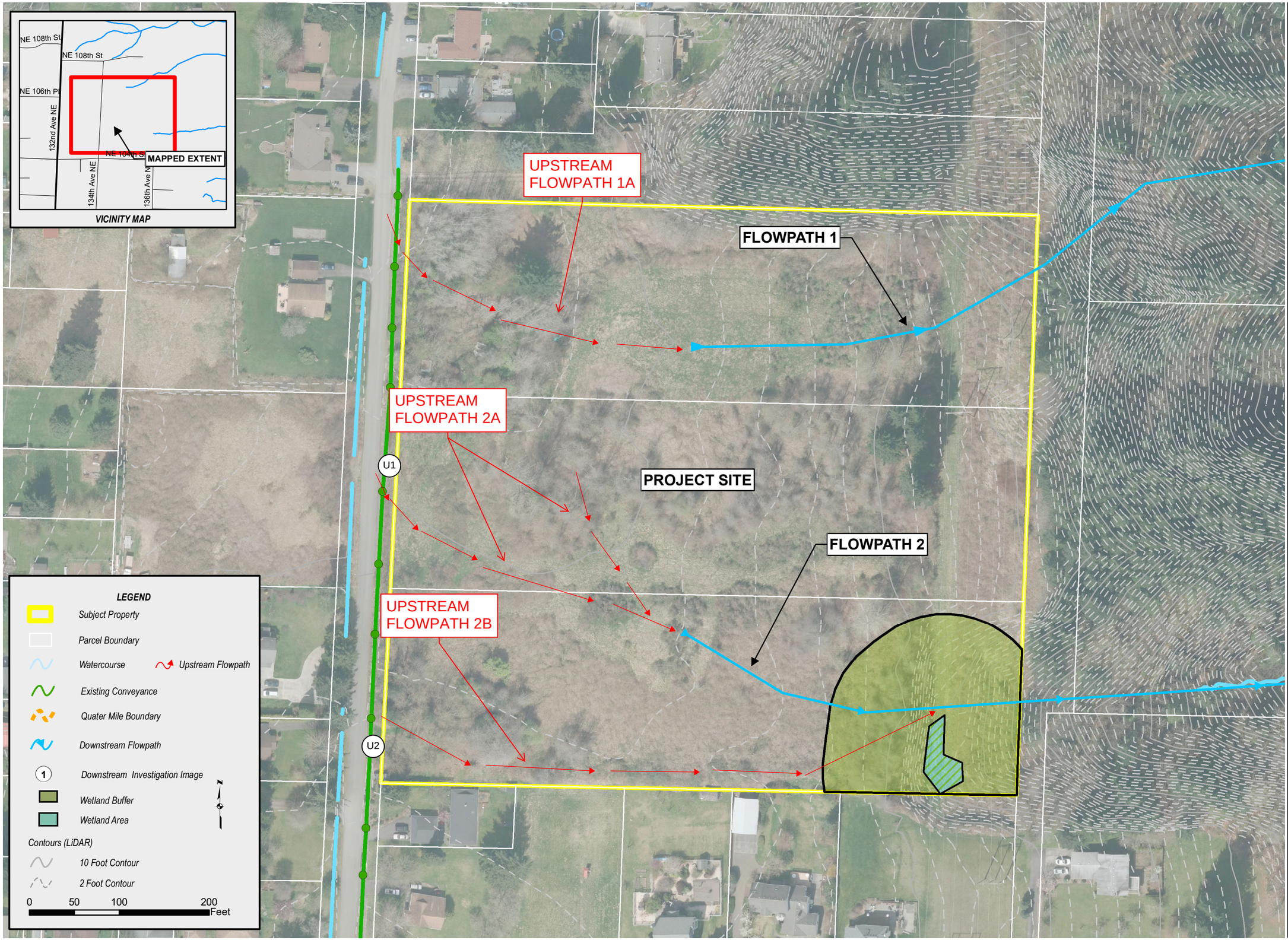
onsite. The complaint was closed 1/21/1999. Neither drainage complaints impact the project site. Refer to Appendix 3-D for documented drainage complaints.

APPENDIX 3-A

FIGURE 4.0A DOWNSTREAM ANALYSIS MAP

FIGURE 4.0B UPSTREAM ANALYSIS MAP

SITE VISIT IMAGERY



Upstream Map.mxd | MOD: 2/4/2020 | mjurewicz

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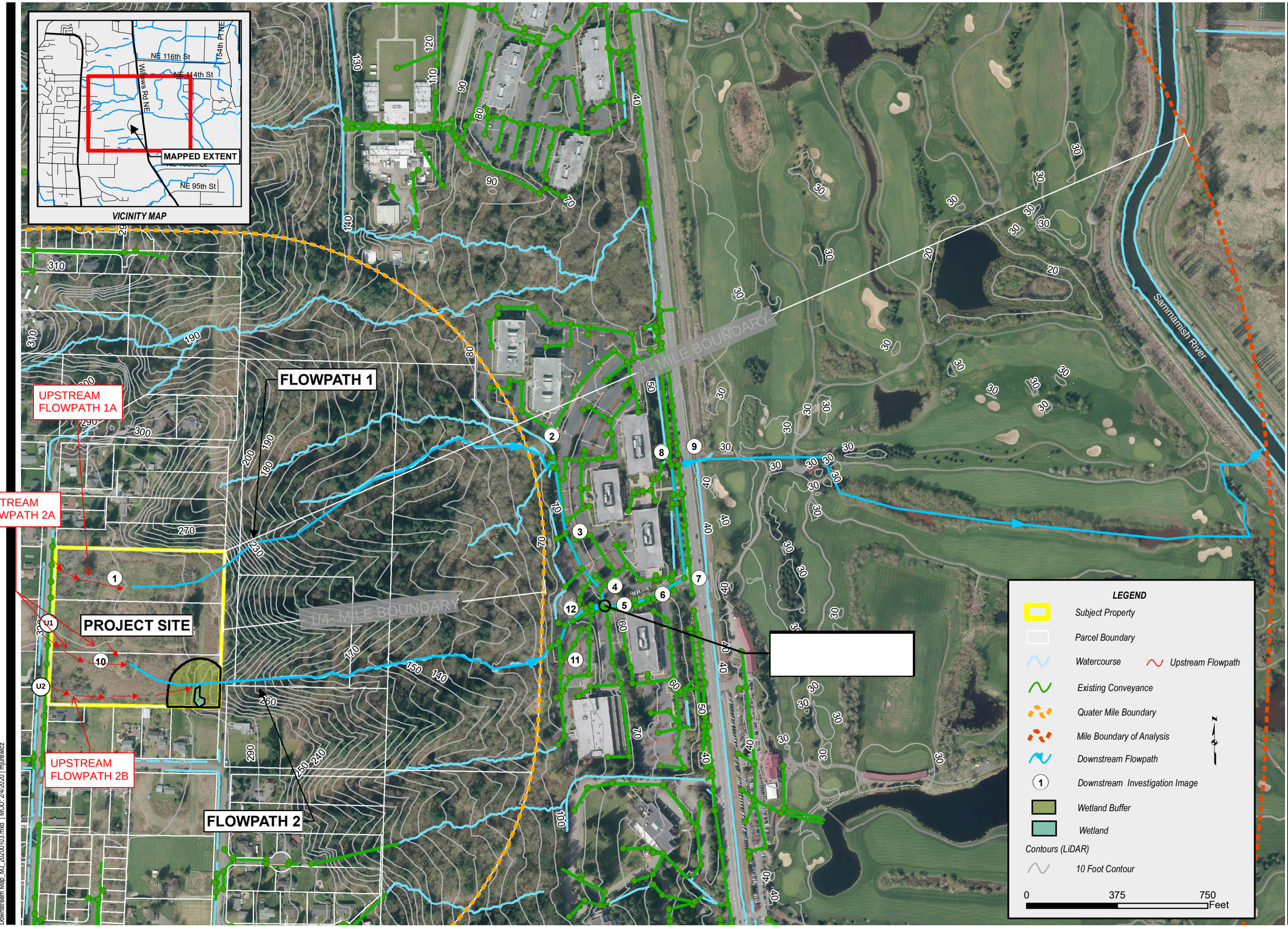
UPSTREAM MAP

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601

REVISION:
JOB NUMBER: C19-104
DRAWING NAME: C19-104-4.0
DESIGNER: CDANBY
DRAWING BY: MJUREWICZ
DATE: 2/4/2020
SCALE: AS SHOWN
JURISDICTION: REDMOND

FIGURE:
4.0B



Downstream Map_MJ_20200103.mxd | MOD: 2/4/2020 | mjurewicz

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ROSEWOOD COURT
DOWNSTREAM MAP

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601

REVISION:
JOB NUMBER: C19-104
DRAWING NAME: C19-104-4.0
DESIGNER: CDANBY
DRAWING BY: MJUREWICZ
DATE: 2/4/2020
SCALE: AS SHOWN
JURISDICTION: REDMOND

FIGURE:
4.0A

Upstream Photos

N

U1. 134th Ave NE flows discharge onsite and existing topography drains runoff away from the frontage

N

U2. Flow shown to not cross southern boundary line and is directed east through microtopography

Downstream Photos

① Facing east from the western property boundary through the brush onsite

② Looking west upstream towards the steep slopes in the direction of the project site where flows enter the closed network system

③ Following flows towards the point of convergence through the parking lot

④ Closed lid catch basin right before the point of convergence where flow path #1 and #2 meet

⑤ Point of convergence between flow path #1 and #2 looking north in the direction of flow path #2

⑥ Flows are headed to the east towards Willows Road

⑦ At this point flow is conveyed to the north, bypassing the nearby detention pond that collects all onsite flows from the business park

⑧ Flows are then conveyed across Willows Road

⑨ After flows cross Willows Road they exit the closed network and are passed through a culvert until out letting towards the Sammamish River.

⑩ Looking northeast from the western property boundary through the brush onsite

⑪ Facing west towards the steep slopes in the direction of the project site where flows enter the closed network system

⑫ Facing east in the direction of flow through the closed conveyance system

APPENDIX 3-B

SCS AND USGS SOIL SURVEY MAPPING

Map Scale: 1:1,760 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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: King County Area, Washington
Survey Area Data: Version 14, Sep 10, 2018

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

Date(s) aerial images were photographed: Aug 31, 2013—Oct 6, 2013

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
AgB	Alderwood gravelly sandy loam, 0 to 8 percent slopes	7.8	71.2%
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	2.7	24.6%
AgD	Alderwood gravelly sandy loam, 15 to 30 percent slopes	0.5	4.3%
Totals for Area of Interest		**11.0**	**100.0%**

King County Area, Washington

AgB—Alderwood gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t625
Elevation: 50 to 800 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Alderwood and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alderwood

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Glacial drift and/or glacial outwash over dense glaciomarine deposits

Typical profile

A - 0 to 7 inches: gravelly sandy loam
Bw1 - 7 to 21 inches: very gravelly sandy loam
Bw2 - 21 to 30 inches: very gravelly sandy loam
Bg - 30 to 35 inches: very gravelly sandy loam
2Cd1 - 35 to 43 inches: very gravelly sandy loam
2Cd2 - 43 to 59 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B

Forage suitability group: Limited Depth Soils (G002XS301WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Minor Components

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

Mckenna
Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Shalcar
Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Norma
Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 14, Sep 10, 2018

King County Area, Washington

AgC—Alderwood gravelly sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2t626
Elevation: 50 to 800 feet
Mean annual precipitation: 20 to 60 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Alderwood and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alderwood

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Glacial drift and/or glacial outwash over dense glaciomarine deposits

Typical profile

A - 0 to 7 inches: gravelly sandy loam
Bw1 - 7 to 21 inches: very gravelly sandy loam
Bw2 - 21 to 30 inches: very gravelly sandy loam
Bg - 30 to 35 inches: very gravelly sandy loam
2Cd1 - 35 to 43 inches: very gravelly sandy loam
2Cd2 - 43 to 59 inches: very gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XS301WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Minor Components

Everett
Percent of map unit: 5 percent
Landform: Kames, eskers, moraines
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Crest, base slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

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

Shalcar
Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Norma
Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 14, Sep 10, 2018

King County Area, Washington

AgD—Alderwood gravelly sandy loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2t627
Elevation: 0 to 1,000 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Alderwood and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alderwood

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, nose slope, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Glacial drift and/or glacial outwash over dense glaciomarine deposits

Typical profile

A - 0 to 7 inches: gravelly sandy loam
Bw1 - 7 to 21 inches: very gravelly sandy loam
Bw2 - 21 to 30 inches: very gravelly sandy loam
Bg - 30 to 35 inches: very gravelly sandy loam
2Cd1 - 35 to 43 inches: very gravelly sandy loam
2Cd2 - 43 to 59 inches: very gravelly sandy loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XS301WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Minor Components

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

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

Shalcar
Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

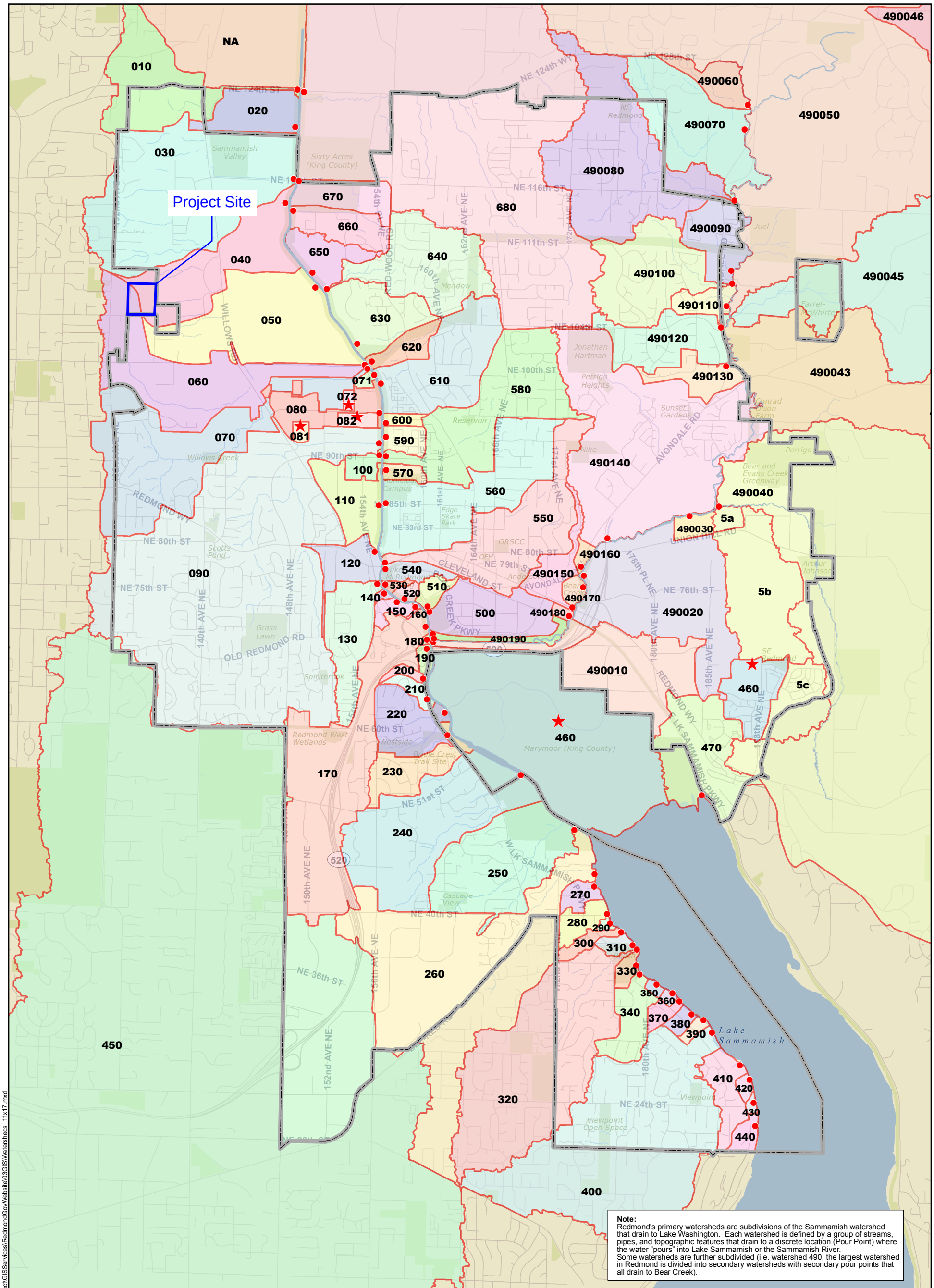
Norma
Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 14, Sep 10, 2018

APPENDIX 3-C

REDMOND WATERSHED MAP



Redmond Watershed Map

City of Redmond, Washington

11/18/2010

0 0.5 1
Miles

N

Pour Points

Denotes Infiltration

Watershed

City Limit

Park and Open Space

Water

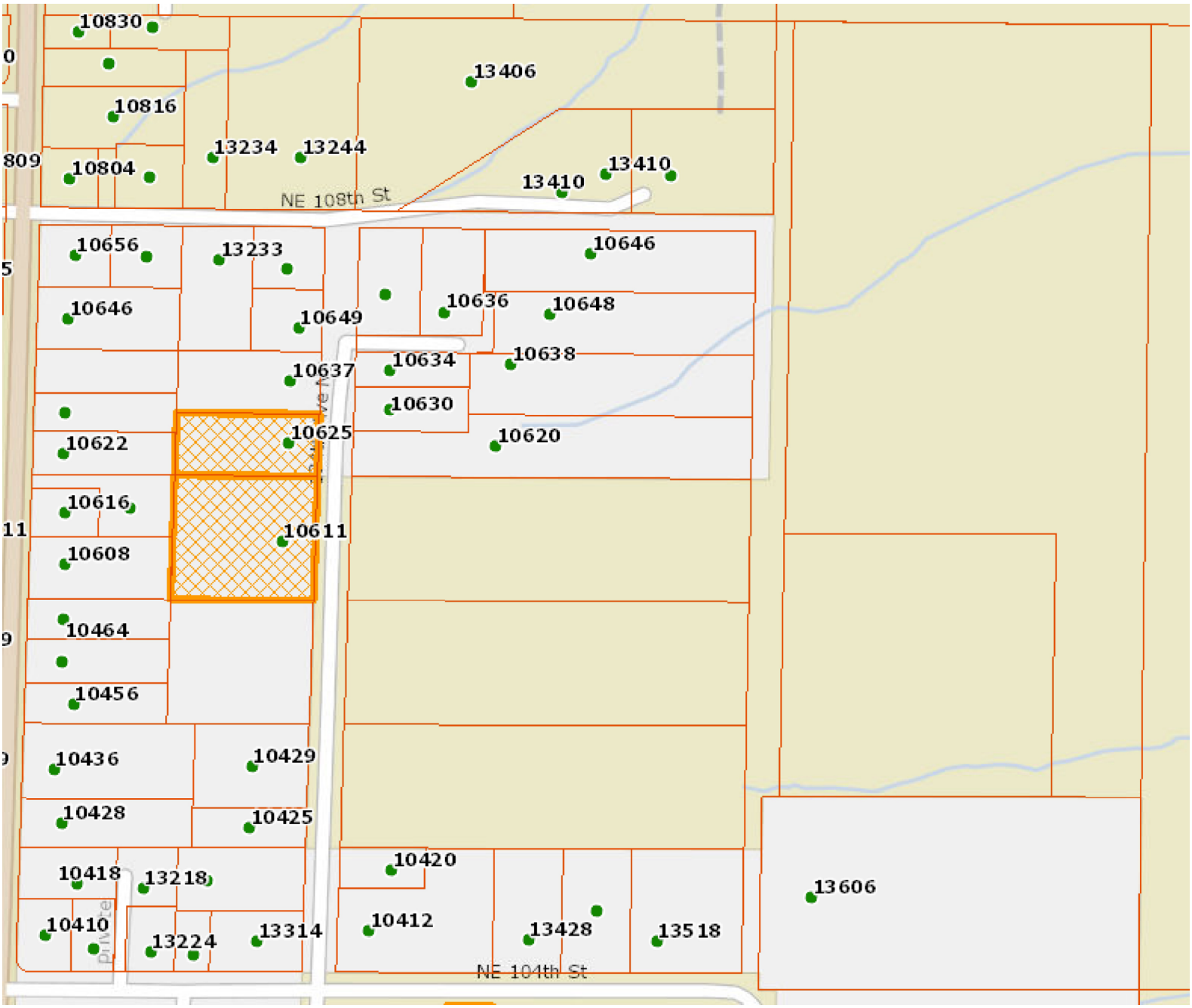
Disclaimer: This map is created and maintained by GIS Services Group,Finance and Information Services, City of Redmond, Washington, for reference purposes only.

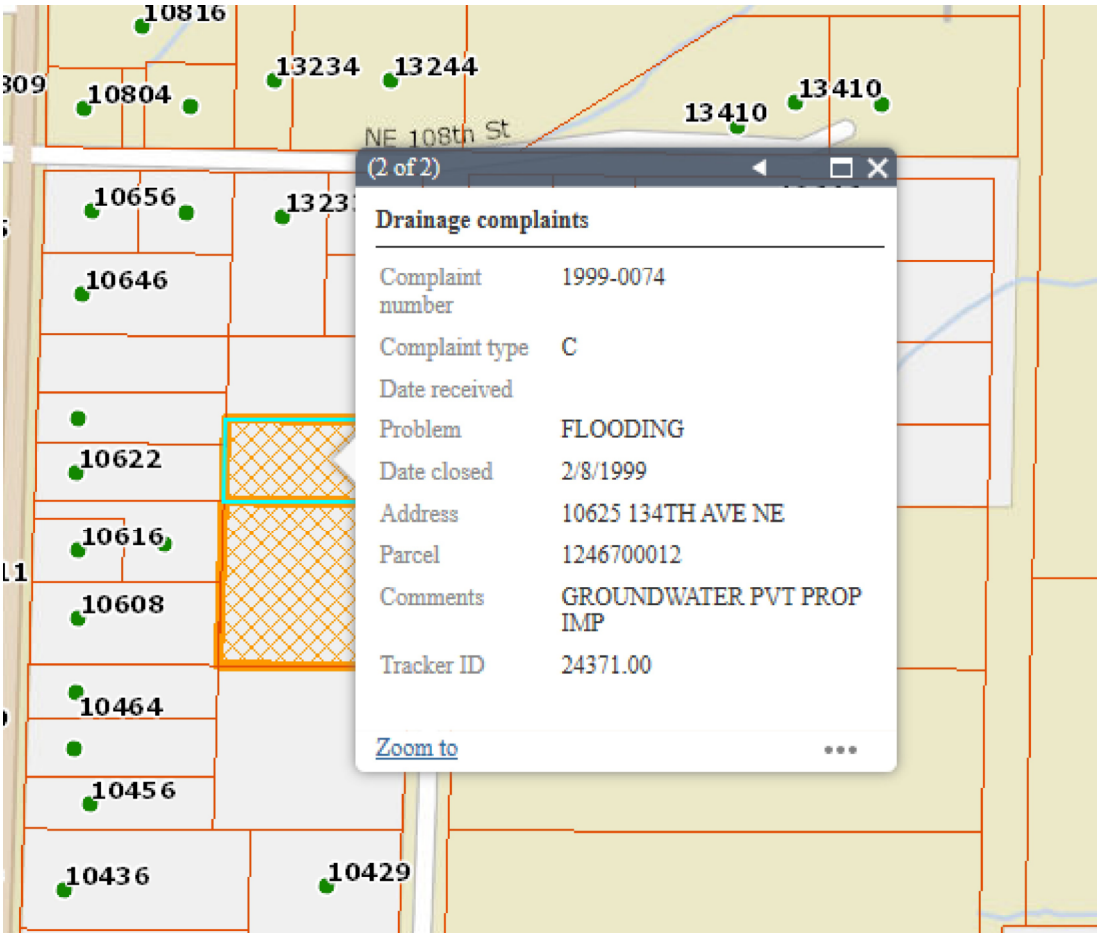
The City makes no guarantee as to the accuracy of the features shown on this map.

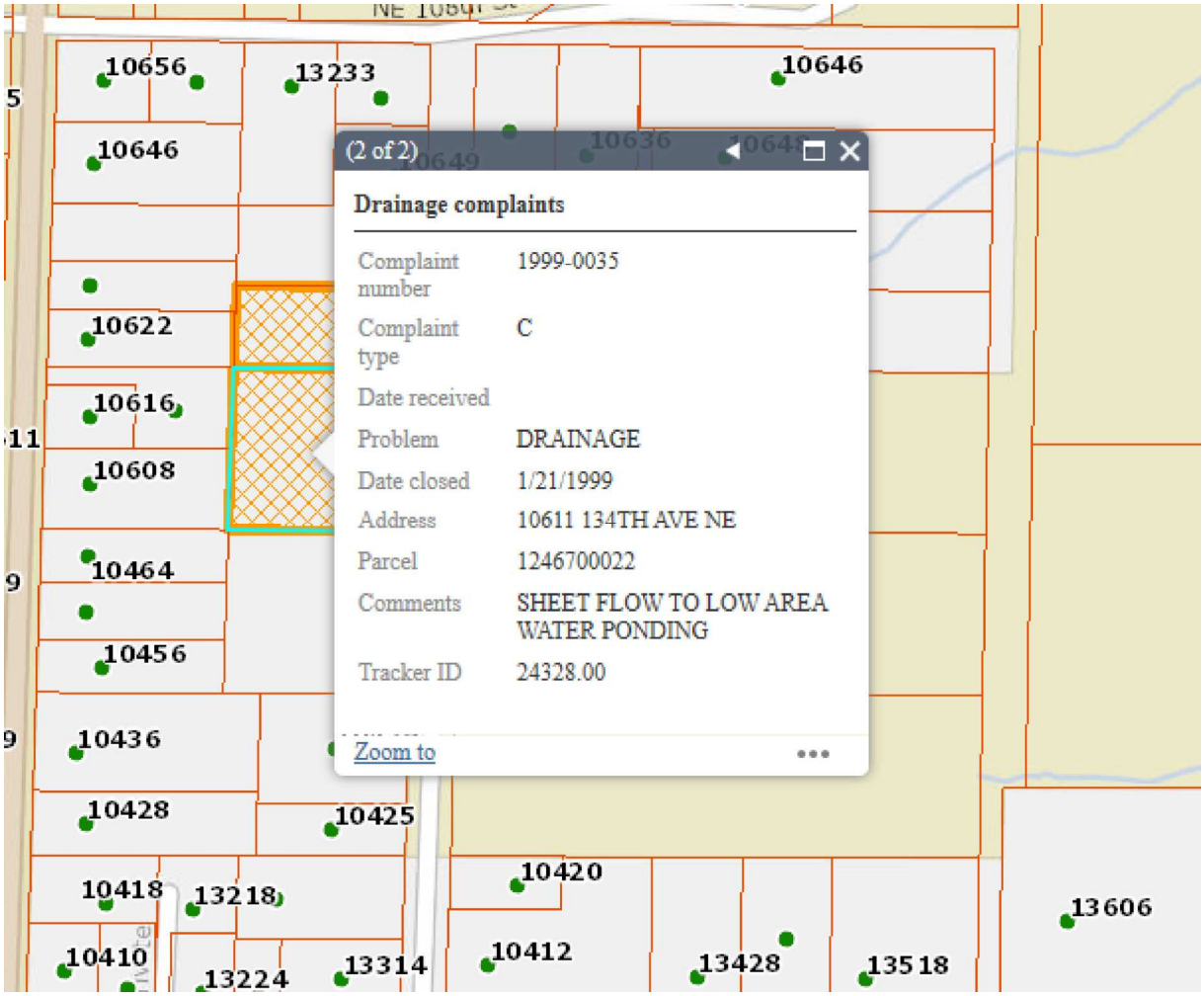
File Name:File Name:\\redmond.man\ts\GISUser\GIS\GISServicesProject\GISServices\RedmondGovWebsite\03GIS\Watersheds_11x17.mxd

APPENDIX 3-D

DRAINAGE COMPLAINTS

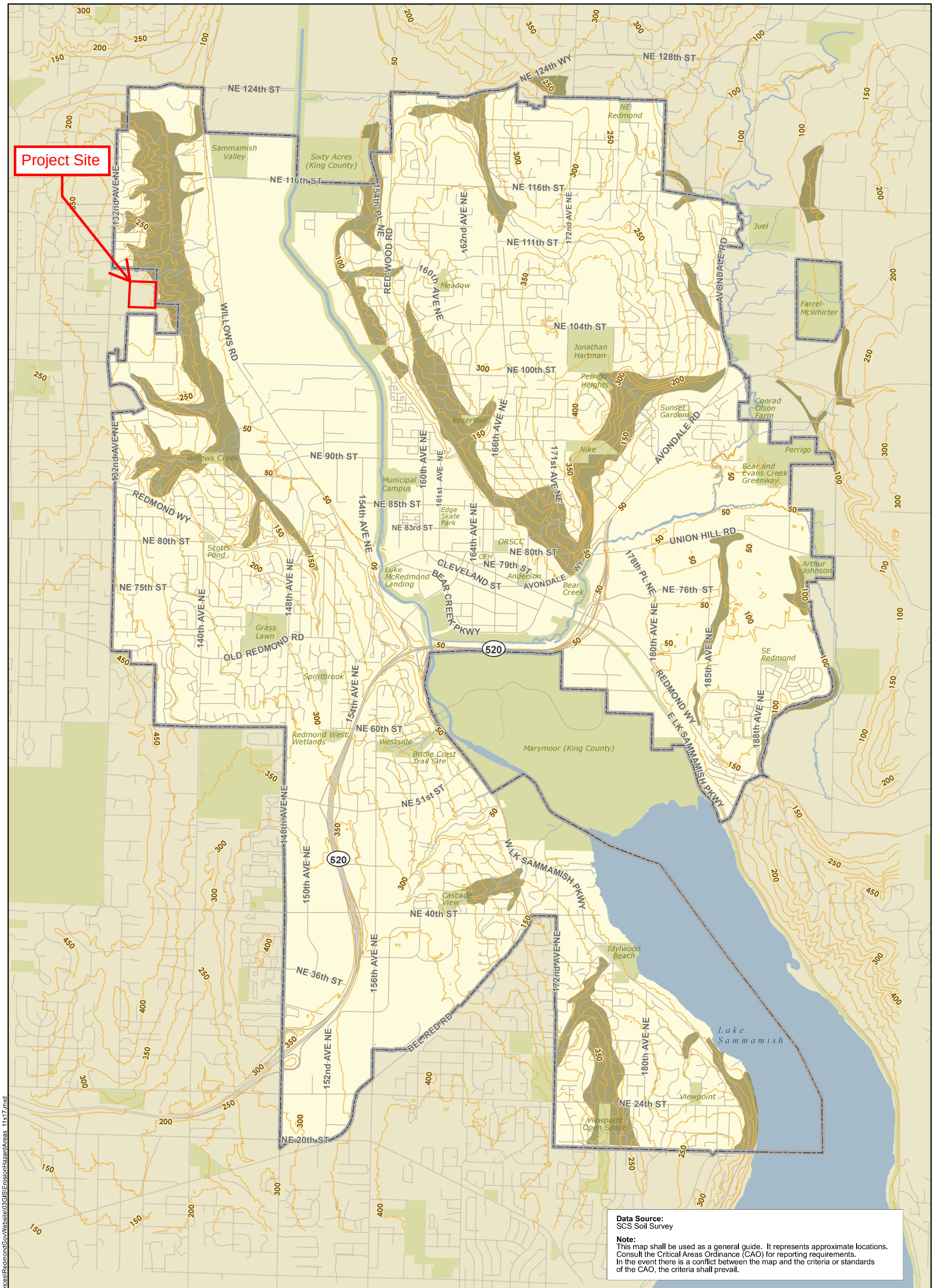

10830
13406
10816
13234
13244
10804
13410
13410
NE 108th St
10656
13233
10646
10646
10649
10636
10648
10637
10634
10638
10630
10625
10620
10622
10616
10611
10608
10464
10456
10436
10429
10428
10425
10420
10418
13218
13606
10410
13224
13314
10412
13428
13518
NE 104th St


10816
13234
13244
10804
13410
13410
NE 108th St
(2 of 2)
10656
10646
10622
10616
10608
10464
10456
10436
10429
Drainage complaints
Complaint number 1999-0074
Complaint type C
Date received
Problem FLOODING
Date closed 2/8/1999
Address 10625 134TH AVE NE
Parcel 1246700012
Comments GROUNDWATER PVT PROP IMP
Tracker ID 24371.00
Zoom to


10656
13233
10646
10646
10636
(2 of 2)
Drainage complaints
Complaint number 1999-0035
Complaint type C
Date received
Problem DRAINAGE
Date closed 1/21/1999
Address 10611 134TH AVE NE
Parcel 1246700022
Comments SHEET FLOW TO LOW AREA WATER PONDING
Tracker ID 24328.00
Zoom to
10622
10616
10608
10464
10456
10436
10428
10425
10420
10418
13218
13606
10410
13224
13314
10412
13428
13518

APPENDIX 3-E

EROSION HAZARD AREA MAP



Erosion Hazard Areas

Critical Areas Map

City of Redmond, Washington

Effective: 05/28/2005

0 0.5 1
Miles

N

Contour

Erosion Hazard Area

City Limit

Park and Open Space

Water

Disclaimer: This map is created and maintained by GIS Services Group,Finance and Information Services, City of Redmond, Washington, for reference purposes only.

The City makes no guarantee as to the accuracy of the features shown on this map.

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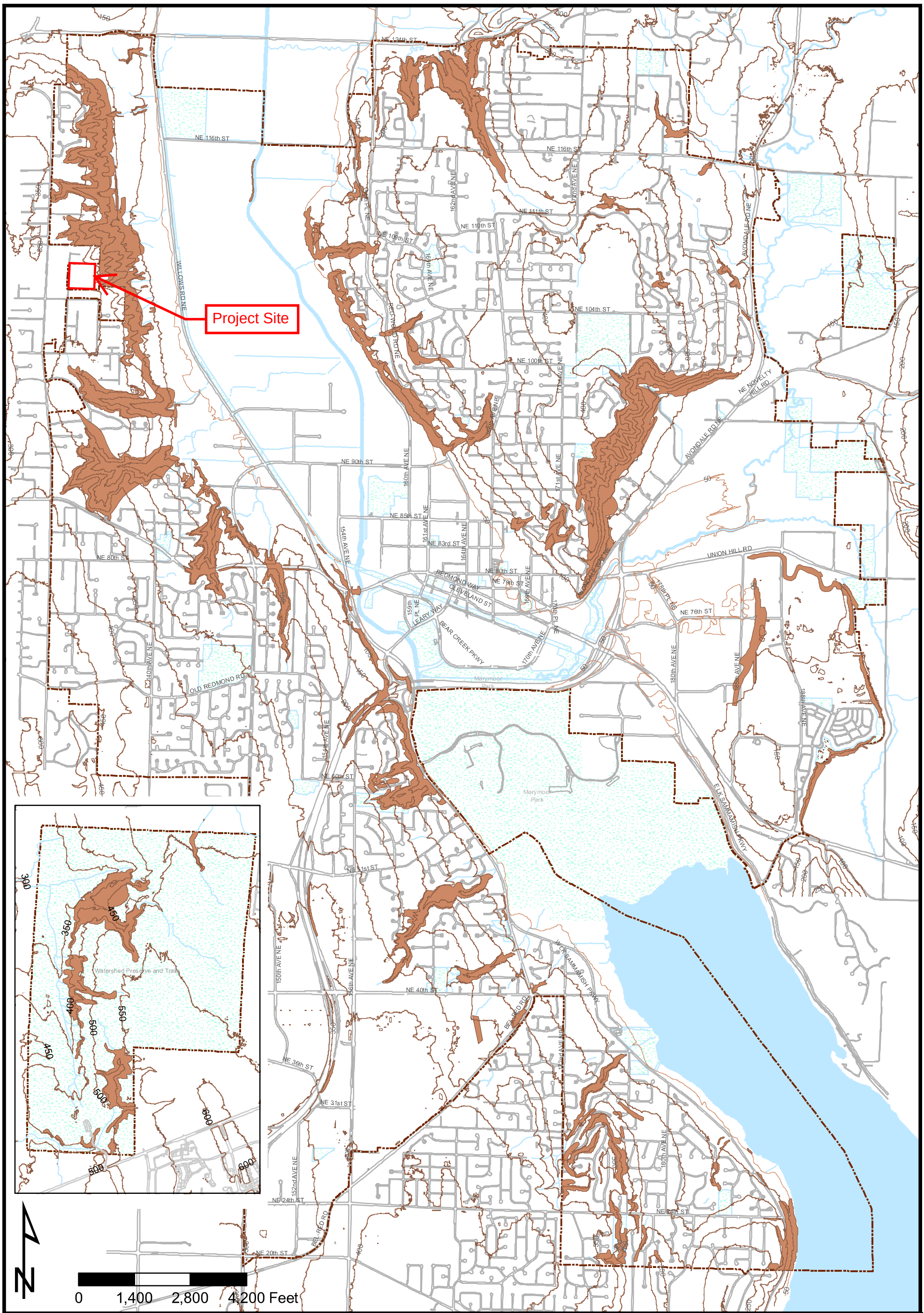
APPENDIX 3-F

LANDSLIDE HAZARD AREA MAP



City of Redmond

Critical Areas Map
Effective: 03/12/2016

Map 64.7 Landslide Hazards

Legend

- Landslide Hazards Areas
- Contours
- Park

Sources:
City of Redmond GIS Services
King County GIS

Note: This map shall be used as a general guide representing the approximate location of steep slopes, per RZC 21.64.060(A)(1)b.vii. The map does not necessarily ensure the presence or absence of landslide hazards. In the event of a conflict between the map and the criteria of the Critical Areas Ordinance (CAO), the criteria shall prevail. Consult the CAO (RZC 21.64) for reporting requirements.

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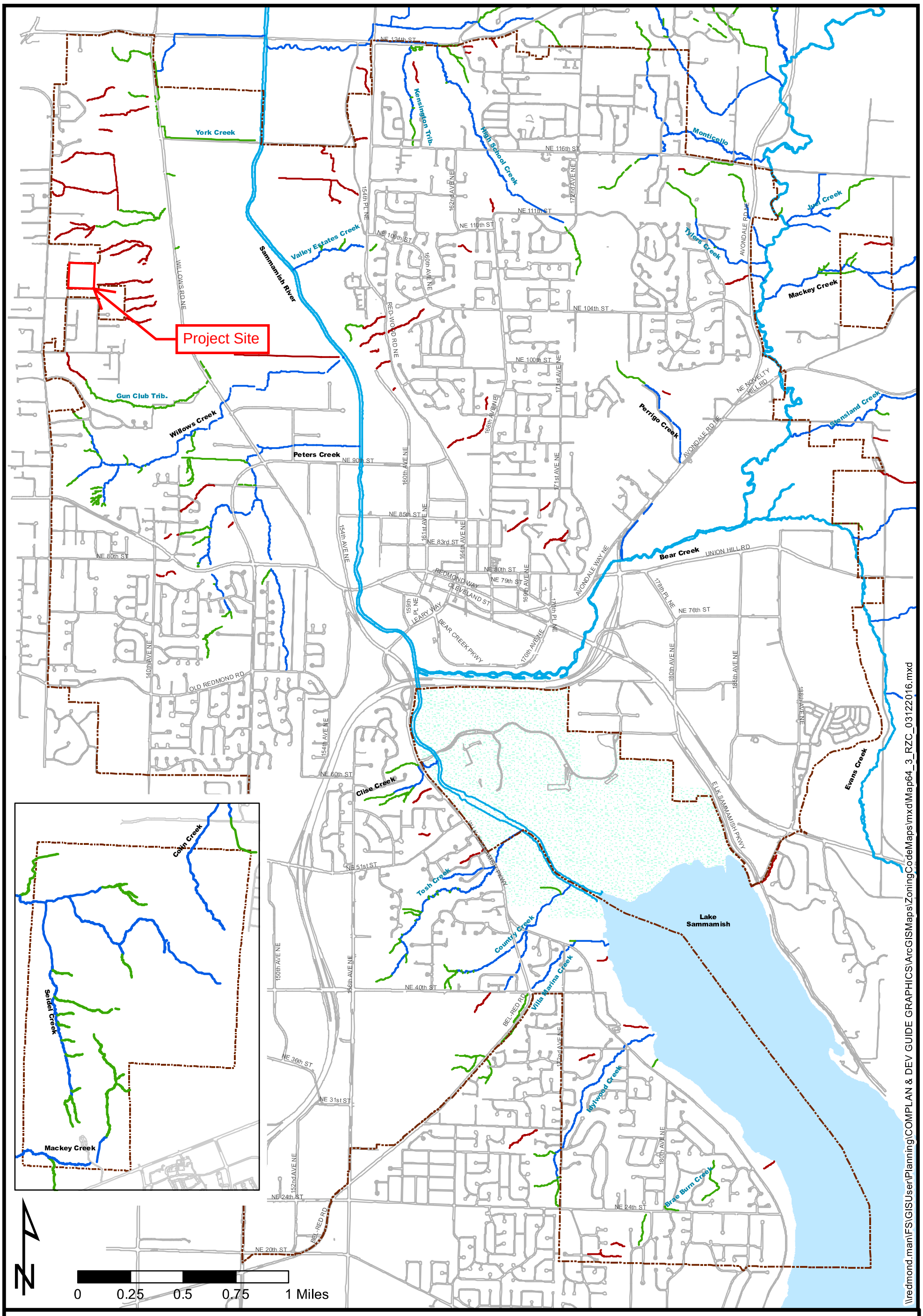
APPENDIX 3-G

STREAM CLASSIFICATION MAP



\\redmond.man\FS\GISUser\Planning\COMPLAN & DEV GUIDE GRAPHICS\ArcGISMaps\ZoningCodeMaps\mxd\Map64_3_RZC_03122016.mxd

City of Redmond

Critical Areas Map
Effective: **3/12/2016**

Stream Official USGS Stream Name
Stream Informal Stream Name

Class I Stream
Class II Stream
Class III Stream
Class IV Stream

Map 64.3 Streams Classification

Sources:
City of Redmond Public Works, Natural Resources Division
City of Redmond GIS Services
Washington Trout / Wild Fish Conservancy
King County GIS

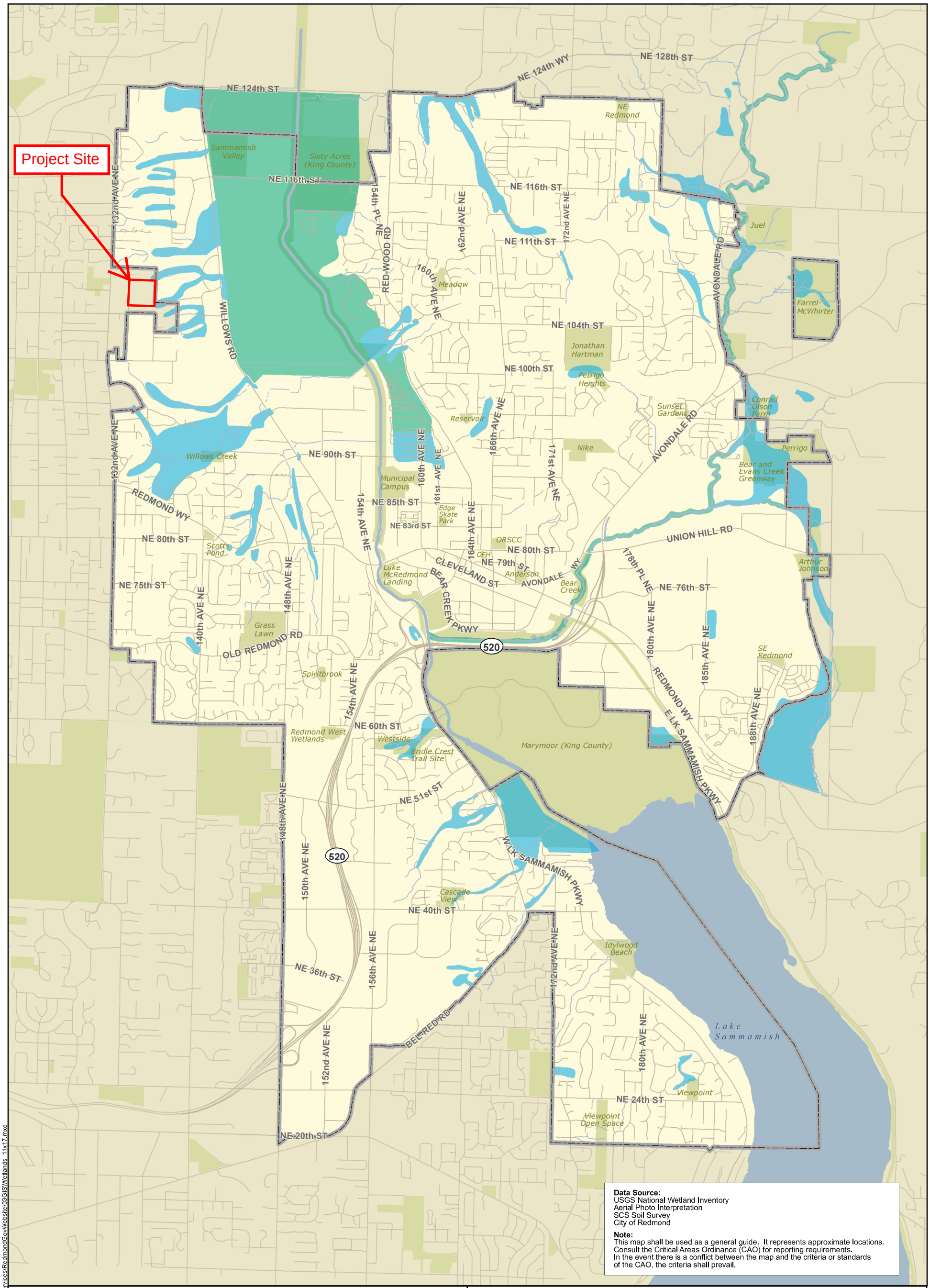
Note: This map shall be used as a general guide representing the approximate location of streams, per RZC 21.64.010(E)(2). The map does not necessarily ensure the presence or absence of streams. In the event of a conflict between the map and the criteria of the Critical Areas Ordinance (CAO), the criteria shall prevail. Consult the CAO (RZC 21.64) for reporting requirements

Note: Gaps in illustrated streams may indicate culverts, pipes, etc.

Note: Informal stream names may not conform to USGS policies and may change in the future.

APPENDIX 3-H

WETLAND MAP



Data Source:
USGS National Wetland Inventory
Aerial Photo Interpretation
SCS Soil Survey
City of Redmond

Note:
This map shall be used as a general guide. It represents approximate locations.
Consult the Critical Areas Ordinance (CAO) for reporting requirements.
In the event there is a conflict between the map and the criteria or standards of the CAO, the criteria shall prevail.

Wetlands

Critical Areas Map

City of Redmond, Washington

Effective: 05/28/2005

0 0.5 1
Miles

N

Mixed Wetland/Upland
Wetland
City Limit
Park and Open Space
Water

Disclaimer: This map is created and maintained by GIS Services Group,Finance and Information Services, City of Redmond, Washington, for reference purposes only.

The City makes no guarantee as to the accuracy of the features shown on this map.

File Name:\\redmond.man\fs\GISUser\GIS\GISServicesProject\GISServicesRedmondGovWebsite\03GIS\Wetlands_11x17.mxd

4.0 FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

The flow control and water quality requirements are vested under the Redmond Municipal Code (RMC), Redmond Zoning Code (RZC) and Redmond Stormwater Technical Notebook (2019). The 2014 Ecology Manual as modified by the Western Washington Phase II Municipal Stormwater Permit regulates issues not addressed by the RMC, RZC and Stormwater Notebook. Flow control modeling has been performed with WWHM 2012. A public combined detention/wetvault will collect onsite flows and utilize a flow splitter downstream of the vault to split mitigated flows to each TDA. Refer to Section 4.5 for areas associated to each TDA related to flow splitter design.

4.1 On-Site Stormwater Management

List #2 was the chosen approach for onsite stormwater management. According to the Geotechnical Report, infiltration is not likely feasible on the site due to the high percentage of fines in the soil. LID BMP's such as infiltration and permeable pavement will not be used to manage stormwater onsite. Dispersion is also infeasible due to steep slopes onsite and limited flow path lengths. In effort to meet LID standards to the maximum feasible extent given site soil and slope constraints, perforated roof downspouts according to Section 2.5.5 in the 2019 City of Redmond Technical Notebook in conjunction with soil augmentation according to City of Redmond standard detail 632 will be used to manage roof runoff. See Appendix 4-A Figure 2.5.1 for determination of LID MR #5 requirements and an analysis of List #2 LID BMP Feasibility within the LID Site Assessment and Planning Packet per City of Redmond.

4.2 Water Quality

The flow control and water quality requirements are vested under the 2019 Redmond Stormwater Technical Notebook and the 2014 DOE Manual. LID water quality BMP's such as biofiltration and bioretention are not feasible on the site due to the high percentage of soil fines that would impede any downward migration of stormwater according to the Geotechnical Report prepared by Terra Associates, Inc. As LID water quality BMP's are not feasible, water quality minimum requirements will be met through use of a Combined Detention/Wetvault and associated dead storage volume. Due to the residential nature of the site, "Basic" treatment is the minimum treatment level required.

4.2.2 Water Quality Treatment Sizing

According to water quality treatment design flow calculations (see WWHM output), the WQ Design Flow (based on the 6-month, 24-hour storm event using the WWHM 701 data series), a water quality storage volume of 0.6938 ac-ft (30,222 CF) is required. A water quality depth of 3.73-feet will be provided for the 8,107 square foot vault with an additional 10 inches of dead sediment storage. A total water quality and storage depth of 4.57 feet across the entire footprint of the combined detention/wetvault will be provided below the live storage area.

4.3 Flow Control System

Flow control for the project site will be achieved through the use of a combined Detention/Wetvault located in a Tract A the eastern end of the site. The facility was sized using WWHM 2012 and with the total aggregate site areas identified in the Predeveloped and Developed Hydrology sections below. Basin areas and land covers for all predeveloped basins are additionally itemized and quantified in the predeveloped basins spreadsheet.

4.3.1 Predeveloped Hydrology

For visual representation of the site basins in the predeveloped condition see Figure 5.0, "Predeveloped Hydrology Map" in Appendix 4-B.

<u>Onsite Basin</u>

The Onsite Basin is approximately 8.71 acres and is primarily covered with trees and brush. All acreage will be modeled as "forested" in the pre-developed condition.

Table 4.3.1.1 – Predeveloped Conditions Areas: Onsite Basin - WWHM

Land Cover	**Area**	
	(AC)	**(SF)**
Forest	*8.71*	*379,410*
Total	**8.71**	**379,410**

<u>Frontage Basin</u>

The Frontage Basin is approximately 0.34 acres. Frontage improvements associated with the project in the 134th Ave NE ROW will be collected and routed to the onsite detention system in the developed condition. The existing area to be converted in the developed condition has been modeled as a

forested land cover. WWHM modeled areas for the Frontage Basin in the predeveloped condition have been entered as follows:

Table 4.3.1.2 – Predeveloped Conditions Areas: Frontage Basin - WWHM

Land Cover	**Area**	
	(AC)	**(SF)**
Forest	*0.34*	*14,810*
Total	**0.34 AC**	**14,810 SF**

<u>Pre-Existing Pavement Basin</u>

The Pre-Existing Pavement Basin is approximately 0.12 acres and consists of existing pavement in the 134th Ave ROW that will not be disturbed by project development and will continue to remain tributary to the site in the developed condition. All acreage has been modeled as "pavement" in the pre-developed condition and has been modeled as flow through area in the WWHM modeling.

Table 4.3.1.3 – Predeveloped Conditions Areas: Pre-Existing Pavement Basin - WWHM

Land Cover	**Area**	
	(AC)	**(SF)**
Road	*0.12*	*5,227*
Total	**0.12 AC**	**5,227 SF**

4.3.2 Developed Site Hydrology

The developed site for Rosewood Court will consist of impervious surface roofs, driveways, sidewalks, pavement, and landscaped areas. Developed basin runoff is conveyed to a single Combined Detention/Wetvault, less the Wetland Hydration Basin and the Frontage Bypass Basin which has been modeled as bypass. Individual basins are identified below and are the basis for the developed condition and the Combined Detention/Wetvault sizing in WWHM. For visual representation of all basins in the forthcoming section, see Figure 6.0 "Developed Hydrology Map" in Appendix 4-B.

Pervious Land Cover

Pervious land cover in each developed basin has been modeled as pasture. In Section 7.2 of the 2014 Low Impact Development Technical Guidance Manual for Puget Sound (LID Manual), referenced in

Appendix III-C of the 2014 DOE manual, it is prescribed that if landscaped areas are underlain with BMP T5.13 soils, the area may be modeled as pasture. These landscaped areas will be underlain with BMP T5.13 soil mixtures in the developed condition and thus have been modeled as pasture land cover in WWHM.

Onsite Basin

In the developed condition, the Onsite Basin is approximately 8.3 acres and includes the developed lots, ROW, and open space. For calculation of lot impervious areas, 80% of the maximum achievable impervious coverage was used. This was equivalent to a 52% lot impervious coverage after application of the 80% factor. Flow control credits were received for site trees per BMP T5.16 Tree Retention and Tree Planting. Approximately 0.05 acres of impervious credits were awarded for onsite tree retention and planting, which have been omitted from impervious road coverage in WWHM modeling. The WWHM land cover "Road" has been reduced by 0.05 acres. Proposed tree and existing canopy values have been pulled from the landscape and arborist plans and documents.

Table 4.3.2.1 – Newly Planted Tree Calculation

Tree Type	Impervious Credit	Proposed # of Tree	Credit (sf)	Credit (ac)
Deciduous	20 Sf/Tree	54	1,080	0.02
Evergreen	50 Sf/Tree	23	1,150	0.03
			Total Impervious Credit=	**0.05**

Table 4.3.2.2– Developed Conditions Areas: Onsite Basin – WWHM

Land Cover	Area (AC)	(SF)
Road	***1.20****	*52,272*
Roof	*2.04*	*88,863*
Driveway	*0.82*	*35,719*
Sidewalk	*0.70*	*30,492*
Pasture	*3.54*	*154,202*
Total	**8.30 AC**	**361,548 SF**

*Reduced 0.05 ac per tree calculations above

Frontage Bypass Basin

In the developed condition a portion of the 134th Ave Frontage cannot be collected due to topographical constraints and has been modeled as bypass. See Figure 6.0 "Developed Hydrology

Map" for the location of this bypass area. The following area coverages have been modeled as bypass in WWHM:

Table 4.3.2.4 – Developed Conditions Areas: Frontage Bypass Basin – WWHM

Land Cover	Area (AC)	(SF)
Road	*0.02*	*871*
Sidewalk	*0.01*	*435*
Pasture	*0.02*	*871*
Total	**0.08 AC**	**3,484 SF**

Pre-Existing Pavement Basin

Runoff from the pre-existing pavement in 134th Ave NE will be collected and routed to the Combined Detention/Wetvault. The following area coverages have been modeled to account for this pre-existing pavement area in WWHM:

Table 4.3.2.5 –Developed Conditions Areas: Pre-Existing Pavement Basin – WWHM

Land Cover	Area (AC)	(SF)
Road	*0.12*	*5,227*
Total	**0.12 AC**	**5,227 SF**

Frontage Basin

Runoff from the 134th Ave NE frontage improvements associated with the project will be collected and routed to the Combined Detention/Wetvault. The following area coverages have been modeled to account for this frontage area in WWHM:

Table 4.3.2.6– Developed Conditions Areas: Frontage Basin – WWHM

Land Cover	Area (AC)	(SF)
Road	*0.08*	*3,484*
Sidewalk	*0.06*	*2,613*
Pasture	*0.12*	*5,227*
Total	**0.26 AC**	**11,325 SF**

Wetland Tributary Area Basin

Onsite area that was previously tributary to the Category III wetland, located in the southeast corner of the site, in the existing condition will be developed as part of construction. To ensure proper hydration of the wetland in the developed condition, developed lot and pedestrian pathway area will be routed to the wetland. The roof and lawn area of lots 47, 48 and 49 and a portion of pedestrian path pervious and impervious cover will drain directly to the wetland. For further discussion and calculations that verify hydraulic equivalency, see Section 4.4.1. This area has been modeled as bypass in WWHM. The following area coverages have been modeled to account for this wetland tributary area in WWHM:

Table 4.3.2.7 – Developed Conditions Areas: Wetland Tributary Area Basin – WWHM

Land Cover	**Area**	
	(AC)	**(SF)**
Roof	*0.12*	*5,228*
Sidewalk	*0.03*	*1,307*
Pasture	*0.21*	*9,147*
Total	**0.36 AC**	**15,682**

4.3.3 Detention/Wetvault

The flow control facility was designed as a standalone detention facility, meeting the release rates and durations as required by the 2014 DOE Manual. Water quality will be achieved by providing additional dead storage across the entire vault footprint, directly below the live storage. The WWHM output is located in Appendix 4-B. The critical detention statistics as modeled in WWHM are as follows:

Combined Detention/Wetvault

Modeled Bottom Area:	8,107 ft^2
Provided Bottom Area:	8,107 ft^2
Facility Internal Sides:	Vertical
Top of Riser Elevation:	312.50
Facility WQ Surface (Begin Live):	301.50
Facility Bottom Elev.:	296.96
Effective Depth:	16.07’
Riser Height:	11.0’
WQ Depth:	3.73’
Req. Additional Sediment Storage:	10”

Table 4.3.3.1 – Detention Peak Flow Rates and WSE

Storm Event	Predeveloped Rate (cfs)	Unmitigated Rate (cfs)	Mitigated Rate (cfs)	Water Surface Elevation
2-Year	0.30	1.99	0.23	308.47
10-Year	0.61	2.89	0.41	311.57
50-Year	0.90	3.74	0.64	312.50
100-Year	1.02	4.12	0.75	312.53

4.4 Wetland Guidelines

The onsite wetland and 60-foot reduced buffer will remain undisturbed in the developed condition and construction activity within the buffer areas will be restored to native vegetation. As required by the Department of Ecology, project sites with onsite wetlands and/or whose onsite runoff is tributary to an onsite/offsite wetland must comply with Guide Sheets #1-#3 of *Appendix I-D: Guidelines for Wetlands when Managing Stormwater* in the 2014 DOE Manual to minimize changes to wetland functions and values.

There is a single wetland located onsite in the southeastern corner. The wetland has been designated as Category III with 5 habitat credits and no breeding populations per the Critical Areas Report. The following are Guide Sheets #1-#3 criteria and project wetland compliance.

Guide Sheet #1 Criteria that Excludes Wetlands from Serving as a Treatment or Flow Control BMP/facility: Guide Sheet #1 indicates Category I, high level of function Category I and II, and/or wetlands that provide habitat for threatened are endangered species must meet criteria in Guide Sheets 3B and 3C in order to receive flows from a stormwater system.

- **Per the Wetland Report, the onsite is listed as a Category III wetland and therefore does not fall under Guide Sheet #1 requirements.**

Guide Sheet #2 Criteria for Including Wetlands as a Treatment or Flow Control BMP/facility: Guide Sheet #2 indicates a wetland can be physically or hydrologically altered if the wetland is a Category IV wetland or III with a habitat score of 19 or less points, no "net loss" of function or value is concluded, no breeding population is present, the hydraulic functions of the wetland can be improved, and the wetland lies in the natural routing of the runoff and maintains natural routing.

- **Per the Wetland Report, the onsite is listed as a Category III wetland with 5 habitat credit points, does not contain breeding populations, and approximately 1.77 acres of onsite runoff is directed through the wetland in the existing condition. Per Guide Sheet #2 the site can include the wetland as flow control, if desired. The project does not propose to use the wetland for flow control.**

Guide Sheet #3 Wetland Protection Guidelines: Indicates wetland protection guidelines set forth for Guide Sheet #1 wetlands.

- **Guide Sheet #3 is not required for the site as the onsite wetland does not fall under Guide Sheet #1. The following supplement Guide Sheets 3A-C will be followed to maximum extent feasible to protect the onsite wetland in its current condition.**

Guide Sheet #3A: General Guidelines for Protecting Functions and Values of Wetlands

1. Consult regulations issued under federal and state laws that govern the discharge of pollutants. Wetlands are classified as "Waters of the United States" and "Waters of the State" in Washington.
    - **Wetland Resources has produced a wetland critical areas study and plan.**

2. Maintain the wetland buffer required by local regulations.
    - **An 80-foot wetland buffer/60-foot reduced wetland buffer has been provided for the existing Category III wetland. Se the Wetland Report for justification of wetland buffer reduction.**

3. Retain areas of native vegetation connecting the wetland and its buffer with nearby wetlands and other contiguous areas of native vegetation.
    - **All native vegetation within the existing wetland and its buffer will remain. The wetland discharges into a ravine that will remain undisturbed by development.**

4. Avoid compaction of soil and introduction of exotic plant species during any work in a wetland.
    - **Soil compaction will be avoided as well as introduction of exotic plan species.**

5. Take measures to avoid general urban impacts (e.g., littering and vegetation destruction). Examples are protecting existing buffer zones; discouraging access, especially by vehicles, by plantings outside the wetland; and encouragement of stewardship by a homeowners' association.
    - **Fencing will be provided around the perimeter of the wetland buffer to discourage access.**

6. Fences can be useful to restrict dogs and pedestrian access, but they also interfere with wildlife movements. Their use should be very carefully evaluated on the basis of the relative importance

of intrusive impacts versus wildlife presence. Fences should generally not be installed when wildlife would be restricted, and intrusion is relatively minor. They generally should be used when wildlife passage is not a major issue and the potential for intrusive impacts is high. When wildlife movements and intrusion are both issues, the circumstances will have to be weighed to make a decision about fencing.

- **Fencing will be provided around the perimeter of the wetland buffer to discourage access. Fencing will not interfere with wildlife onsite.**

7. If the wetland inlet will be modified for the stormwater management project, use a diffuse flow method, (eg. BMP C206: Level Spreader, and BMP T5.10B: Downspout Dispersion Systems) to discharge water into the wetland in order to prevent flow channelization.
    - **A point discharge to a crushed rock pad will discharge into the wetland buffer as well as well as towards the wetland area. The crushed rock pad will reduce erosive flows produces by channelization of runoff. Flows have been kept under threshold the 2014 DOE Manual for point discharge of 0.3 cfs (for 15-minute time steps) in the 100-year event.**

Guide Sheet #3B: Protecting Wetlands from Impacts of Changes in Water Flows

This section indicates the design thresholds of pre- to post- developed runoff volumes directed to the wetland.

- **The Category III onsite wetland is not a depressional wetland, rather a riverine/slope wetland as there is no low point within the wetland and contours indicate eastward through flows discharged to the onsite Class IV stream. According to this section "The criteria developed by that program apply only to depressional wetlands. They are not applicable to riverine, slope, or lake-fringe wetlands. Ecology does not have any hydrologic models available to characterize the hydrodynamics in these types of wetlands." Therefore, the site cannot comply with design criteria thresholds. The project will implement pre- post- development analysis in WWHM to match 10-, 50- and 100- year peak flows within 50% of the pre-developed flow condition. Refer to *"4.4.1 Onsite Basin Wetland Hydraulic Equivalency"* for calculations.**

Guide Sheet #3C: Guidelines for Protection Wetlands from Pollutants

Protecting a wetland from pollutants generated by a development should include the following measures:

1. Use effective erosion control at construction sites in the wetland's drainage catchment. Refer to Volume II this manual and local jurisdiction requirements.
    - **Erosion control will be implemented to reduce contaminated runoff from entering the wetland during construction.**

2. Institute a program of source control BMPs and minimize the pollutants that will enter storm runoff that drains to the wetland.
    - **No PGHS will be graded towards the wetland. Roof and sidewalk non pollution generating hard surfaces and lawn cover will be directed to the wetland. Vault discharge will receive treatment prior to leaving the vault and entering the wetland buffer at mitigated historic rates.**

3. For wetlands that meet the criteria in Guide Sheet 1, provide a water quality control facility consisting of one or more treatment BMPs to treat runoff entering the wetland.
    - **Not applicable as the wetland does not meet the criteria listed in Guide Sheet 1.**

4.4.1 Onsite Basin Wetland Hydraulic Equivalency

Areas located in the Onsite Basin, previously tributary to wetlands in the predeveloped condition, will be developed as part of onsite improvements. In order to adequately hydrate the onsite wetland to which these areas were previously tributary, a portion of developed non-PGIS lot and tract areas will be routed to the wetland in such a way that the converted tributary area and lot area routed to the wetland will be hydraulically equivalent.

In order to determine a reasonable hydraulic equivalency, WWHM was used to estimate the flows that drain to the wetland in the predeveloped and developed conditions. A summary and comparison of both the areas and peak flow values between the predeveloped and developed conditions tributary to the wetland are found below. WWHM output comparison calculations can also be found in Appendix 4-C.

As shown in Figure 7.0, "Wetland Tributary Map" in Appendix 4-C, approximately 1.77 AC (77,212 SF) within the Onsite Basin is tributary to the Wetland in the predominantly forested existing condition that will be converted due to onsite development. The area does not account for offsite upstream or buffer area that will remain tributary to the wetland in the developed condition. To produce

hydraulic equivalency for this wetland, approximately 0.36 AC (4,356 SF) of developed area (0.15 AC/6,534 SF impervious, 0.21 AC/9,148 SF pervious) on lots 47-49 and adjacent pedestrian pathway and surrounding pervious cover will be routed and/or graded to the wetland in the developed condition, matching the flowrate within 50% of the 10-year, 50-year, and 100-year flow, as shown in the table below.

PERCENT DIFFERENCE IN FLOW BETWEEN PRE- & POST- DEVELOPMENT FLOWS	
100 YEAR	50%
50 YEAR	47%
10 YEAR	41%

4.5 Flow Splitter Design and Analysis

The site contains two threshold discharge basins (TDAs): North TDA and South TDA. A single detention vault will collect onsite runoff and the flow splitter will discharge developed condition flows to both the northeast and southeast discharge points that mimic existing conditions runoff.

Just outside of the ¼ mile boundary of analysis for threshold basin area determination, runoff from the separate flow paths enter a closed conveyance system associated with the Willow Creek Corporate Center at various intake points. Flows converge within the closed system but as convergence is outside the quarter mile analysis boundary, for threshold basin area determination, two TDAs must be considered. Splitting flows will also maintain adequate hydration of each existing drainage course and will prevent the downstream offsite conveyance line from exceeding its design capacity (refer to Section 5.0 for offsite capacity analysis).

WWHM2012 was used to determine existing peak runoffs produced for each of the TDAs that will be used to design the flow splitter release rates. Approximately 5.09 acres and 4.08 acres of onsite and offsite frontage area is associated with the North and South TDA, respectively. WWHM2012 flows found in summary Table 4.5.1 below of existing condition flows is located in Appendix 4-D. Refer to the Figure 8.0 “Flow Splitter Tributary Map” in Appendix 4-D for a map of the North and South TDA Basins.

Table 4.5.1 – TDA: Existing Conditions Discharge Summary Table

Basin	Forest	Impervious	2- Year Storm Event	50- Year Storm Event	100- Year Storm Event
North TDA	5.09 AC	0.04 AC	0.17 cfs	0.48 cfs	0.54 cfs
South TDA	4.08 AC	0.08 AC	0.13 cfs	0.35 cfs	0.48 cfs

The flow splitter was used to split discharge to each TDA in a way that best matches the existing condition flows for each TDA. The flow splitter used inflow taken from the modeled discharge from the detention/wetvault facility. Tables 4.5.2 and 4.5.3 below summarize the existing condition flows to each TDA in comparison to the developed condition discharge from the flow splitter. Full data analysis and stage storage tables for the design of the proposed flow splitter can be found in Appendix 4-D. The South TDA will also receive flows from the wetland hydration, as calculated in Section 4.4 of this Report, in addition to flows emitted from the flow splitter.

Table 4.5.2 – South TDA Discharge Comparison Table

Storm Event	Existing Discharge: South TDA (cfs)	Developed Discharge from Splitter: South TDA (cfs)	Developed Discharge from Wetland Rehydration: South TDA (cfs)	Developed Condition Flow as Percent of Existing
2-Year	0.13	0.11	0.06	130.8%*
50-Year	0.35	0.26	0.12	118.75%*
100-Year	0.48	0.30	0.14	91.7%*

* Percent includes Flow Splitter and Wetland Hydration flows

Table 4.5.3 – North TDA Discharge Comparison Table

Storm Event	Existing Discharge: North TDA (cfs)	Developed Discharge from Splitter: North TDA (cfs)	Developed Condition Flow as Percent of Existing
2-Year	0.17	0.19	105.88%
50-Year	0.48	0.46	95.83%
100-Year	0.54	0.53	98.15%

South discharge flows will release into a bubble up structure and continue downhill east offsite. Due to existing steep slopes, the south discharge conveyance line will be anchored underground to the steep hill side as noted per the Geotechnical Report in Section 4.10. North discharge flows will disperse via a dispersion trench.

APPENDIX 4-A

LID DOCUMENTATION

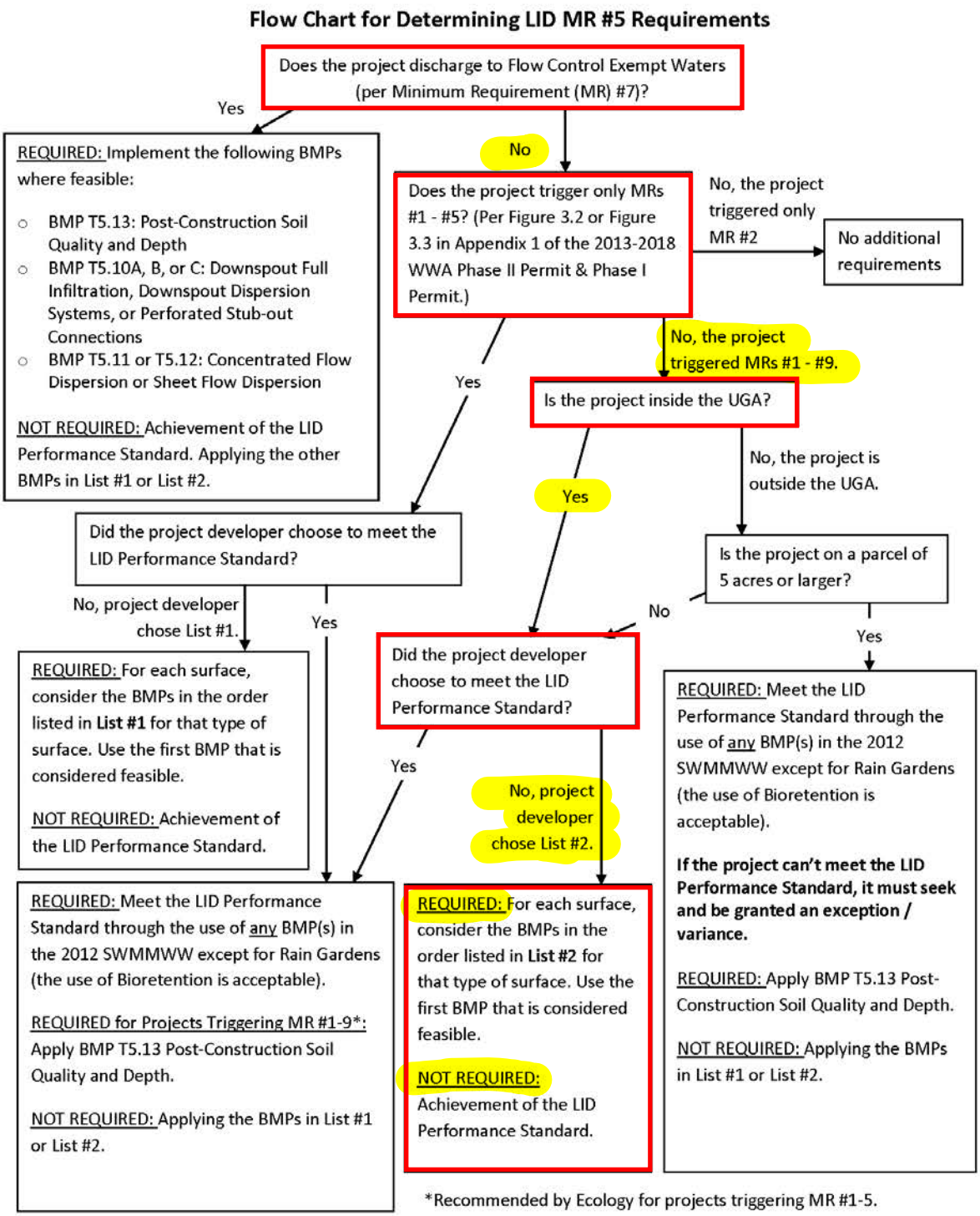


Figure 2.5.1 – Flow Chart for Determining LID MR #5 Requirements

LID Site Assessment and Planning Packet

Instructions for completing this packet:

- This packet is to be completed as part of a preliminary site assessment by the applicant per RZC 21.17.10E and as specified in the Stormwater Technical Notebook (STN).
- For documentation purposes, all projects that result in 2,000 square feet or greater of new, replaced, or new plus replaced hard surface area or have land disturbing activity of 7,000 square feet or greater must complete an LID assessment and include this packet as an appendix to the project drainage report submitted as part of the site plan entitlement process.
- This packet is to be completed early in the site development process. Please complete all sections of this packet to the best of your ability. Some sections may not apply. You may state "Not Applicable" only when you can explain why it does not apply and not when the answer is unknown. Consulting with a qualified consultant may be necessary to determine ascertain certain features of the property (i.e. depth to groundwater/ infiltration rates). Please consult with a geotechnical engineer or civil engineer if your project meets the thresholds identified above.
- This is a fillable PDF form. The forms will expand and allow you to enter more text than the space indicates. If you should run out of space, attach a separate sheet and write "continued from" and include the section and number (i.e. D.1).

The goal of this assessment is to:

- Document how projects propose to minimize:
  - Impervious areas
  - Loss of native vegetation
  - Stormwater runoff
- Demonstrate how the project proposes to comply with Minimum Requirement #5: On-site Stormwater Management.
- Some of the below requirements are modified based on whether the project is located within an urban center or an area draining to a flow control exempt water body. To determine how your site's location in the City influences On-site Stormwater Requirements (Minimum Requirement #5) refer to Map 1- MR 5: Stormwater Management Custom Areas at end of this packet and then look for the corresponding symbol for where requirements are modified. (This map is also found as Appendix F in the Redmond Stormwater Technical notebook). The custom flow control areas in Redmond include:
  - Downtown
  - Overlake
  - SR520 Drainage Basin
  - 40th Street Basin
  - SE Redmond (some properties)

APPLICANT INFORMATION

Company/Agency/Owner: DR Horton

Contact Person: Tom Abbott

Address: 20210 142nd Ave NE
Woodinville, WA 98072

Phone: (425) 806-1869 ext. 142

Email: tabbott@ldccorp.com

Signature: _____

Date: 01/03/2020

A PROJECT INFORMATION

Project Number: C19-104

Project Address or Boundaries: 10428/10612 134th Ave NE Redmond, WA

Parcel Number: 1246700090, 1246700100, 1246700080

Is the site in a Flow Control Exempt area? (Refer to Section 2.5.7 of the STN): ☐ Yes ☑ No

If yes, note the items that are footnoted in the tables in Section F "F. Potential LID BMP Matrix" and refer to that footnote at the bottom of each table.

Is the site located within the Marymoor Subarea as depicted on Map 1? (Refer to Map 1at the end of this packet): ☐ Yes ☑ No

If yes, Sections B, C, D and E do not need to be completed as the intent of this packet will be exceeded through the infiltration of 100% of site runoff.

Is the site located within a Critical Aquifer Recharge Area? (Refer to Map 2: Critical Aquifer Recharge Areas at the end of this packet): ☐ Yes ☑ No

If yes, refer to Section 8.3.2 of the STN. Single-family residential projects in Critical Aquifer Recharge Area I may infiltrate runoff from pollution generating hard surfaces only after enhanced treatment using a BMP that is exposed to the surface (such as bioretention visible from public sidewalks or roads). In the Marymoor Subarea there is no stormwater conveyance available, so development is required to infiltrate stormwater, even if it lies within CARA I. Stormwater must receive enhanced treatment prior to infiltration. Infiltration of runoff from non-pollution generating surfaces is encouraged where feasible.

Project Type: ☑ Residential ☐ Commercial ☐ Industrial ☐ Public ☑ New Development ☐ Redevelopment ☐ Remodel ☐ Retrofit

☐ Combination (explain) _____

Project Description: The project proposes to construct 51 single-family lots with associated infrastructure on 8.38 acres of disturbed on-site area with 2.15 acres of undisturbed area that includes steep slopes, wetland buffer area, and area within the PSE and Olympic Gas Pipeline easements.

B LOW IMPACT DEVELOPMENT GOALS

In the spaces below, please document project efforts to:

Minimize Impervious Surface Coverage: Shared driveway accesses and access tracts for some lots on site versus large right-of-way access for all lots

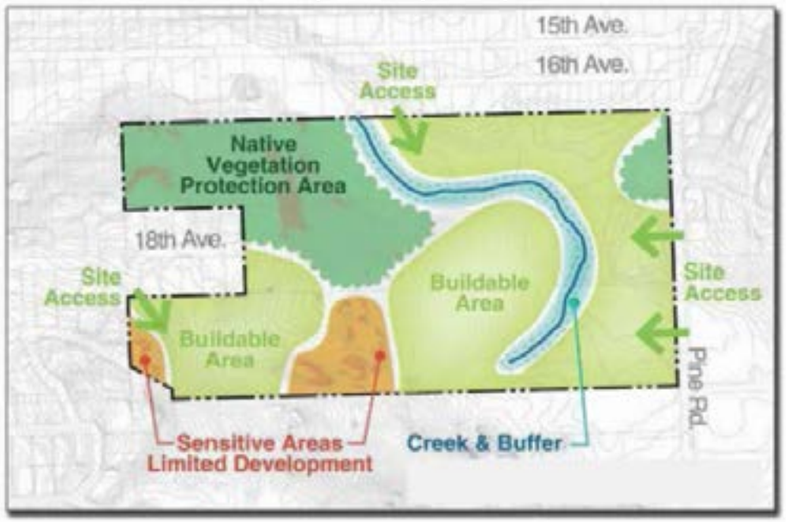
Minimize Loss of Native Vegetation: Protecting critical areas and their buffers for the on-site wetland and steep slopes; protecting viable trees and on-site easement to remain undisturbed

Minimize Stormwater Runoff: Dispersion trenches for the outfalls; splitting flows to two basins to minimize impact

C CREATE SITE COMPOSITE MAP

Develop a composite site map as you collect site information in Section D. See the example below. This map must be submitted as part of the completed packet, and will be used as the basis for the site design.

Example Site Composite Map



D EXISTING SITE INVENTORY AND ANALYSIS CHECKLIST

Use this portion of the packet to document the site inventory and analysis. For additional information on each portion of the analysis, refer to Chapter 2 of the City of Redmond Stormwater Technical Notebook 8.

1. PROJECT BOUNDARIES AND STRUCTURES

- ☒ Identify/delineate on map:
  - ☒ Project Site boundaries (limits of disturbance)
  - ☒ Existing and proposed buildings
  - ☐ Required Infiltration setbacks (please describe)_____
  - ☐ Location and extent of proposed foundations and footing drains

2. SOILS

- ☒ Characterize existing soil type(s) (Refer to Section 10.5.3 of the Stormwater Technical Notebook): Alderwood gravelly sandy loam
- ☒ What is the depth to seasonal average high groundwater (feet) as determined by a geotechnical investigation? (Refer to Section 2.9.3.9 of the Stormwater Technical Notebook) Between 78 and 88 feet below existing site grades
- ☒ Is bedrock present? ☐ Yes ☑ No If yes, depth (feet) _____
- ☒ What is the measured long-term native soil infiltration rate (inch/hour) 0.0
- ☒ Identify source(s) of information used: Geotechnical Report/USGS Web Soil Survey

3. CRITICAL AREAS

- ☒ Identify and map any Critical Areas and associated buffers located on the project site and within the project vicinity
  - ☒ Erosion Hazard Areas Eastern property boundary located near this hazard area
  - ☐ Fish and Habitat Conservation Areas_____
  - ☐ Floodplains_____
  - ☐ Frequently Flooded Area/Special Flood Hazard Area_____
  - ☐ Critical Aquifer Recharge Areas_____
  - ☒ Landslide hazard Areas Eastern property boundary located near this hazard area
  - ☐ Seismic Hazard Areas_____
  - ☐ Shoreline Environments_____
  - ☒ Streams No streams on-site; class IV streams leading up to eastern property boundary
  - ☒ Wetlands on-site wetland in the south eastern corner; associated buffer has been noted
  - ☐ Other_____

4. TOPOGRAPHY

- ☒ Describe site topography and slopes: Mostly flat to moderate slopes, some moderate-steep slopes in the northeast corner
- ☒ Identify/Delineate on map:
  - ☒ Areas of flat(≤5%), moderate (5%-20%), moderate-steep (20%-40%) and steep(≥40%)slopes
  - ☐ Closed depressions

5. HYDROLOGIC PATTERNS & FEATURES

- ☒ Identify/Delineate on map:
  - ☒ Sub-basin(s) Willows, Sammamish River
  - ☐ Existing drainage swales and ditches (please describe)_____
  - ☐ Location(s) if any natural seeps or springs (please describe)_____
  - ☒ Existing discharge location(s) from each sub-basin and overall project site: (please describe) Eastern property boundary
  - ☐ Signs of existing erosion (please describe)_____
  - ☐ Existing flooding or drainage complaints on site or vicinity_____
  - ☐ Other_____

6. VEGETATION

- ☒ Native vegetation type(s): Trees, brush, Himalayan blackberries, high grasses; see Arborist report for more info
- ☒ Approximate tree canopy coverage (acres): 2.68
- ☒ Number of trees (greater than 6-inch diameter at breast height) 307
- ☒ Identify source(s) of information used: Arborist

7. LAND USE CONTROLS

- ☒ What is the project site zoning? RIN
- ☒ Describe landscaping requirements: See landscape plans for RIN landscape requirements
- ☒ Describe parking requirements: 2 per dwelling unit
- ☒ Describe any applicable comprehensive plan designation, zoning classification, and/or overlay districts that apply to the site: Rosehill Neighborhood Standards
- ☒ Does a Shoreline Master Plan apply to the site? ☐ Yes ☑ No
  - ☐ If yes, describe

8. ACCESS

- ☒ Identify/Delineate on map:
  - ☒ Roads, driveways, and other points of ingress and egress within 50 feet of the project site: Existing driveways along 134th Ave
  - ☒ Identify frontage improvement requirements: All on-site and frontage improvements per rustic street standards

9. UTILITY AVAILABILITY AND CONFLICTS

A complete understanding of existing and proposed buried utilities is necessary to properly plan for infiltration.

- ☒ Identify/Delineate on map:
  - ☒ Existing utilities and easements present on and adjacent to the project site, including utility owner. Also note any utility or easement setback requirements that affect site planning: PSE/Olympic gas main & power line easements; 30' BSBL setback from pipe
  - ☒ Existing utilities that may need to be moved and new utilities that may need to be extended to the site: Extending sewer to the site from NE 100th St

EXISTING SITE CONDITIONS

	EXISTING CONDITIONS		PROPOSED CONDITIONS	
Vegetated Areas				
Tree Canopy (acres)	2.68 AC	116,741 SF	0.91 AC	39,457 SF
Landscape (acres)	7.85 AC	341,946 SF	3.79 AC	165,092 SF
Total project vegetated area	10.53 AC	458,689 SF	5.79 AC	252,212 SF
Impervious Area				
Total roof impervious area (sq. feet)	0		2.10 AC	91,476 SF
Total site impervious area (acres)	0		4.79 AC	208,434 SF
Change				
% Increase/decrease in vegetated area			45% decrease	
% Increase/decrease in impervious area			Increased by 4.79 AC (208,434SF)	

POTENTIAL LID BMP MATRIX

For each of the following surfaces proposed, complete the following matrices evaluating the BMPs in the order as specified in Lists #1 and #2 contained within the Stormwater Technical Notebook*:*

- ☒ Lawn and landscaped areas
- ☒ Roofs
- ☒ Other hard surfaces

SURFACE TYPE: Lawn&Landscaped Areas

For each LID BMP being evaluated, use the infeasibility criteria for each BMP in the SWMMWW to determine whether the LID BMP is infeasible for your project. You must use the first BMP that is feasible in accordance with Lists #1 and List#2 of the STN.

	FEASIBILITY/INFEASIBILITY EVALUATION			
	FEASIBLE	INFEASIBLE	NOT APPLICABLE/ NOT KNOWN	If infeasible provide justification as stated by the Infeasibility Criteria in the SWMMWW
Post Construction Soil Quality and Depth	◉	○	○	Feasible
Full Dispersion[1]	○	○	◉	Per 2019 Stormwater Technical Notebook
Downspout Full Infiltration (Roofs, only)	○	○	◉	Per 2019 Stormwater Technical Notebook
Rain Gardens/Bioretention[1]	○	○	◉	Per 2019 Stormwater Technical Notebook
Permeable Pavement or Functional Equivalent[1]	○	○	◉	Per 2019 Stormwater Technical Notebook
Downspout Dispersion	○	○	◉	Per 2019 Stormwater Technical Notebook
Perforated Stubout Connection (Roofs, only)	○	○	◉	Per 2019 Stormwater Technical Notebook
Sheet Flow Dispersion	○	○	◉	Per 2019 Stormwater Technical Notebook
Concentrated Flow Dispersion	○	○	◉	Per 2019 Stormwater Technical Notebook

See Below For Infeasibilty Criteria

[1]Not Required in Flow Control Exempt Areas

Table 1.1 In-feasibility Criteria

Full Dispersion: More than 35% of the total site area is to be converted for development
Downspout Full Infiltration: Depth to seasonal high-water table is 3 feet or more.
Rain Gardens/Bioretention: Geo-technical evaluation has determined the infiltration rates is less than 0.3 in/hr and will likely fill and locally flood during rain events.
Permeable Pavement or Functional Equivalent: Not applicable as no permeable pavement is proposed. Infiltration rates are considered less then 0.30 in/hr per Geo-technical evaluation.
Downspout Dispersion: Space constraints on each lot (allowed per zoning) do not allow for 25-50' vegetated flowpath such that stormwater does not pool.
Sheet Flow Dispersion: Due to lot locations, generally a 10-foot flowpath per every 20 feet of contributing surface flow path cannot be provided
Concentrated Flow Dispersion: A vegetated flow path of 25 feet cannot be provided due to lot layout.

SURFACE TYPE: Roof

For each LID BMP being evaluated, use the infeasibility criteria for each BMP in the SWMMWW to determine whether the LID BMP is infeasible for your project. You must use the first BMP that is feasible in accordance with Lists #1 and List#2 of the STN.

	FEASIBILITY/INFEASIBILITY EVALUATION			
	FEASIBLE	INFEASIBLE	NOT APPLICABLE/ NOT KNOWN	If infeasible provide justification as stated by the Infeasibility Criteria in the SWMMWW
Post Construction Soil Quality and Depth	○	○	●	Refer to Table 1.1 Infeasibility Criteria
Full Dispersion[1]	○	●	○	Refer to Table 1.1 Infeasibility Criteria
Downspout Full Infiltration (Roofs, only)	○	●	○	Refer to Table 1.1 Infeasibility Criteria
Rain Gardens/Bioretention[1]	○	●	○	Refer to Table 1.1 Infeasibility Criteria
Permeable Pavement or Functional Equivalent[1]	○	○	●	Refer to Table 1.1 Infeasibility Criteria
Downspout Dispersion	○	●	○	Refer to Table 1.1 Infeasibility Criteria
Perforated Stubout Connection (Roofs, only)	●	○	○	Feasible
Sheet Flow Dispersion	○	○	●	Refer to Table 1.1 Infeasibility Criteria
Concentrated Flow Dispersion	○	○	●	Refer to Table 1.1 Infeasibility Criteria

[1]Not Required in Flow Control Exempt Areas

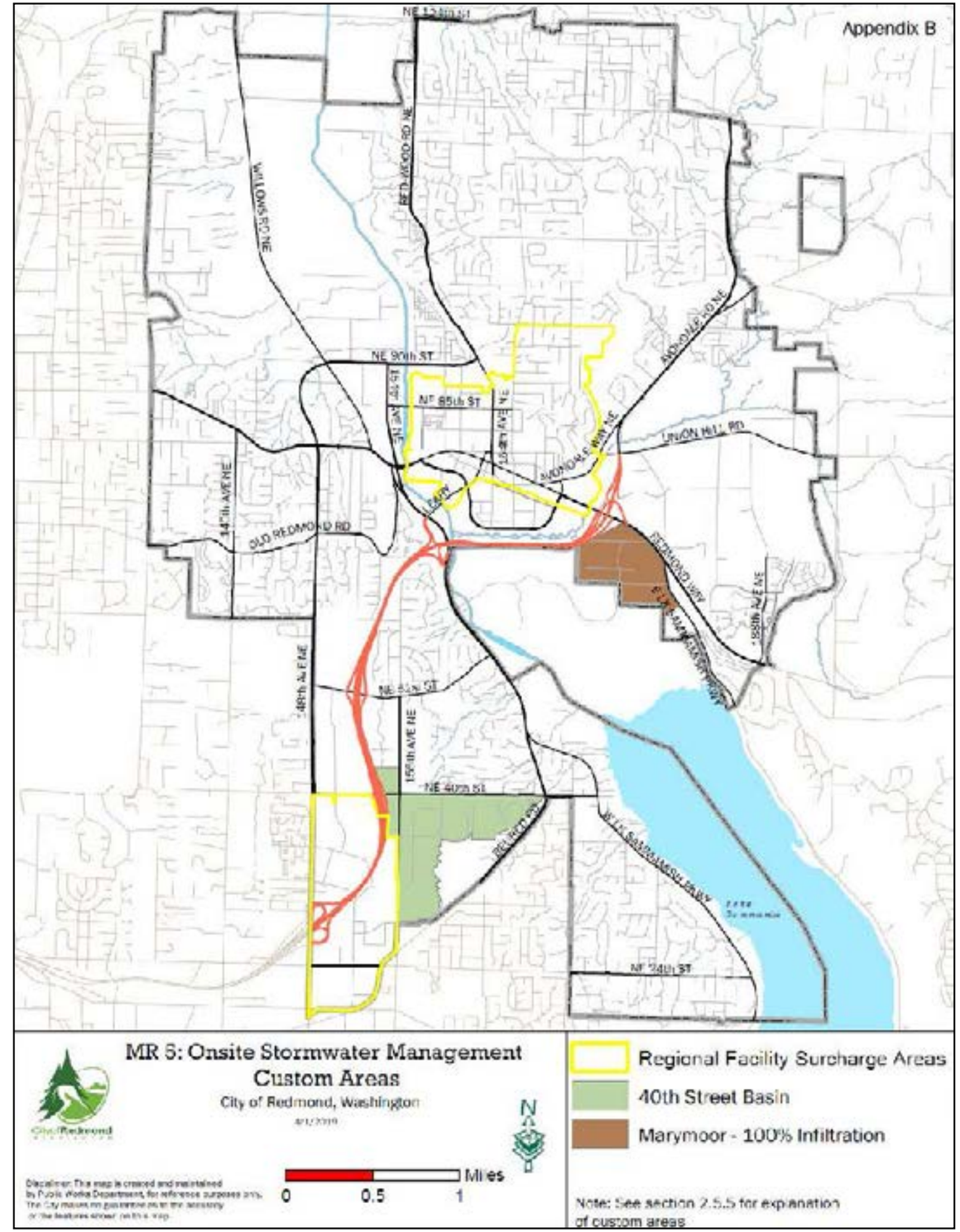
SURFACE TYPE: Other hard surfaces

For each LID BMP being evaluated, use the infeasibility criteria for each BMP in the SWMMWW to determine whether the LID BMP is infeasible for your project. You must use the first BMP that is feasible in accordance with Lists #1 and List#2 of the STN.

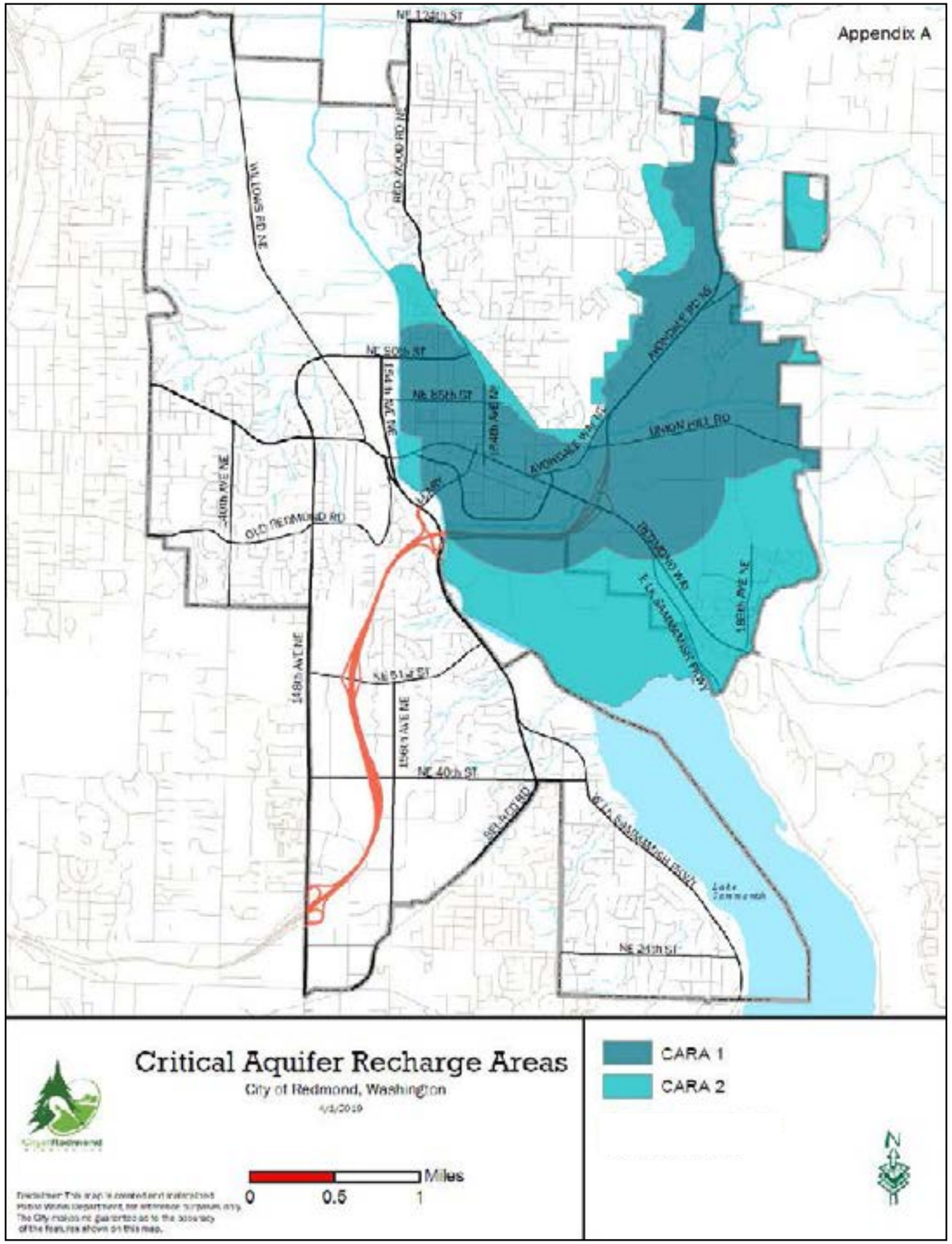
	FEASIBILITY/INFEASIBILITY EVALUATION			
	FEASIBLE	INFEASIBLE	NOT APPLICABLE/ NOT KNOWN	If infeasible provide justification as stated by the Infeasibility Criteria in the SWMMWW
Post Construction Soil Quality and Depth	○	○	●	Refer to Table 1.1 Infeasibility Criteria
Full Dispersion[1]	○	●	○	Refer to Table 1.1 Infeasibility Criteria
Downspout Full Infiltration (Roofs, only)	○	○	●	Refer to Table 1.1 Infeasibility Criteria
Rain Gardens/Bioretention[1]	○	●	○	Refer to Table 1.1 Infeasibility Criteria
Permeable Pavement or Functional Equivalent[1]	○	●	○	Refer to Table 1.1 Infeasibility Criteria
Downspout Dispersion	○	○	●	Refer to Table 1.1 Infeasibility Criteria
Perforated Stubout Connection (Roofs, only)	○	○	●	Refer to Table 1.1 Infeasibility Criteria
Sheet Flow Dispersion	○	●	○	Refer to Table 1.1 Infeasibility Criteria
Concentrated Flow Dispersion	○	○	●	Per 2019 Stormwater Technical Notebook

[1]Not Required in Flow Control Exempt Areas

Map 1: Onsite Stormwater Management Custom Areas



Map 2: Critical Aquifer Recharge Areas



ATTACH COMPLETED SITE COMPOSITE MAP HERE.

APPENDIX 4-B

PRE- DEVELOPED AREAS SPREADSHEET

FIGURE 5.0 PREDEVELOPED HYDROLODY MAP

DEVELOPED AREAS SPREADHSHEET

FIGURE 6.0 DEVELOPED HYDROLOGY MAP

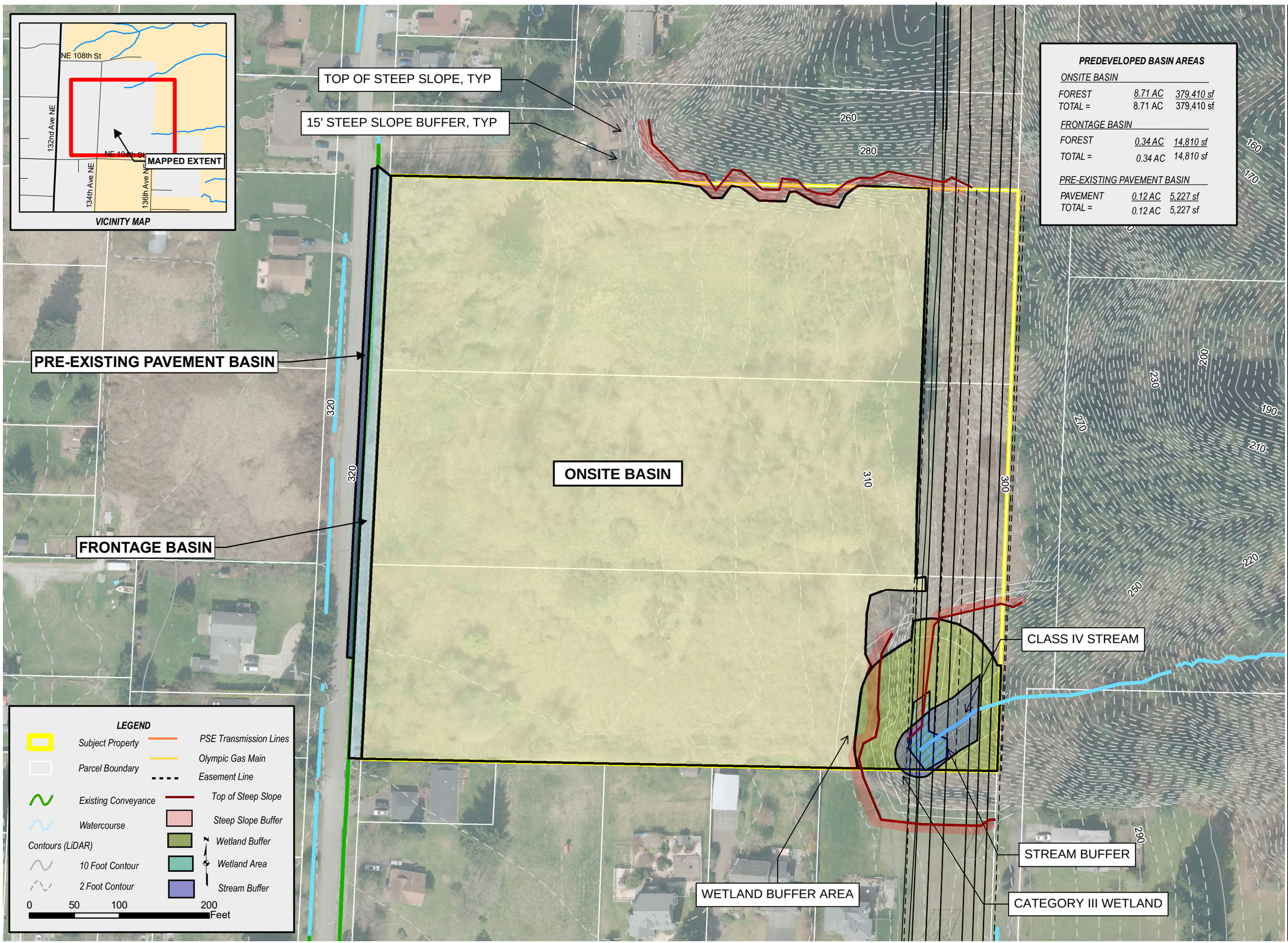
WWHM – COMBINED WET/DETENTION VAULT OUTPUT

Predeveloped Areas Spreadsheet	LDC, Inc.	
	20210 142nd Ave NE Woodinville, WA 98072	Tel: (425) 806-1869 Fax: (425) 482-2893

Project Name:	Rosewood Court	Project No.:	C19-104
Description:	Predeveloped Areas	Date:	4/13/2020
		Calc. By:	MEJ

Predeveloped Areas

	Area (Acres)	Impervious (%)	Impervious (Acres)	Lawn (Acres)	Forested (Acres)
Onsite	**8.71**	**0.00%**	**0.00**	**0.00**	**8.71**
Frontage	**0.34**	**0.00%**	**0.00**	**0.00**	**0.34**
Pre-Existing Pavement	**0.12**	**100.00%**	**0.12**	**0.00**	**0.00**
Total Area	**9.17**	**1.31%**	**0.12**	**0.00**	**9.05**



PREDEVELOPED BASIN AREAS

ONSITE BASIN		
FOREST	8.71 AC	379,410 sf
TOTAL =	8.71 AC	379,410 sf
FRONTAGE BASIN		
FOREST	0.34 AC	14,810 sf
TOTAL =	0.34 AC	14,810 sf
PRE-EXISTING PAVEMENT BASIN		
PAVEMENT	0.12 AC	5,227 sf
TOTAL =	0.12 AC	5,227 sf

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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DR HORTON

ROSEWOOD COURT
PREDEVELOPED HYDROLOGY MAP

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601

REVISION:
JOB NUMBER: C19-104
DRAWING NAME: C19-104-5.0
DESIGNER: CDANBY
DRAWING BY: MJUREWICZ
DATE: 3/18/2020
SCALE: AS SHOWN
JURISDICTION: REDMOND

FIGURE:
5.0

Predeveloped Hydrology Map.mxd | MOD: 3/18/2020 | mjurewicz

Developed Areas Spreadsheet	LDC, Inc.	
	20210 142nd Ave NE Woodinville, WA 98072	Tel: (425) 806-1869 Fax: (425) 482-2893

Project Name:	Rosewood Court	Project No.:	C19-104
Description:	Developed Areas	Date:	4/13/2020
		Calc. By:	MEJ

Developed Areas

ONSITE BASIN	Area (Acres)	Impervious (%)	Impervious (Acres)	Pasture (Acres)	Forested (Acres)	PGIS (Acres)
Lots To Vault	**6.16**	**51%**	**3.16**	**3.00**	**0.00**	**0.82**
Roofs	2.04	100.0%	2.04	0.00	0.00	0.00
Patio/Walk	0.30	100.0%	0.30	0.00	0.00	0.00
Pasture/Lawn	3.00	0.0%	0.00	3.00	0.00	0.00
Driveways	0.82	100.0%	0.82	0.00	0.00	0.82
ROW and TRACTS	**2.14**	**75%**	**1.60**	**0.54**	**0.00**	**1.20**
Pavement*	1.200	100%	1.200	0.00	0.00	1.20
Sidewalk	0.40	100%	0.40	0.00	0.00	0.00
Pasture/Lawn	0.54	0%	0.00	0.54	0.00	0.00

FRONTAGE BYPASS BASIN	Area (Acres)	Impervious (%)	Impervious (Acres)	Pasture (Acres)	Forested (Acres)	PGIS (Acres)
Frontage Bypass	**0.08**	**75%**	**0.06**	**0.02**	**0.00**	**0.05**
Pavement	0.05	100%	0.05	0.00	0.00	0.05
Sidewalk	0.01	100%	0.01	0.00	0.00	0.00
Pasture/Lawn	0.02	0%	0.00	0.02	0.00	0.00

FRONTAGE BASIN	Area (Acres)	Impervious (%)	Impervious (Acres)	Pasture (Acres)	Forested (Acres)	PGIS (Acres)
Frontage	**0.26**	**54%**	**0.14**	**0.12**	**0.00**	**0.08**
Pavement	0.08	100%	0.08	0.00	0.00	0.08
Sidewalk	0.06	100%	0.06	0.00	0.00	0.00
Pasture/Lawn	0.12	0%	0.00	0.12	0.00	0.00

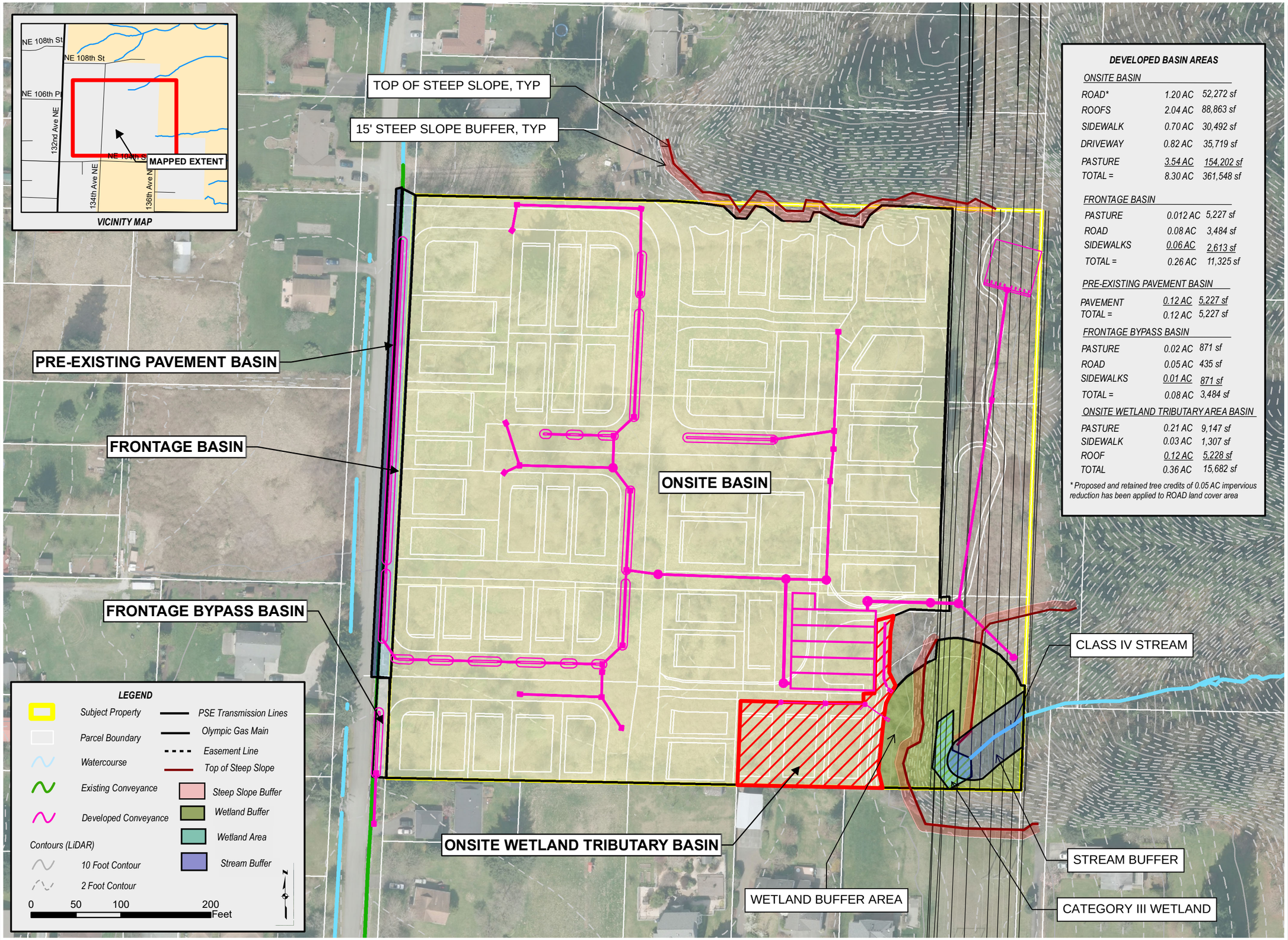
	Area (Acres)	Impervious (%)	Impervious (Acres)	Pasture (Acres)	Forested (Acres)	PGIS (Acres)
EX-FRONTAGE UPSTREAM	**0.12**	**100%**	**0.12**	**0.00**	**0.00**	**0.12**
Pavement	0.12	100%	0.12	0.00	0.00	0.12
Pasture/Lawn	0.00	0%	0.00	0.00	0.00	0.00

	Area (Acres)	Impervious (%)	Impervious (Acres)	Pasture (Acres)	Forested (Acres)	PGIS (Acres)
WETLAND TRIBUTARY AREA BASIN	**0.36**	**42%**	**0.15**	**0.21**	**0.00**	**0.00**
Roofs	0.12	100%	0.12	0.00	0.00	0.00
Sidewalk	0.03	100%	0.03	0.00	0.00	0.00
Pasture/Lawn	0.21	0%	0.00	0.21	0.00	0.00

Total To Vault	**8.68**	**58%**	**5.02**	**3.66**	**0.00**	**2.22**
Total Bypass	**0.44**	**48%**	**0.21**	**0.23**	**0.00**	**0.05**
Total Developed Area**	**9.05**	**57%**	**5.19**	**3.89**	**0.00**	**2.15**
Total Project Related Area**	**9.12**	**57%**	**5.23**	**3.89**	**0.00**	**2.27**

*Pavement area includes 0.05 AC tree impervious credit

** Total developed area does not include 0.05 AC impervious area credit



DEVELOPED BASIN AREAS

ONSITE BASIN		
ROAD*	1.20 AC	52,272 sf
ROOFS	2.04 AC	88,863 sf
SIDEWALK	0.70 AC	30,492 sf
DRIVEWAY	0.82 AC	35,719 sf
PASTURE	3.54 AC	154,202 sf
TOTAL =	8.30 AC	361,548 sf
FRONTAGE BASIN		
PASTURE	0.012 AC	5,227 sf
ROAD	0.08 AC	3,484 sf
SIDEWALKS	0.06 AC	2,613 sf
TOTAL =	0.26 AC	11,325 sf
PRE-EXISTING PAVEMENT BASIN		
PAVEMENT	0.12 AC	5,227 sf
TOTAL =	0.12 AC	5,227 sf
FRONTAGE BYPASS BASIN		
PASTURE	0.02 AC	871 sf
ROAD	0.05 AC	435 sf
SIDEWALKS	0.01 AC	871 sf
TOTAL =	0.08 AC	3,484 sf
ONSITE WETLAND TRIBUTARY AREA BASIN		
PASTURE	0.21 AC	9,147 sf
SIDEWALK	0.03 AC	1,307 sf
ROOF	0.12 AC	5,228 sf
TOTAL	0.36 AC	15,682 sf

* Proposed and retained tree credits of 0.05 AC impervious reduction has been applied to ROAD land cover area

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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www.LDCcorp.com

DR HORTON

ROSEWOOD COURT
DEVELOPED HYDROLOGY MAP

NAD 1983 HARN
STATEPLANE WASHINGTON
NORTH FIPS 4601

REVISION:
JOB NUMBER: C19-104
DRAWING NAME: C19-104-6.0
DESIGNER: CDANBY
DRAWING BY: MJUREWICZ
DATE: 4/8/2020
SCALE: AS SHOWN
JURISDICTION: REDMOND

FIGURE:
6.0

Developed Hydrology Map.mxd | MOD: 4/8/2020 | mjurewicz

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Rosewood Onsite Detenion_51 Lot
Site Name:	
Site Address:	
City:	
Report Date:	4/7/2020
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

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

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Landuse Basin Data
Predeveloped Land Use

Onsite

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	8.3
C, Forest, Steep	0.41
Pervious Total	8.71
Impervious Land Use	acre
Impervious Total	0
Basin Total	8.71

Element Flows To:

Surface	Interflow	Groundwater

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New Frontage

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	0.34
Pervious Total	0.34
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.34

Element Flows To:

Surface	Interflow	Groundwater

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Ex Frontage Upstream

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.12
Impervious Total	0.12
Basin Total	0.12

Element Flows To:

Surface	Interflow	Groundwater

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Mitigated Land Use

Onsite

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Mod	0.33
C, Pasture, Flat	3.21
Pervious Total	3.54
Impervious Land Use	acre
ROADS FLAT	1.2
ROOF TOPS FLAT	2.04
DRIVEWAYS FLAT	0.82
SIDEWALKS FLAT	0.7
Impervious Total	4.76
Basin Total	8.3

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

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Ex Frontage Upstream

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.12
Impervious Total	0.12
Basin Total	0.12

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

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Frontage Collected

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Mod	0.12
Pervious Total	0.12
Impervious Land Use	acre
ROADS FLAT	0.08
SIDEWALKS FLAT	0.06
Impervious Total	0.14
Basin Total	0.26

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

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Frontage Bypass

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Mod	0.02
Pervious Total	0.02
Impervious Land Use	acre
ROADS FLAT	0.05
SIDEWALKS FLAT	0.01
Impervious Total	0.06
Basin Total	0.08

Element Flows To:

Surface	Interflow	Groundwater

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Wetland Tributary Area Basin

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.17
C, Pasture, Mod	0.04
Pervious Total	0.21
Impervious Land Use	acre
ROOF TOPS FLAT	0.12
SIDEWALKS FLAT	0.03
Impervious Total	0.15
Basin Total	0.36

Element Flows To:

Surface	Interflow	Groundwater

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Routing Elements
Predeveloped Routing

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Mitigated Routing

Vault 1

Width:	81.07 ft.	
Length:	100 ft.	
Depth:	11.5 ft.	
Discharge Structure		
Riser Height:	11 ft.	
Riser Diameter:	12 in.	
Notch Type:	Rectangular	
Notch Width:	0.070 ft.	
Notch Height:	0.930 ft.	
Orifice 1 Diameter:	1.46875 in	Elevation:0 ft.
Orifice 2 Diameter:	1.5 in.	Elevation:5.6 ft.
Orifice 3 Diameter:	1.5 in.	Elevation:7.48 ft.
Element Flows To:		
Outlet 1	Outlet 2	

Vault Hydraulic Table

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Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.186	0.000	0.000	0.000
0.1278	0.186	0.023	0.020	0.000
0.2556	0.186	0.047	0.029	0.000
0.3833	0.186	0.071	0.036	0.000
0.5111	0.186	0.095	0.041	0.000
0.6389	0.186	0.118	0.046	0.000
0.7667	0.186	0.142	0.051	0.000
0.8944	0.186	0.166	0.055	0.000
1.0222	0.186	0.190	0.059	0.000
1.1500	0.186	0.214	0.062	0.000
1.2778	0.186	0.237	0.066	0.000
1.4056	0.186	0.261	0.069	0.000
1.5333	0.186	0.285	0.072	0.000
1.6611	0.186	0.309	0.075	0.000
1.7889	0.186	0.332	0.078	0.000
1.9167	0.186	0.356	0.081	0.000
2.0444	0.186	0.380	0.083	0.000
2.1722	0.186	0.404	0.086	0.000
2.3000	0.186	0.428	0.088	0.000
2.4278	0.186	0.451	0.091	0.000
2.5556	0.186	0.475	0.093	0.000
2.6833	0.186	0.499	0.095	0.000
2.8111	0.186	0.523	0.098	0.000
2.9389	0.186	0.547	0.100	0.000
3.0667	0.186	0.570	0.102	0.000
3.1944	0.186	0.594	0.104	0.000
3.3222	0.186	0.618	0.106	0.000
3.4500	0.186	0.642	0.108	0.000
3.5778	0.186	0.665	0.110	0.000
3.7056	0.186	0.689	0.112	0.000
3.8333	0.186	0.713	0.114	0.000
3.9611	0.186	0.737	0.116	0.000
4.0889	0.186	0.761	0.118	0.000
4.2167	0.186	0.784	0.120	0.000
4.3444	0.186	0.808	0.122	0.000

4.4722	0.186	0.832	0.123	0.000
4.6000	0.186	0.856	0.125	0.000
4.7278	0.186	0.879	0.127	0.000
4.8556	0.186	0.903	0.129	0.000
4.9833	0.186	0.927	0.130	0.000
5.1111	0.186	0.951	0.132	0.000
5.2389	0.186	0.975	0.134	0.000
5.3667	0.186	0.998	0.135	0.000
5.4944	0.186	1.022	0.137	0.000
5.6222	0.186	1.046	0.147	0.000
5.7500	0.186	1.070	0.164	0.000
5.8778	0.186	1.093	0.174	0.000
6.0056	0.186	1.117	0.182	0.000
6.1333	0.186	1.141	0.189	0.000
6.2611	0.186	1.165	0.196	0.000
6.3889	0.186	1.189	0.202	0.000
6.5167	0.186	1.212	0.207	0.000
6.6444	0.186	1.236	0.213	0.000
6.7722	0.186	1.260	0.218	0.000
6.9000	0.186	1.284	0.223	0.000
7.0278	0.186	1.307	0.228	0.000
7.1556	0.186	1.331	0.232	0.000
7.2833	0.186	1.355	0.237	0.000
7.4111	0.186	1.379	0.241	0.000
7.5389	0.186	1.403	0.260	0.000
7.6667	0.186	1.426	0.276	0.000
7.7944	0.186	1.450	0.288	0.000
7.9222	0.186	1.474	0.298	0.000
8.0500	0.186	1.498	0.307	0.000
8.1778	0.186	1.522	0.316	0.000
8.3056	0.186	1.545	0.324	0.000
8.4333	0.186	1.569	0.332	0.000
8.5611	0.186	1.593	0.339	0.000
8.6889	0.186	1.617	0.347	0.000
8.8167	0.186	1.640	0.353	0.000
8.9444	0.186	1.664	0.360	0.000
9.0722	0.186	1.688	0.367	0.000
9.2000	0.186	1.712	0.373	0.000
9.3278	0.186	1.736	0.379	0.000
9.4556	0.186	1.759	0.385	0.000
9.5833	0.186	1.783	0.391	0.000
9.7111	0.186	1.807	0.397	0.000
9.8389	0.186	1.831	0.403	0.000
9.9667	0.186	1.854	0.408	0.000
10.094	0.186	1.878	0.415	0.000
10.222	0.186	1.902	0.433	0.000
10.350	0.186	1.926	0.457	0.000
10.478	0.186	1.950	0.485	0.000
10.606	0.186	1.973	0.516	0.000
10.733	0.186	1.997	0.549	0.000
10.861	0.186	2.021	0.583	0.000
10.989	0.186	2.045	0.617	0.000
11.117	0.186	2.068	1.044	0.000
11.244	0.186	2.092	1.813	0.000
11.372	0.186	2.116	2.492	0.000
11.500	0.186	2.140	2.866	0.000
11.628	0.000	0.000	3.139	0.000

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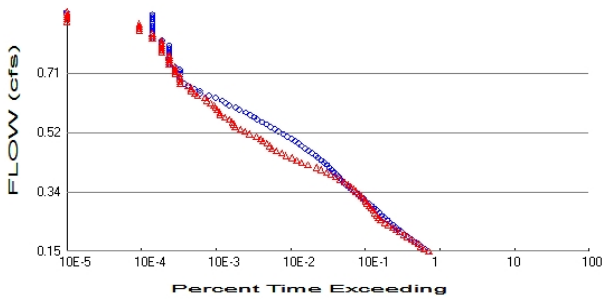
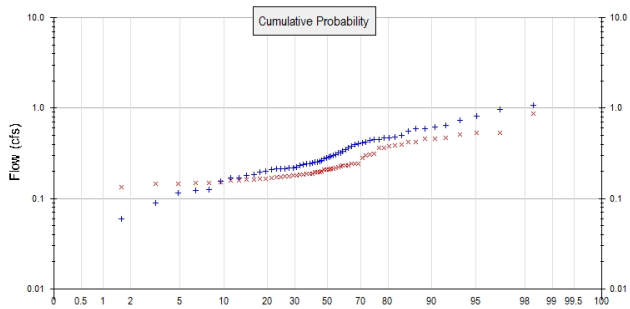
Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 9.05
Total Impervious Area: 0.12

Mitigated Landuse Totals for POC #1
Total Pervious Area: 3.89
Total Impervious Area: 5.23

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.297813
5 year	0.482146
10 year	0.610115
25 year	0.77475
50 year	0.898143
100 year	1.021417

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.225608
5 year	0.330557
10 year	0.413873
25 year	0.53644
50 year	0.641346
100 year	0.758819

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.376	0.198
1950	0.419	0.235
1951	0.621	0.537
1952	0.212	0.148
1953	0.169	0.163
1954	0.242	0.189
1955	0.397	0.187
1956	0.332	0.281
1957	0.293	0.201
1958	0.285	0.213

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1959	0.240	0.163
1960	0.452	0.420
1961	0.238	0.244
1962	0.153	0.134
1963	0.209	0.171
1964	0.301	0.173
1965	0.212	0.243
1966	0.195	0.160
1967	0.471	0.211
1968	0.275	0.180
1969	0.262	0.176
1970	0.211	0.170
1971	0.251	0.216
1972	0.476	0.364
1973	0.218	0.233
1974	0.251	0.221
1975	0.361	0.210
1976	0.260	0.195
1977	0.059	0.164
1978	0.216	0.233
1979	0.123	0.157
1980	0.592	0.380
1981	0.184	0.183
1982	0.417	0.392
1983	0.320	0.196
1984	0.199	0.153
1985	0.115	0.166
1986	0.497	0.304
1987	0.453	0.393
1988	0.180	0.149
1989	0.125	0.145
1990	1.074	0.462
1991	0.590	0.426
1992	0.247	0.207
1993	0.223	0.147
1994	0.088	0.129
1995	0.308	0.229
1996	0.733	0.516
1997	0.562	0.462
1998	0.170	0.182
1999	0.640	0.361
2000	0.233	0.181
2001	0.056	0.176
2002	0.279	0.303
2003	0.407	0.189
2004	0.439	0.474
2005	0.321	0.211
2006	0.351	0.240
2007	0.822	0.875
2008	0.968	0.538
2009	0.472	0.314

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Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	1.0736	0.8748
2	0.9684	0.5377
3	0.8219	0.5370

4	0.7328	0.5165
5	0.6397	0.4736
6	0.6213	0.4623
7	0.5920	0.4616
8	0.5903	0.4262
9	0.5623	0.4198
10	0.4965	0.3929
11	0.4761	0.3916
12	0.4723	0.3805
13	0.4707	0.3645
14	0.4532	0.3611
15	0.4523	0.3138
16	0.4386	0.3040
17	0.4191	0.3029
18	0.4174	0.2812
19	0.4071	0.2435
20	0.3974	0.2429
21	0.3760	0.2403
22	0.3610	0.2348
23	0.3514	0.2333
24	0.3325	0.2331
25	0.3211	0.2294
26	0.3201	0.2210
27	0.3076	0.2159
28	0.3014	0.2131
29	0.2931	0.2114
30	0.2848	0.2107
31	0.2791	0.2100
32	0.2749	0.2073
33	0.2621	0.2013
34	0.2595	0.1980
35	0.2510	0.1959
36	0.2505	0.1948
37	0.2474	0.1891
38	0.2422	0.1890
39	0.2401	0.1875
40	0.2382	0.1833
41	0.2327	0.1824
42	0.2228	0.1809
43	0.2184	0.1804
44	0.2161	0.1761
45	0.2124	0.1759
46	0.2123	0.1726
47	0.2112	0.1713
48	0.2091	0.1698
49	0.1993	0.1662
50	0.1951	0.1636
51	0.1838	0.1634
52	0.1802	0.1634
53	0.1702	0.1599
54	0.1687	0.1568
55	0.1535	0.1533
56	0.1246	0.1490
57	0.1226	0.1476
58	0.1147	0.1467
59	0.0883	0.1451
60	0.0593	0.1339
61	0.0557	0.1289

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Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1489	15051	15188	100	Pass
0.1565	13449	13056	97	Pass
0.1640	12012	11706	97	Pass
0.1716	10857	10799	99	Pass
0.1792	9706	9760	100	Pass
0.1867	8855	8793	99	Pass
0.1943	7978	7863	98	Pass
0.2019	7272	7028	96	Pass
0.2095	6547	6145	93	Pass
0.2170	5957	5478	91	Pass
0.2246	5486	4945	90	Pass
0.2322	5014	4372	87	Pass
0.2397	4644	3918	84	Pass
0.2473	4239	3446	81	Pass
0.2549	3901	3206	82	Pass
0.2624	3570	3020	84	Pass
0.2700	3326	2873	86	Pass
0.2776	3050	2716	89	Pass
0.2851	2793	2552	91	Pass
0.2927	2588	2413	93	Pass
0.3003	2363	2271	96	Pass
0.3078	2165	2147	99	Pass
0.3154	1990	1992	100	Pass
0.3230	1817	1877	103	Pass
0.3305	1670	1750	104	Pass
0.3381	1518	1607	105	Pass
0.3457	1388	1493	107	Pass
0.3532	1256	1364	108	Pass
0.3608	1167	1240	106	Pass
0.3684	1067	1123	105	Pass
0.3759	1006	990	98	Pass
0.3835	937	856	91	Pass
0.3911	867	733	84	Pass
0.3987	807	644	79	Pass
0.4062	756	545	72	Pass
0.4138	702	474	67	Pass
0.4214	652	363	55	Pass
0.4289	600	297	49	Pass
0.4365	548	258	47	Pass
0.4441	498	223	44	Pass
0.4516	462	185	40	Pass
0.4592	408	163	39	Pass
0.4668	369	136	36	Pass
0.4743	333	119	35	Pass
0.4819	301	111	36	Pass
0.4895	271	102	37	Pass
0.4970	242	90	37	Pass
0.5046	218	84	38	Pass
0.5122	190	74	38	Pass
0.5197	170	60	35	Pass
0.5273	146	52	35	Pass
0.5349	131	45	34	Pass
0.5424	114	38	33	Pass

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0.5500	101	37	36	Pass
0.5576	88	35	39	Pass
0.5651	76	32	42	Pass
0.5727	69	28	40	Pass
0.5803	62	24	38	Pass
0.5879	53	24	45	Pass
0.5954	43	22	51	Pass
0.6030	39	21	53	Pass
0.6106	32	20	62	Pass
0.6181	29	18	62	Pass
0.6257	26	16	61	Pass
0.6333	21	15	71	Pass
0.6408	17	12	70	Pass
0.6484	13	11	84	Pass
0.6560	13	10	76	Pass
0.6635	11	10	90	Pass
0.6711	9	9	100	Pass
0.6787	8	7	87	Pass
0.6862	7	7	100	Pass
0.6938	7	7	100	Pass
0.7014	7	7	100	Pass
0.7089	7	6	85	Pass
0.7165	7	6	85	Pass
0.7241	7	6	85	Pass
0.7316	6	6	100	Pass
0.7392	5	5	100	Pass
0.7468	5	5	100	Pass
0.7544	5	5	100	Pass
0.7619	5	5	100	Pass
0.7695	5	5	100	Pass
0.7771	5	4	80	Pass
0.7846	5	4	80	Pass
0.7922	5	4	80	Pass
0.7998	5	4	80	Pass
0.8073	4	4	100	Pass
0.8149	4	4	100	Pass
0.8225	3	3	100	Pass
0.8300	3	3	100	Pass
0.8376	3	3	100	Pass
0.8452	3	2	66	Pass
0.8527	3	2	66	Pass
0.8603	3	2	66	Pass
0.8679	3	2	66	Pass
0.8754	3	0	0	Pass
0.8830	3	0	0	Pass
0.8906	3	0	0	Pass
0.8981	3	0	0	Pass

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Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.689 acre-feet
On-line facility target flow:	0.7941 cfs.
Adjusted for 15 min:	0.7941 cfs.
Off-line facility target flow:	0.446 cfs.
Adjusted for 15 min:	0.446 cfs.

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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
Vault 1 POC	☐	891.63			☐	0.00			
Total Volume Infiltrated		891.63	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

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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.

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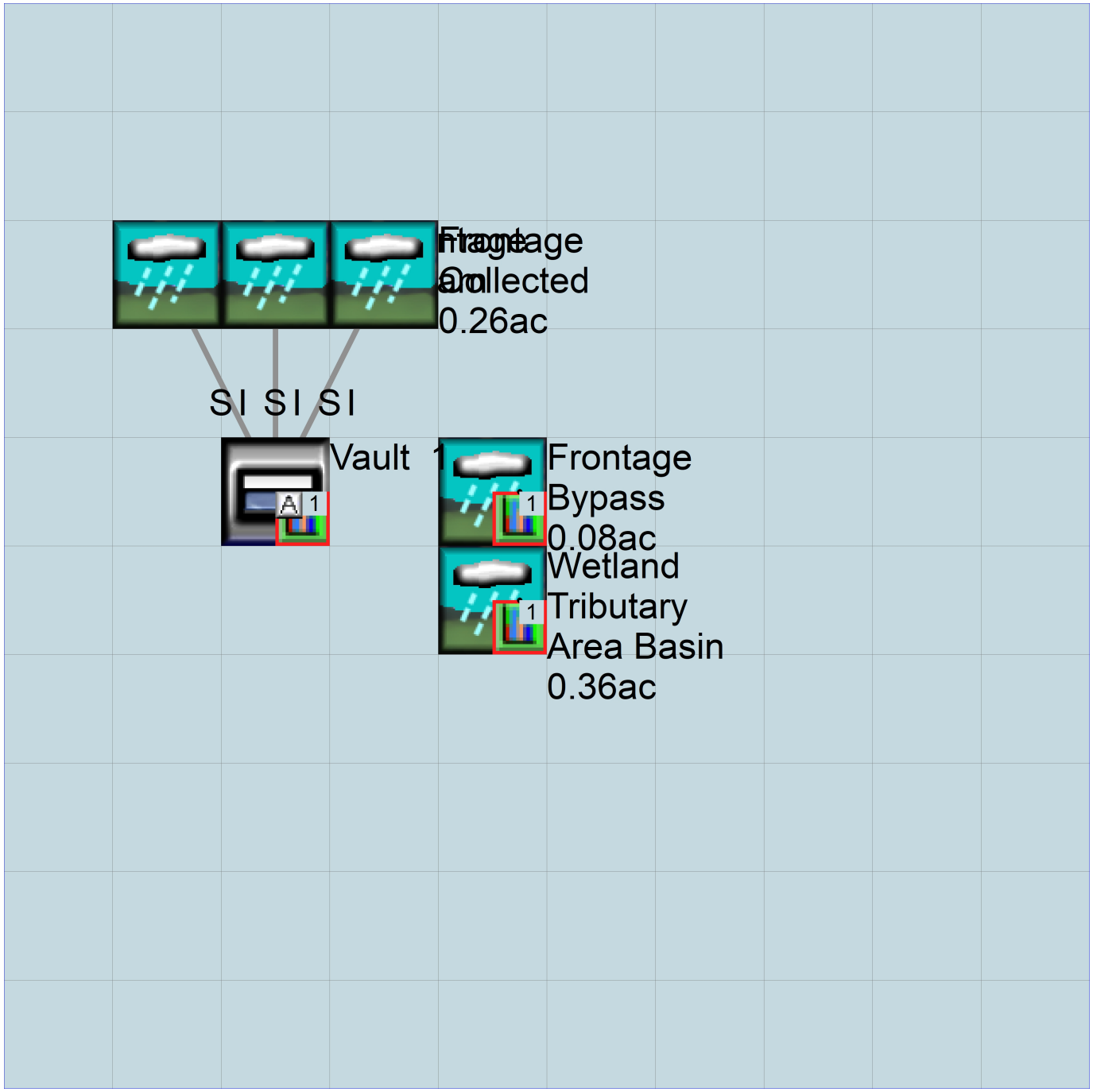
Appendix
Predeveloped Schematic

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM        26   Rosewood Onsite Detenion_51 Lot.wdm
MESSU      25   PreRosewood Onsite Detenion_51 Lot.MES
           27   PreRosewood Onsite Detenion_51 Lot.L61
           28   PreRosewood Onsite Detenion_51 Lot.L62
           30   POCRosewood Onsite Detenion_51 Lot1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      PERLND      12
      IMPLND       1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Onsite                     MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out            ***
   11     C, Forest, Mod          1    1    1    1   27    0
   12     C, Forest, Steep        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
   12         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
```

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```
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   12         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -   # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   11         0    0    0    0    0    0    0    0    0    0    0
   12         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -   # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   11              0       4.5      0.08       400       0.1       0.5     0.996
   12              0       4.5      0.08       400      0.15       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -   # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   11              0         0         2         2         0         0         0
   12              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                  ***
    # -   #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11            0.2       0.5      0.35         6       0.5       0.7
   12            0.2       0.3      0.35         6       0.3       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -   # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   11              0         0         0         0       2.5         1         0
   12              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -   #                     User  t-series Engl Metr ***
                                       in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -   # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -   # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -   # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
```

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```
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Onsite***
PERLND  11                        8.3     COPY   501     12
PERLND  11                        8.3     COPY   501     13
PERLND  12                       0.41     COPY   501     12
PERLND  12                       0.41     COPY   501     13
New Frontage***
PERLND  11                       0.34     COPY   501     12
PERLND  11                       0.34     COPY   501     13
Ex Frontage Upstream***
IMPLND   1                       0.12     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<-----------------><---> User T-series  Engl Metr LKFG            ***
                                       in  out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
```

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```
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1      48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

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Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM        26   Rosewood Onsite Detenion_51 Lot.wdm
MESSU      25   MitRosewood Onsite Detenion_51 Lot.MES
           27   MitRosewood Onsite Detenion_51 Lot.L61
           28   MitRosewood Onsite Detenion_51 Lot.L62
           30   POCRosewood Onsite Detenion_51 Lot1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      14
      PERLND      13
      IMPLND       1
      IMPLND       4
      IMPLND       5
      IMPLND       8
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Vault  1                   MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
   14     C, Pasture, Mod         1    1    1    1   27    0
   13     C, Pasture, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
```

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```
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   14         0    0    1    0    0    0    0    0    0    0    0    0
   13         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -   # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   14         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -   # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   14         0    0    0    0    0    0    0    0    0    0    0
   13         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -   # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   14              0       4.5      0.06       400       0.1       0.5     0.996
   13              0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -   # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   14              0         0         2         2         0         0         0
   13              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -   #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   14           0.15       0.4       0.3         6       0.5       0.4
   13           0.15       0.4       0.3         6       0.5       0.4
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -   # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   14              0         0         0         0       2.5         1         0
   13              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -   #                     User  t-series Engl Metr ***
                                       in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    5      DRIVEWAYS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -   # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    5         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY
```

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```
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
    5         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    5         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    5              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
    5              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK    ***
<Name>   #                  <-factor->     <Name>   #   Tbl#    ***
Onsite***
PERLND  14                        0.33     RCHRES   1      2
PERLND  14                        0.33     RCHRES   1      3
PERLND  13                        3.21     RCHRES   1      2
PERLND  13                        3.21     RCHRES   1      3
IMPLND   1                         1.2     RCHRES   1      5
IMPLND   4                        2.04     RCHRES   1      5
IMPLND   5                        0.82     RCHRES   1      5
IMPLND   8                         0.7     RCHRES   1      5
Ex Frontage Upstream***
IMPLND   1                        0.12     RCHRES   1      5
Frontage Collected***
PERLND  14                        0.12     RCHRES   1      2
PERLND  14                        0.12     RCHRES   1      3
IMPLND   1                        0.08     RCHRES   1      5
IMPLND   8                        0.06     RCHRES   1      5
Frontage Bypass***
PERLND  14                        0.02     COPY   501     12
PERLND  14                        0.02     COPY   601     12
PERLND  14                        0.02     COPY   501     13
```

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```
PERLND  14                        0.02     COPY   601     13
IMPLND   1                        0.05     COPY   501     15
IMPLND   1                        0.05     COPY   601     15
IMPLND   8                        0.01     COPY   501     15
IMPLND   8                        0.01     COPY   601     15
Wetland Tributary Area Basin***
PERLND  13                        0.17     COPY   501     12
PERLND  13                        0.17     COPY   601     12
PERLND  13                        0.17     COPY   501     13
PERLND  13                        0.17     COPY   601     13
PERLND  14                        0.04     COPY   501     12
PERLND  14                        0.04     COPY   601     12
PERLND  14                        0.04     COPY   501     13
PERLND  14                        0.04     COPY   601     13
IMPLND   4                        0.12     COPY   501     15
IMPLND   4                        0.12     COPY   601     15
IMPLND   8                        0.03     COPY   501     15
IMPLND   8                        0.03     COPY   601     15

******Routing******
PERLND  14                        0.33     COPY     1     12
PERLND  13                        3.21     COPY     1     12
IMPLND   1                         1.2     COPY     1     15
IMPLND   4                        2.04     COPY     1     15
IMPLND   5                        0.82     COPY     1     15
IMPLND   8                         0.7     COPY     1     15
PERLND  14                        0.33     COPY     1     13
PERLND  13                        3.21     COPY     1     13
IMPLND   1                        0.12     COPY     1     15
PERLND  14                        0.12     COPY     1     12
IMPLND   1                        0.08     COPY     1     15
IMPLND   8                        0.06     COPY     1     15
PERLND  14                        0.12     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<-----------------><---> User T-series  Engl Metr LKFG             ***
                                          in  out                             ***
    1     Vault  1                1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
```

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```
    # -   #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
             FG FG FG FG  possible  exit  *** possible  exit      possible  exit
              *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1         0  1  0  0    4  0  0  0  0       0  0  0  0  0        2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -   #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.02       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -   # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.186111  0.000000  0.000000
  0.127778  0.186111  0.023781  0.020926
  0.255556  0.186111  0.047562  0.029594
  0.383333  0.186111  0.071343  0.036245
  0.511111  0.186111  0.095123  0.041852
  0.638889  0.186111  0.118904  0.046792
  0.766667  0.186111  0.142685  0.051258
  0.894444  0.186111  0.166466  0.055364
  1.022222  0.186111  0.190247  0.059187
  1.150000  0.186111  0.214028  0.062777
  1.277778  0.186111  0.237809  0.066173
  1.405556  0.186111  0.261590  0.069403
  1.533333  0.186111  0.285370  0.072489
  1.661111  0.186111  0.309151  0.075449
  1.788889  0.186111  0.332932  0.078297
  1.916667  0.186111  0.356713  0.081045
  2.044444  0.186111  0.380494  0.083703
  2.172222  0.186111  0.404275  0.086279
  2.300000  0.186111  0.428056  0.088781
  2.427778  0.186111  0.451836  0.091213
  2.555556  0.186111  0.475617  0.093583
  2.683333  0.186111  0.499398  0.095894
  2.811111  0.186111  0.523179  0.098151
  2.938889  0.186111  0.546960  0.100357
  3.066667  0.186111  0.570741  0.102515
  3.194444  0.186111  0.594522  0.104629
  3.322222  0.186111  0.618302  0.106701
  3.450000  0.186111  0.642083  0.108734
  3.577778  0.186111  0.665864  0.110729
  3.705556  0.186111  0.689645  0.112689
  3.833333  0.186111  0.713426  0.114615
  3.961111  0.186111  0.737207  0.116510
  4.088889  0.186111  0.760988  0.118374
  4.216667  0.186111  0.784769  0.120210
  4.344444  0.186111  0.808549  0.122017
  4.472222  0.186111  0.832330  0.123799
  4.600000  0.186111  0.856111  0.125555
  4.727778  0.186111  0.879892  0.127287
  4.855556  0.186111  0.903673  0.128995
  4.983333  0.186111  0.927454  0.130682
  5.111111  0.186111  0.951235  0.132346
  5.238889  0.186111  0.975015  0.133991
  5.366667  0.186111  0.998796  0.135615
```

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```
  5.494444  0.186111  1.022577  0.137220
  5.622222  0.186111  1.046358  0.147908
  5.750000  0.186111  1.070139  0.164022
  5.877778  0.186111  1.093920  0.174106
  6.005556  0.186111  1.117701  0.182344
  6.133333  0.186111  1.141481  0.189569
  6.261111  0.186111  1.165262  0.196126
  6.388889  0.186111  1.189043  0.202199
  6.516667  0.186111  1.212824  0.207899
  6.644444  0.186111  1.236605  0.213298
  6.772222  0.186111  1.260386  0.218449
  6.900000  0.186111  1.284167  0.223389
  7.027778  0.186111  1.307948  0.228148
  7.155556  0.186111  1.331728  0.232747
  7.283333  0.186111  1.355509  0.237205
  7.411111  0.186111  1.379290  0.241536
  7.538889  0.186111  1.403071  0.260570
  7.666667  0.186111  1.426852  0.276247
  7.794444  0.186111  1.450633  0.288123
  7.922222  0.186111  1.474414  0.298418
  8.050000  0.186111  1.498194  0.307762
  8.177778  0.186111  1.521975  0.316441
  8.305556  0.186111  1.545756  0.324618
  8.433333  0.186111  1.569537  0.332394
  8.561111  0.186111  1.593318  0.339838
  8.688889  0.186111  1.617099  0.347002
  8.816667  0.186111  1.640880  0.353922
  8.944444  0.186111  1.664660  0.360628
  9.072222  0.186111  1.688441  0.367143
  9.200000  0.186111  1.712222  0.373487
  9.327778  0.186111  1.736003  0.379675
  9.455556  0.186111  1.759784  0.385721
  9.583333  0.186111  1.783565  0.391635
  9.711111  0.186111  1.807346  0.397428
  9.838889  0.186111  1.831127  0.403109
  9.966667  0.186111  1.854907  0.408685
  10.09444  0.186111  1.878688  0.415048
  10.22222  0.186111  1.902469  0.432969
  10.35000  0.186111  1.926250  0.457446
  10.47778  0.186111  1.950031  0.485806
  10.60556  0.186111  1.973812  0.516767
  10.73333  0.186111  1.997593  0.549482
  10.86111  0.186111  2.021373  0.583316
  10.98889  0.186111  2.045154  0.617760
  11.11667  0.186111  2.068935  1.044149
  11.24444  0.186111  2.092716  1.813560
  11.37222  0.186111  2.116497  2.492002
  11.50000  0.186111  2.140278  2.866547
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY   601 OUTPUT MEAN   1 1     48.4      WDM    901 FLOW     ENGL      REPL
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
END EXT TARGETS
```

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```
MASS-LINK
<Volume>    <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK         2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK     2

  MASS-LINK         3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK     3

  MASS-LINK         5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK     5

  MASS-LINK        12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    12

  MASS-LINK        13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    13

  MASS-LINK        15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK    15

  MASS-LINK        16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK    16


END MASS-LINK

END RUN
```

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Predeveloped HSPF Message File

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Mitigated HSPF Message File

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APPENDIX 4-C

FIGURE 7.0 WETLAND TRIBUTARY AREA MAP

WWHM WETLAND HYDRATION OUTPUT

WWHM2012
PROJECT REPORT

Project Name: Wetland Hydration Calc
Site Name:
Site Address:
City :
Report Date: 3/2/2020
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
(adjusted) **Precip Scale:** 0.00
Version Date: 2019/09/13
Version : 4.2.17

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : PreDev Wetland Cont Area.
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	1.8
Pervious Total	0

Impervious Land Use	acre
ROADS FLAT	0.12
Impervious Total	0
Basin Total	0

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Wetland Bypass
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	.04

C, Pasture, Flat	.17
Pervious Total	0

Impervious Land Use	acre
ROOF TOPS FLAT	0.12
SIDEWALKS FLAT	0.03
Impervious Total	0
Basin Total	0

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.8
Total Impervious Area:0.12

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.21
Total Impervious Area:0.15

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.084884
5 year	0.125067
10 year	0.155128
25 year	0.197126
50 year	0.231393
100 year	0.268274

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.061392
5 year	0.079153
10 year	0.091665
25 year	0.108366
50 year	0.121477
100 year	0.135179

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.121	0.085

1950	0.119	0.080
1951	0.140	0.055
1952	0.063	0.041
1953	0.049	0.044
1954	0.067	0.051
1955	0.095	0.056
1956	0.090	0.055
1957	0.094	0.066
1958	0.072	0.050
1959	0.063	0.049
1960	0.119	0.059
1961	0.074	0.056
1962	0.044	0.045
1963	0.070	0.054
1964	0.080	0.049
1965	0.078	0.066
1966	0.062	0.045
1967	0.131	0.073
1968	0.084	0.080
1969	0.078	0.059
1970	0.075	0.058
1971	0.082	0.068
1972	0.113	0.074
1973	0.059	0.040
1974	0.081	0.062
1975	0.108	0.068
1976	0.079	0.051
1977	0.039	0.049
1978	0.063	0.060
1979	0.065	0.081
1980	0.161	0.090
1981	0.065	0.064
1982	0.132	0.093
1983	0.081	0.069
1984	0.058	0.046
1985	0.049	0.060
1986	0.117	0.058
1987	0.117	0.080
1988	0.048	0.048
1989	0.048	0.061
1990	0.276	0.140
1991	0.167	0.097
1992	0.073	0.046
1993	0.058	0.038
1994	0.032	0.040
1995	0.079	0.056
1996	0.176	0.069
1997	0.131	0.064
1998	0.061	0.056
1999	0.171	0.114
2000	0.075	0.061
2001	0.051	0.062
2002	0.082	0.080
2003	0.116	0.068
2004	0.120	0.112
2005	0.093	0.056
2006	0.091	0.051

2007	0.219	0.121
2008	0.228	0.097
2009	0.128	0.074

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.2756	0.1397
2	0.2282	0.1210
3	0.2187	0.1143
4	0.1761	0.1119
5	0.1709	0.0971
6	0.1672	0.0967
7	0.1607	0.0929
8	0.1405	0.0896
9	0.1321	0.0846
10	0.1311	0.0815
11	0.1310	0.0801
12	0.1276	0.0799
13	0.1209	0.0798
14	0.1204	0.0798
15	0.1188	0.0744
16	0.1185	0.0740
17	0.1171	0.0734
18	0.1169	0.0695
19	0.1158	0.0687
20	0.1127	0.0683
21	0.1079	0.0678
22	0.0953	0.0676
23	0.0944	0.0661
24	0.0925	0.0661
25	0.0905	0.0639
26	0.0896	0.0637
27	0.0844	0.0622
28	0.0824	0.0622
29	0.0823	0.0612
30	0.0808	0.0605
31	0.0805	0.0602
32	0.0802	0.0601
33	0.0795	0.0595
34	0.0794	0.0586
35	0.0777	0.0584
36	0.0776	0.0580
37	0.0753	0.0563
38	0.0750	0.0562
39	0.0738	0.0559
40	0.0725	0.0558
41	0.0720	0.0557
42	0.0697	0.0554
43	0.0675	0.0547
44	0.0653	0.0536
45	0.0652	0.0514
46	0.0632	0.0510
47	0.0631	0.0505
48	0.0631	0.0502
49	0.0615	0.0494

50	0.0613	0.0487
51	0.0592	0.0485
52	0.0582	0.0484
53	0.0576	0.0462
54	0.0509	0.0461
55	0.0492	0.0447
56	0.0490	0.0446
57	0.0484	0.0445
58	0.0475	0.0413
59	0.0436	0.0404
60	0.0393	0.0401
61	0.0323	0.0382

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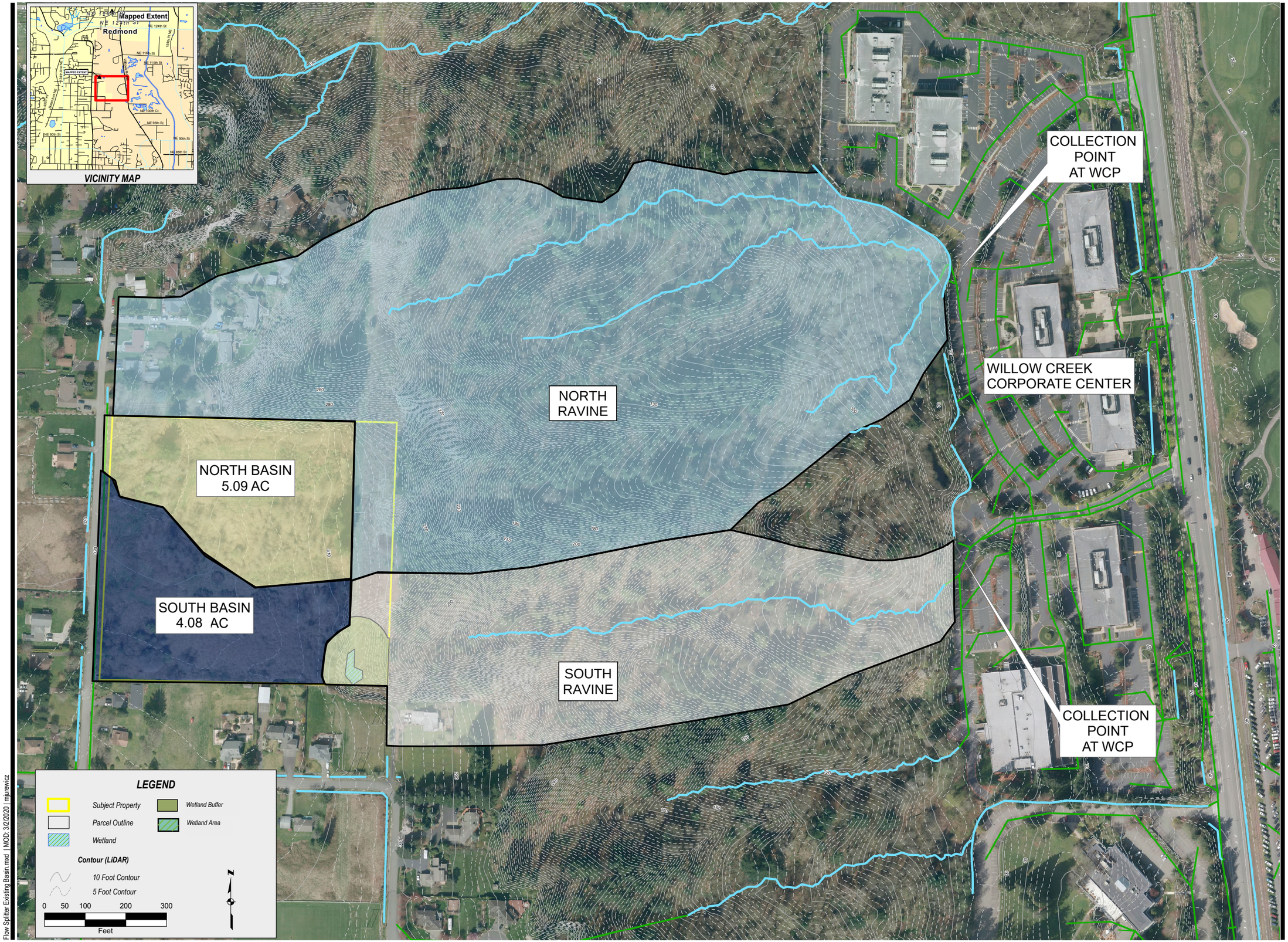
APPENDIX 4-D

FIGURE 8.0 FLOW SPLITTER TRIBUTARY MAP

PRE- & POST-DEVELOPED FLOW SUMMARY

WWHM – NORTH AND SOUTH FLOW SPLIT OUTPUT



Flow Splitter Existing Basin.mxd | MOD: 3/2/2020 | mjurewicz

SOURCE INFORMATION

SOURCE AGENCY	DESCRIPTION
PUGET SOUND LIDAR CONSORTIUM	CONTOURS - GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.
KING COUNTY GIS	PARCEL BOUNDARY
KING COUNTY	WETLAND, HYDROLOGY, CONTOUR DATA

LDC
Surveying
Engineering
Planning
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Kent, WA 98030
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DR HORTON

ROSEWOOD COURT
FLOW SPLITTER TRIBUTARY MAP

PROJECTION: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, FEET

REVISION:
JOB NUMBER: 18-100
DRAWING NAME: 19-104F07
DESIGNER: M.COVERT
DRAWING BY: D.KNIGHT
DATE: 12-31-18
SCALE: AS SHOWN
JURISDICTION: REDMOND

FIGURE:

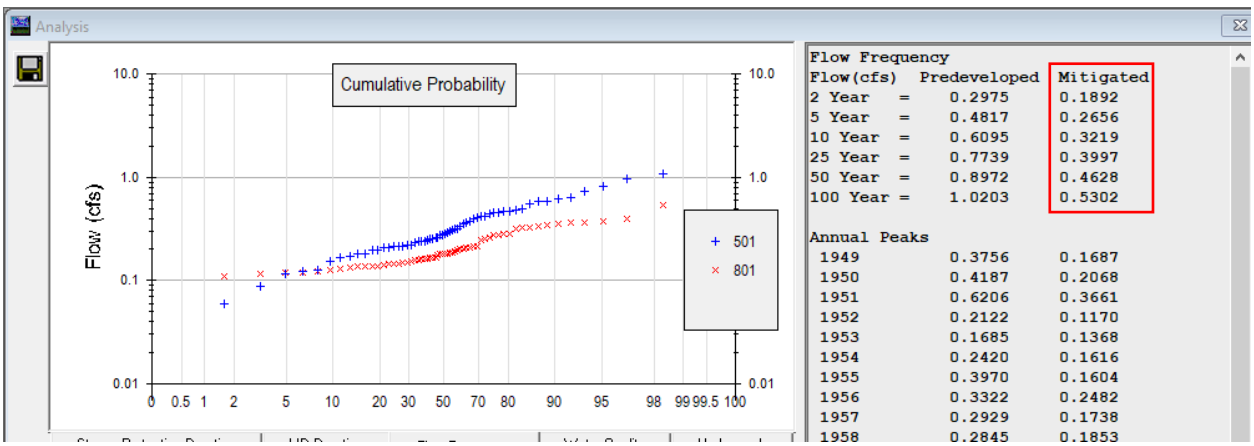
8.0

North Discharge

Predeveloped Flows

```
Flow Frequency
Flow(cfs)   Predeveloped
2 Year    =     0.1629
5 Year    =     0.2667
10 Year   =     0.3373
25 Year   =     0.4263
50 Year   =     0.4915
100 Year  =     0.5555
```

Mitigated Flow Splitter North Discharge Flows



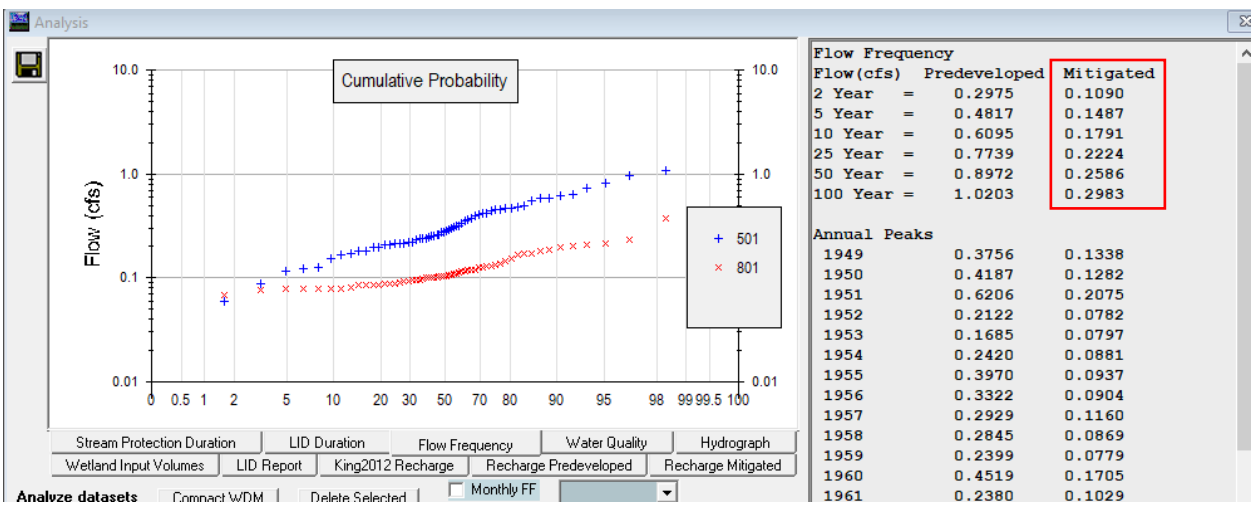

```
Flow Frequency
Flow(cfs)   Predeveloped   Mitigated
2 Year    =     0.2975     0.1892
5 Year    =     0.4817     0.2656
10 Year   =     0.6095     0.3219
25 Year   =     0.7739     0.3997
50 Year   =     0.8972     0.4628
100 Year  =     1.0203     0.5302

Annual Peaks
 1949           0.3756     0.1687
 1950           0.4187     0.2068
 1951           0.6206     0.3661
 1952           0.2122     0.1170
 1953           0.1685     0.1368
 1954           0.2420     0.1616
 1955           0.3970     0.1604
 1956           0.3322     0.2482
 1957           0.2929     0.1738
 1958           0.2845     0.1853
```

South Discharge

Predeveloped Flows

```
Flow Frequency
Flow(cfs)  Predeveloped
2 Year   =     0.1340
5 Year   =     0.2150
10 Year  =     0.2738
25 Year  =     0.3529
50 Year  =     0.4149
100 Year =     0.4791
```

Mitigated Flow Splitter South Discharge Flows




```
Flow Frequency
Flow(cfs)  Predeveloped  Mitigated
2 Year   =     0.2975     0.1090
5 Year   =     0.4817     0.1487
10 Year  =     0.6095     0.1791
25 Year  =     0.7739     0.2224
50 Year  =     0.8972     0.2586
100 Year =     1.0203     0.2983

Annual Peaks
 1949          0.3756     0.1338
 1950          0.4187     0.1282
 1951          0.6206     0.2075
 1952          0.2122     0.0782
 1953          0.1685     0.0797
 1954          0.2420     0.0881
 1955          0.3970     0.0937
 1956          0.3322     0.0904
 1957          0.2929     0.1160
 1958          0.2845     0.0869
 1959          0.2399     0.0779
 1960          0.4519     0.1705
 1961          0.2380     0.1029
```

WWHM2012
PROJECT REPORT

Project Name: NORTH FLOW SPLITTER OUTPUT
Site Name:
Site Address:
City :
Report Date: 4/7/2020
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
(adjusted) **Precip Scale:** 0.00
Version Date: 2019/09/13
Version : 4.2.17

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Onsite
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	8.3
C, Forest, Steep	.41
Pervious Total	8.71

Impervious Land Use	acre
Impervious Total	0
Basin Total	8.71

Element Flows To:

Surface	Interflow	Groundwater

Name : New Frontage
Bypass: No

GroundWater: No

Pervious Land Use	acre

C, Forest, Mod	.34
Pervious Total	**0.34**

Impervious Land Use	acre
Impervious Total	**0**
Basin Total	**0.34**

Element Flows To:

Surface	Interflow	Groundwater

Name : Ex Frontage Upstream
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	**0**

Impervious Land Use	acre
ROADS FLAT	0.12
Impervious Total	**0.12**
Basin Total	**0.12**

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Onsite
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	.33
C, Pasture, Flat	3.21
Pervious Total	**3.54**

Impervious Land Use	acre
ROADS FLAT	1.2
ROOF TOPS FLAT	2.04
DRIVEWAYS FLAT	0.82
SIDEWALKS FLAT	0.7
Impervious Total	4.76
Basin Total	8.3

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Ex Frontage Upstream
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
ROADS FLAT	0.12
Impervious Total	0.12
Basin Total	0.12

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Frontage Collected
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	.12
Pervious Total	0.12

Impervious Land Use	acre
ROADS FLAT	0.08
SIDEWALKS FLAT	0.06

Impervious Total 0.14

Basin Total 0.26

Element Flows To:

Surface	**Interflow**	**Groundwater**
Vault 1	Vault 1	

Name : Frontage Bypass
Bypass: Yes

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**.02**

Pervious Total 0.02

Impervious Land Use	**acre**
ROADS FLAT	**0.05**
SIDEWALKS FLAT	**0.01**

Impervious Total 0.06

Basin Total 0.08

Element Flows To:

Surface	**Interflow**	**Groundwater**

Name : Vault 1
Width : 81.07 ft.
Length : 100 ft.
Depth: 11.5 ft.
Discharge Structure
Riser Height: 11 ft.
Riser Diameter: 12 in.
Notch Type: Rectangular
Notch Width: 0.070 ft.
Notch Height: 0.930 ft.
Orifice 1 Diameter: 1.46875 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 1.5 in. **Elevation:** 5.6 ft.
Orifice 3 Diameter: 1.5 in. **Elevation:** 7.48 ft.

Element Flows To:

Outlet 1	**Outlet 2**

Flow Splitter 1

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.186	0.000	0.000	0.000
0.1278	0.186	0.023	0.020	0.000
0.2556	0.186	0.047	0.029	0.000
0.3833	0.186	0.071	0.036	0.000
0.5111	0.186	0.095	0.041	0.000
0.6389	0.186	0.118	0.046	0.000
0.7667	0.186	0.142	0.051	0.000
0.8944	0.186	0.166	0.055	0.000
1.0222	0.186	0.190	0.059	0.000
1.1500	0.186	0.214	0.062	0.000
1.2778	0.186	0.237	0.066	0.000
1.4056	0.186	0.261	0.069	0.000
1.5333	0.186	0.285	0.072	0.000
1.6611	0.186	0.309	0.075	0.000
1.7889	0.186	0.332	0.078	0.000
1.9167	0.186	0.356	0.081	0.000
2.0444	0.186	0.380	0.083	0.000
2.1722	0.186	0.404	0.086	0.000
2.3000	0.186	0.428	0.088	0.000
2.4278	0.186	0.451	0.091	0.000
2.5556	0.186	0.475	0.093	0.000
2.6833	0.186	0.499	0.095	0.000
2.8111	0.186	0.523	0.098	0.000
2.9389	0.186	0.547	0.100	0.000
3.0667	0.186	0.570	0.102	0.000
3.1944	0.186	0.594	0.104	0.000
3.3222	0.186	0.618	0.106	0.000
3.4500	0.186	0.642	0.108	0.000
3.5778	0.186	0.665	0.110	0.000
3.7056	0.186	0.689	0.112	0.000
3.8333	0.186	0.713	0.114	0.000
3.9611	0.186	0.737	0.116	0.000
4.0889	0.186	0.761	0.118	0.000
4.2167	0.186	0.784	0.120	0.000
4.3444	0.186	0.808	0.122	0.000
4.4722	0.186	0.832	0.123	0.000
4.6000	0.186	0.856	0.125	0.000
4.7278	0.186	0.879	0.127	0.000
4.8556	0.186	0.903	0.129	0.000
4.9833	0.186	0.927	0.130	0.000
5.1111	0.186	0.951	0.132	0.000
5.2389	0.186	0.975	0.134	0.000
5.3667	0.186	0.998	0.135	0.000
5.4944	0.186	1.022	0.137	0.000
5.6222	0.186	1.046	0.147	0.000
5.7500	0.186	1.070	0.164	0.000
5.8778	0.186	1.093	0.174	0.000
6.0056	0.186	1.117	0.182	0.000
6.1333	0.186	1.141	0.189	0.000
6.2611	0.186	1.165	0.196	0.000

6.3889	0.186	1.189	0.202	0.000
6.5167	0.186	1.212	0.207	0.000
6.6444	0.186	1.236	0.213	0.000
6.7722	0.186	1.260	0.218	0.000
6.9000	0.186	1.284	0.223	0.000
7.0278	0.186	1.307	0.228	0.000
7.1556	0.186	1.331	0.232	0.000
7.2833	0.186	1.355	0.237	0.000
7.4111	0.186	1.379	0.241	0.000
7.5389	0.186	1.403	0.260	0.000
7.6667	0.186	1.426	0.276	0.000
7.7944	0.186	1.450	0.288	0.000
7.9222	0.186	1.474	0.298	0.000
8.0500	0.186	1.498	0.307	0.000
8.1778	0.186	1.522	0.316	0.000
8.3056	0.186	1.545	0.324	0.000
8.4333	0.186	1.569	0.332	0.000
8.5611	0.186	1.593	0.339	0.000
8.6889	0.186	1.617	0.347	0.000
8.8167	0.186	1.640	0.353	0.000
8.9444	0.186	1.664	0.360	0.000
9.0722	0.186	1.688	0.367	0.000
9.2000	0.186	1.712	0.373	0.000
9.3278	0.186	1.736	0.379	0.000
9.4556	0.186	1.759	0.385	0.000
9.5833	0.186	1.783	0.391	0.000
9.7111	0.186	1.807	0.397	0.000
9.8389	0.186	1.831	0.403	0.000
9.9667	0.186	1.854	0.408	0.000
10.094	0.186	1.878	0.415	0.000
10.222	0.186	1.902	0.433	0.000
10.350	0.186	1.926	0.457	0.000
10.478	0.186	1.950	0.485	0.000
10.606	0.186	1.973	0.516	0.000
10.733	0.186	1.997	0.549	0.000
10.861	0.186	2.021	0.583	0.000
10.989	0.186	2.045	0.617	0.000
11.117	0.186	2.068	1.044	0.000
11.244	0.186	2.092	1.813	0.000
11.372	0.186	2.116	2.492	0.000
11.500	0.186	2.140	2.866	0.000
11.628	0.000	0.000	3.139	0.000

Name : Wetland Tributary Area Basin
Bypass: Yes

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Flat	**.17**
C, Pasture, Mod	**.04**
Pervious Total	**0.21**

Impervious Land Use	**acre**
ROOF TOPS FLAT	**0.12**

SIDEWALKS FLAT	**0.03**
Impervious Total	**0.15**
Basin Total	**0.36**

Element Flows To:

Surface	**Interflow**	**Groundwater**

Name : Flow Splitter 1
Bottom Length: 10.00 ft.
Bottom Length: 10.00 ft.
Depth: 10 ft.
Side slope 1: 0 To 1
Side slope 2: 0 To 1
Side slope 3: 0 To 1
Side slope 4: 0 To 1

Structure Splitter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Primary(cfs)	Secondary(cfs)
0.000	0.002	0.000	0.000	0.000
0.111	0.002	0.000	0.002	0.005
0.222	0.002	0.000	0.003	0.007
0.333	0.002	0.000	0.003	0.008
0.444	0.002	0.001	0.004	0.010
0.555	0.002	0.001	0.005	0.015
0.666	0.002	0.001	0.005	0.018
0.777	0.002	0.001	0.006	0.021
0.888	0.002	0.002	0.006	0.023
1.000	0.002	0.002	0.006	0.026
1.111	0.002	0.002	0.009	0.030
1.222	0.002	0.002	0.010	0.033
1.333	0.002	0.003	0.011	0.036
1.444	0.002	0.003	0.012	0.038
1.555	0.002	0.003	0.013	0.040
1.666	0.002	0.003	0.014	0.042
1.777	0.002	0.004	0.015	0.044
1.888	0.002	0.004	0.015	0.046
2.000	0.002	0.004	0.016	0.047
2.111	0.002	0.004	0.017	0.049
2.222	0.002	0.005	0.017	0.051
2.333	0.002	0.005	0.018	0.052
2.444	0.002	0.005	0.018	0.054
2.555	0.002	0.005	0.019	0.055
2.666	0.002	0.006	0.020	0.057
2.777	0.002	0.006	0.021	0.058
2.888	0.002	0.006	0.021	0.060
3.000	0.002	0.006	0.022	0.061
3.111	0.002	0.007	0.023	0.062
3.222	0.002	0.007	0.023	0.064
3.333	0.002	0.007	0.024	0.065
3.444	0.002	0.007	0.024	0.066

3.555	0.002	0.008	0.025	0.075
3.666	0.002	0.008	0.025	0.095
3.777	0.002	0.008	0.026	0.122
3.888	0.002	0.008	0.026	0.152
4.000	0.002	0.009	0.027	0.185
4.111	0.002	0.009	0.417	0.576
4.222	0.002	0.009	1.074	1.234
4.333	0.002	0.009	1.712	1.872
4.444	0.002	0.010	2.117	2.278
4.555	0.002	0.010	2.377	2.538
4.666	0.002	0.010	2.601	2.763
4.777	0.002	0.011	2.808	2.970
4.888	0.002	0.011	3.000	3.163
5.000	0.002	0.011	3.181	3.344
5.111	0.002	0.011	3.351	3.516
5.222	0.002	0.012	3.514	3.679
5.333	0.002	0.012	3.669	3.835
5.444	0.002	0.012	3.818	3.984
5.555	0.002	0.012	3.961	4.128
5.666	0.002	0.013	4.100	4.267
5.777	0.002	0.013	4.233	4.401
5.888	0.002	0.013	4.363	4.531
6.000	0.002	0.013	4.489	4.657
6.111	0.002	0.014	4.611	4.780
6.222	0.002	0.014	4.730	4.900
6.333	0.002	0.014	4.847	5.017
6.444	0.002	0.014	4.960	5.131
6.555	0.002	0.015	5.071	5.243
6.666	0.002	0.015	5.180	5.352
6.777	0.002	0.015	5.286	5.459
6.888	0.002	0.015	5.391	5.563
7.000	0.002	0.016	5.493	5.666
7.111	0.002	0.016	5.593	5.767
7.222	0.002	0.016	5.692	5.866
7.333	0.002	0.016	5.789	5.964
7.444	0.002	0.017	5.885	6.060
7.555	0.002	0.017	5.978	6.154
7.666	0.002	0.017	6.071	6.247
7.777	0.002	0.017	6.162	6.338
7.888	0.002	0.018	6.252	6.429
8.000	0.002	0.018	6.340	6.517
8.111	0.002	0.018	6.427	6.605
8.222	0.002	0.018	6.513	6.692
8.333	0.002	0.019	6.598	6.777
8.444	0.002	0.019	6.682	6.861
8.555	0.002	0.019	6.765	6.944
8.666	0.002	0.019	6.846	7.027
8.777	0.002	0.020	6.927	7.108
8.888	0.002	0.020	7.007	7.188
9.000	0.002	0.020	7.086	7.268
9.111	0.002	0.020	7.164	7.346
9.222	0.002	0.021	7.242	7.424
9.333	0.002	0.021	7.318	7.501
9.444	0.002	0.021	7.394	7.577
9.555	0.002	0.021	7.469	7.652
9.666	0.002	0.022	7.543	7.727
9.777	0.002	0.022	7.616	7.801

9.888	0.002	0.022	7.689	7.874
10.00	0.002	0.023	7.761	7.946
10.11	0.002	0.023	7.832	8.018

Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 0.5 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 0.5 in. **Elevation:** 1 ft.
Orifice 3 Diameter: 0.25 in. **Elevation:** 2.5 ft.

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

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:9.05
Total Impervious Area:0.12

Mitigated Landuse Totals for POC #1
Total Pervious Area:3.89
Total Impervious Area:5.23

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.29753
5 year	0.481656
10 year	0.609476
25 year	0.773913
50 year	0.897155
100 year	1.020276

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.189165
5 year	0.26558
10 year	0.321885
25 year	0.399742
50 year	0.462763
100 year	0.530214

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.376	0.169
1950	0.419	0.207
1951	0.621	0.366
1952	0.212	0.117
1953	0.169	0.137
1954	0.242	0.162
1955	0.397	0.160
1956	0.332	0.248
1957	0.293	0.174
1958	0.284	0.185
1959	0.240	0.137
1960	0.452	0.329
1961	0.238	0.210
1962	0.153	0.109
1963	0.209	0.144
1964	0.301	0.146
1965	0.212	0.214
1966	0.195	0.128
1967	0.470	0.184
1968	0.275	0.156
1969	0.262	0.148
1970	0.211	0.140
1971	0.250	0.187
1972	0.476	0.287
1973	0.218	0.205
1974	0.251	0.193
1975	0.361	0.183
1976	0.259	0.168
1977	0.059	0.137
1978	0.216	0.205
1979	0.122	0.135
1980	0.591	0.285
1981	0.184	0.148
1982	0.417	0.338
1983	0.320	0.169
1984	0.199	0.127
1985	0.115	0.135
1986	0.496	0.258
1987	0.453	0.313
1988	0.180	0.122
1989	0.124	0.118
1990	1.073	0.373
1991	0.590	0.323
1992	0.247	0.180
1993	0.223	0.120
1994	0.088	0.101
1995	0.307	0.200
1996	0.732	0.356
1997	0.562	0.346
1998	0.170	0.156
1999	0.639	0.274
2000	0.232	0.154
2001	0.056	0.147
2002	0.279	0.256
2003	0.407	0.161
2004	0.438	0.360

2005	0.321	0.181
2006	0.351	0.212
2007	0.821	0.538
2008	0.967	0.394
2009	0.472	0.276

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	1.0726	0.5380
2	0.9674	0.3941
3	0.8211	0.3728
4	0.7321	0.3661
5	0.6391	0.3598
6	0.6206	0.3559
7	0.5915	0.3459
8	0.5897	0.3379
9	0.5617	0.3289
10	0.4960	0.3230
11	0.4756	0.3132
12	0.4718	0.2870
13	0.4702	0.2846
14	0.4527	0.2758
15	0.4519	0.2745
16	0.4381	0.2581
17	0.4187	0.2557
18	0.4171	0.2482
19	0.4067	0.2142
20	0.3970	0.2121
21	0.3756	0.2098
22	0.3607	0.2068
23	0.3510	0.2049
24	0.3322	0.2049
25	0.3207	0.1996
26	0.3198	0.1928
27	0.3073	0.1874
28	0.3012	0.1853
29	0.2929	0.1837
30	0.2845	0.1826
31	0.2789	0.1814
32	0.2746	0.1800
33	0.2619	0.1738
34	0.2593	0.1687
35	0.2508	0.1685
36	0.2503	0.1677
37	0.2472	0.1616
38	0.2420	0.1613
39	0.2399	0.1604
40	0.2380	0.1558
41	0.2324	0.1558
42	0.2225	0.1536
43	0.2181	0.1484
44	0.2159	0.1484
45	0.2122	0.1465
46	0.2121	0.1459
47	0.2111	0.1440

48	0.2089	0.1397
49	0.1991	0.1369
50	0.1949	0.1368
51	0.1837	0.1367
52	0.1800	0.1353
53	0.1700	0.1349
54	0.1685	0.1280
55	0.1533	0.1271
56	0.1245	0.1222
57	0.1225	0.1204
58	0.1146	0.1177
59	0.0882	0.1170
60	0.0593	0.1092
61	0.0556	0.1008

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1488	15013	10312	68	Pass
0.1563	13419	9229	68	Pass
0.1639	12170	8310	68	Pass
0.1714	10827	7364	68	Pass
0.1790	9678	6425	66	Pass
0.1866	8834	5766	65	Pass
0.1941	7952	4992	62	Pass
0.2017	7249	4141	57	Pass
0.2092	6534	3407	52	Pass
0.2168	6010	3118	51	Pass
0.2244	5473	2825	51	Pass
0.2319	5050	2535	50	Pass
0.2395	4626	2220	47	Pass
0.2470	4229	1913	45	Pass
0.2546	3888	1676	43	Pass
0.2622	3555	1424	40	Pass
0.2697	3313	1208	36	Pass
0.2773	3041	953	31	Pass
0.2848	2819	759	26	Pass
0.2924	2584	589	22	Pass
0.3000	2387	440	18	Pass
0.3075	2158	312	14	Pass
0.3151	1982	249	12	Pass
0.3226	1814	205	11	Pass
0.3302	1664	155	9	Pass
0.3378	1533	127	8	Pass
0.3453	1380	99	7	Pass
0.3529	1266	83	6	Pass
0.3604	1159	60	5	Pass
0.3680	1069	41	3	Pass
0.3755	1001	32	3	Pass
0.3831	929	27	2	Pass
0.3907	869	25	2	Pass
0.3982	801	22	2	Pass

0.4058	759	20	2	Pass
0.4133	699	14	2	Pass
0.4209	654	12	1	Pass
0.4285	594	11	1	Pass
0.4360	546	7	1	Pass
0.4436	500	7	1	Pass
0.4511	456	6	1	Pass
0.4587	409	6	1	Pass
0.4663	367	6	1	Pass
0.4738	334	6	1	Pass
0.4814	300	4	1	Pass
0.4889	272	4	1	Pass
0.4965	246	4	1	Pass
0.5041	217	4	1	Pass
0.5116	193	4	2	Pass
0.5192	169	2	1	Pass
0.5267	147	2	1	Pass
0.5343	131	2	1	Pass
0.5419	114	0	0	Pass
0.5494	102	0	0	Pass
0.5570	90	0	0	Pass
0.5645	76	0	0	Pass
0.5721	68	0	0	Pass
0.5797	63	0	0	Pass
0.5872	52	0	0	Pass
0.5948	43	0	0	Pass
0.6023	37	0	0	Pass
0.6099	33	0	0	Pass
0.6175	29	0	0	Pass
0.6250	26	0	0	Pass
0.6326	21	0	0	Pass
0.6401	17	0	0	Pass
0.6477	14	0	0	Pass
0.6553	12	0	0	Pass
0.6628	11	0	0	Pass
0.6704	9	0	0	Pass
0.6779	8	0	0	Pass
0.6855	8	0	0	Pass
0.6930	7	0	0	Pass
0.7006	7	0	0	Pass
0.7082	7	0	0	Pass
0.7157	7	0	0	Pass
0.7233	7	0	0	Pass
0.7308	6	0	0	Pass
0.7384	5	0	0	Pass
0.7460	5	0	0	Pass
0.7535	5	0	0	Pass
0.7611	5	0	0	Pass
0.7686	5	0	0	Pass
0.7762	5	0	0	Pass
0.7838	5	0	0	Pass
0.7913	5	0	0	Pass
0.7989	5	0	0	Pass
0.8064	4	0	0	Pass
0.8140	4	0	0	Pass
0.8216	4	0	0	Pass
0.8291	3	0	0	Pass

0.8367	3	0	0	Pass
0.8442	3	0	0	Pass
0.8518	3	0	0	Pass
0.8594	3	0	0	Pass
0.8669	3	0	0	Pass
0.8745	3	0	0	Pass
0.8820	3	0	0	Pass
0.8896	3	0	0	Pass
0.8972	3	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.6867 **acre-feet**
On-line facility target flow: 0.2251 **cfs.**
Adjusted for 15 min: 0.2251 **cfs.**
Off-line facility target flow: 0.1213 **cfs.**
Adjusted for 15 min: 0.1213 **cfs.**

LID Report

LID Technique	Used for Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Infiltration Volume	Percent Water Quality Volume	Percent Volume Infiltrated	Comment Treated
Flow Splitter 1 POC	N	891.55			N	75.65		
Vault 1	N	891.63			N	0.00		
Total Volume Infiltrated		1783.17	0.00	0.00		37.83	0.00	0% No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

POC #2 was not reported because POC must exist in both scenarios and both scenarios must have been run.**Perlnd and Implnd Changes**
No changes have been made.

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WWHM2012
PROJECT REPORT

Project Name: SOUTH FLOW SPLITTER OUTPUT
Site Name:
Site Address:
City :
Report Date: 4/7/2020
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
(adjusted) **Precip Scale:** 0.00
Version Date: 2019/09/13
Version : 4.2.17

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Onsite
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	8.3
C, Forest, Steep	.41
Pervious Total	8.71

Impervious Land Use	acre
Impervious Total	0
Basin Total	8.71

Element Flows To:

Surface	Interflow	Groundwater

Name : New Frontage
Bypass: No

GroundWater: No

Pervious Land Use	acre

C, Forest, Mod	.34
Pervious Total	**0.34**

Impervious Land Use	acre
Impervious Total	**0**
Basin Total	**0.34**

Element Flows To:

Surface	Interflow	Groundwater

Name : Ex Frontage Upstream
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	**0**

Impervious Land Use	acre
ROADS FLAT	0.12
Impervious Total	**0.12**
Basin Total	**0.12**

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Onsite
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	.33
C, Pasture, Flat	3.21
Pervious Total	**3.54**

Impervious Land Use	acre
ROADS FLAT	1.2
ROOF TOPS FLAT	2.04
DRIVEWAYS FLAT	0.82
SIDEWALKS FLAT	0.7
Impervious Total	4.76
Basin Total	8.3

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Ex Frontage Upstream
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
ROADS FLAT	0.12
Impervious Total	0.12
Basin Total	0.12

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Frontage Collected
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	.12
Pervious Total	0.12

Impervious Land Use	acre
ROADS FLAT	0.08
SIDEWALKS FLAT	0.06

Impervious Total 0.14

Basin Total 0.26

Element Flows To:

Surface	**Interflow**	**Groundwater**
Vault 1	Vault 1	

Name : Frontage Bypass
Bypass: Yes

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Mod	**.02**

Pervious Total 0.02

Impervious Land Use	**acre**
ROADS FLAT	**0.05**
SIDEWALKS FLAT	**0.01**

Impervious Total 0.06

Basin Total 0.08

Element Flows To:

Surface	**Interflow**	**Groundwater**

Name : Vault 1
Width : 81.07 ft.
Length : 100 ft.
Depth: 11.5 ft.
Discharge Structure
Riser Height: 11 ft.
Riser Diameter: 12 in.
Notch Type: Rectangular
Notch Width: 0.070 ft.
Notch Height: 0.930 ft.
Orifice 1 Diameter: 1.46875 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 1.5 in. **Elevation:** 5.6 ft.
Orifice 3 Diameter: 1.5 in. **Elevation:** 7.48 ft.

Element Flows To:

Outlet 1	**Outlet 2**

Flow Splitter 1

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.186	0.000	0.000	0.000
0.1278	0.186	0.023	0.020	0.000
0.2556	0.186	0.047	0.029	0.000
0.3833	0.186	0.071	0.036	0.000
0.5111	0.186	0.095	0.041	0.000
0.6389	0.186	0.118	0.046	0.000
0.7667	0.186	0.142	0.051	0.000
0.8944	0.186	0.166	0.055	0.000
1.0222	0.186	0.190	0.059	0.000
1.1500	0.186	0.214	0.062	0.000
1.2778	0.186	0.237	0.066	0.000
1.4056	0.186	0.261	0.069	0.000
1.5333	0.186	0.285	0.072	0.000
1.6611	0.186	0.309	0.075	0.000
1.7889	0.186	0.332	0.078	0.000
1.9167	0.186	0.356	0.081	0.000
2.0444	0.186	0.380	0.083	0.000
2.1722	0.186	0.404	0.086	0.000
2.3000	0.186	0.428	0.088	0.000
2.4278	0.186	0.451	0.091	0.000
2.5556	0.186	0.475	0.093	0.000
2.6833	0.186	0.499	0.095	0.000
2.8111	0.186	0.523	0.098	0.000
2.9389	0.186	0.547	0.100	0.000
3.0667	0.186	0.570	0.102	0.000
3.1944	0.186	0.594	0.104	0.000
3.3222	0.186	0.618	0.106	0.000
3.4500	0.186	0.642	0.108	0.000
3.5778	0.186	0.665	0.110	0.000
3.7056	0.186	0.689	0.112	0.000
3.8333	0.186	0.713	0.114	0.000
3.9611	0.186	0.737	0.116	0.000
4.0889	0.186	0.761	0.118	0.000
4.2167	0.186	0.784	0.120	0.000
4.3444	0.186	0.808	0.122	0.000
4.4722	0.186	0.832	0.123	0.000
4.6000	0.186	0.856	0.125	0.000
4.7278	0.186	0.879	0.127	0.000
4.8556	0.186	0.903	0.129	0.000
4.9833	0.186	0.927	0.130	0.000
5.1111	0.186	0.951	0.132	0.000
5.2389	0.186	0.975	0.134	0.000
5.3667	0.186	0.998	0.135	0.000
5.4944	0.186	1.022	0.137	0.000
5.6222	0.186	1.046	0.147	0.000
5.7500	0.186	1.070	0.164	0.000
5.8778	0.186	1.093	0.174	0.000
6.0056	0.186	1.117	0.182	0.000
6.1333	0.186	1.141	0.189	0.000
6.2611	0.186	1.165	0.196	0.000

6.3889	0.186	1.189	0.202	0.000
6.5167	0.186	1.212	0.207	0.000
6.6444	0.186	1.236	0.213	0.000
6.7722	0.186	1.260	0.218	0.000
6.9000	0.186	1.284	0.223	0.000
7.0278	0.186	1.307	0.228	0.000
7.1556	0.186	1.331	0.232	0.000
7.2833	0.186	1.355	0.237	0.000
7.4111	0.186	1.379	0.241	0.000
7.5389	0.186	1.403	0.260	0.000
7.6667	0.186	1.426	0.276	0.000
7.7944	0.186	1.450	0.288	0.000
7.9222	0.186	1.474	0.298	0.000
8.0500	0.186	1.498	0.307	0.000
8.1778	0.186	1.522	0.316	0.000
8.3056	0.186	1.545	0.324	0.000
8.4333	0.186	1.569	0.332	0.000
8.5611	0.186	1.593	0.339	0.000
8.6889	0.186	1.617	0.347	0.000
8.8167	0.186	1.640	0.353	0.000
8.9444	0.186	1.664	0.360	0.000
9.0722	0.186	1.688	0.367	0.000
9.2000	0.186	1.712	0.373	0.000
9.3278	0.186	1.736	0.379	0.000
9.4556	0.186	1.759	0.385	0.000
9.5833	0.186	1.783	0.391	0.000
9.7111	0.186	1.807	0.397	0.000
9.8389	0.186	1.831	0.403	0.000
9.9667	0.186	1.854	0.408	0.000
10.094	0.186	1.878	0.415	0.000
10.222	0.186	1.902	0.433	0.000
10.350	0.186	1.926	0.457	0.000
10.478	0.186	1.950	0.485	0.000
10.606	0.186	1.973	0.516	0.000
10.733	0.186	1.997	0.549	0.000
10.861	0.186	2.021	0.583	0.000
10.989	0.186	2.045	0.617	0.000
11.117	0.186	2.068	1.044	0.000
11.244	0.186	2.092	1.813	0.000
11.372	0.186	2.116	2.492	0.000
11.500	0.186	2.140	2.866	0.000
11.628	0.000	0.000	3.139	0.000

Name : Wetland Tributary Area Basin
Bypass: Yes

GroundWater: No

Pervious Land Use	**acre**
C, Pasture, Flat	**.17**
C, Pasture, Mod	**.04**
Pervious Total	**0.21**

Impervious Land Use	**acre**
ROOF TOPS FLAT	**0.12**

SIDEWALKS FLAT	**0.03**
Impervious Total	**0.15**
Basin Total	**0.36**

Element Flows To:

Surface	**Interflow**	**Groundwater**

Name : Flow Splitter 1
Bottom Length: 10.00 ft.
Bottom Length: 10.00 ft.
Depth: 10 ft.
Side slope 1: 0 To 1
Side slope 2: 0 To 1
Side slope 3: 0 To 1
Side slope 4: 0 To 1

Structure Splitter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Primary(cfs)	Secondary(cfs)
0.000	0.002	0.000	0.000	0.000
0.111	0.002	0.000	0.002	0.005
0.222	0.002	0.000	0.003	0.007
0.333	0.002	0.000	0.003	0.008
0.444	0.002	0.001	0.004	0.010
0.555	0.002	0.001	0.005	0.015
0.666	0.002	0.001	0.005	0.018
0.777	0.002	0.001	0.006	0.021
0.888	0.002	0.002	0.006	0.023
1.000	0.002	0.002	0.006	0.026
1.111	0.002	0.002	0.009	0.030
1.222	0.002	0.002	0.010	0.033
1.333	0.002	0.003	0.011	0.036
1.444	0.002	0.003	0.012	0.038
1.555	0.002	0.003	0.013	0.040
1.666	0.002	0.003	0.014	0.042
1.777	0.002	0.004	0.015	0.044
1.888	0.002	0.004	0.015	0.046
2.000	0.002	0.004	0.016	0.047
2.111	0.002	0.004	0.017	0.049
2.222	0.002	0.005	0.017	0.051
2.333	0.002	0.005	0.018	0.052
2.444	0.002	0.005	0.018	0.054
2.555	0.002	0.005	0.019	0.055
2.666	0.002	0.006	0.020	0.057
2.777	0.002	0.006	0.021	0.058
2.888	0.002	0.006	0.021	0.060
3.000	0.002	0.006	0.022	0.061
3.111	0.002	0.007	0.023	0.062
3.222	0.002	0.007	0.023	0.064
3.333	0.002	0.007	0.024	0.065
3.444	0.002	0.007	0.024	0.066

3.555	0.002	0.008	0.025	0.075
3.666	0.002	0.008	0.025	0.095
3.777	0.002	0.008	0.026	0.122
3.888	0.002	0.008	0.026	0.152
4.000	0.002	0.009	0.027	0.185
4.111	0.002	0.009	0.417	0.576
4.222	0.002	0.009	1.074	1.234
4.333	0.002	0.009	1.712	1.872
4.444	0.002	0.010	2.117	2.278
4.555	0.002	0.010	2.377	2.538
4.666	0.002	0.010	2.601	2.763
4.777	0.002	0.011	2.808	2.970
4.888	0.002	0.011	3.000	3.163
5.000	0.002	0.011	3.181	3.344
5.111	0.002	0.011	3.351	3.516
5.222	0.002	0.012	3.514	3.679
5.333	0.002	0.012	3.669	3.835
5.444	0.002	0.012	3.818	3.984
5.555	0.002	0.012	3.961	4.128
5.666	0.002	0.013	4.100	4.267
5.777	0.002	0.013	4.233	4.401
5.888	0.002	0.013	4.363	4.531
6.000	0.002	0.013	4.489	4.657
6.111	0.002	0.014	4.611	4.780
6.222	0.002	0.014	4.730	4.900
6.333	0.002	0.014	4.847	5.017
6.444	0.002	0.014	4.960	5.131
6.555	0.002	0.015	5.071	5.243
6.666	0.002	0.015	5.180	5.352
6.777	0.002	0.015	5.286	5.459
6.888	0.002	0.015	5.391	5.563
7.000	0.002	0.016	5.493	5.666
7.111	0.002	0.016	5.593	5.767
7.222	0.002	0.016	5.692	5.866
7.333	0.002	0.016	5.789	5.964
7.444	0.002	0.017	5.885	6.060
7.555	0.002	0.017	5.978	6.154
7.666	0.002	0.017	6.071	6.247
7.777	0.002	0.017	6.162	6.338
7.888	0.002	0.018	6.252	6.429
8.000	0.002	0.018	6.340	6.517
8.111	0.002	0.018	6.427	6.605
8.222	0.002	0.018	6.513	6.692
8.333	0.002	0.019	6.598	6.777
8.444	0.002	0.019	6.682	6.861
8.555	0.002	0.019	6.765	6.944
8.666	0.002	0.019	6.846	7.027
8.777	0.002	0.020	6.927	7.108
8.888	0.002	0.020	7.007	7.188
9.000	0.002	0.020	7.086	7.268
9.111	0.002	0.020	7.164	7.346
9.222	0.002	0.021	7.242	7.424
9.333	0.002	0.021	7.318	7.501
9.444	0.002	0.021	7.394	7.577
9.555	0.002	0.021	7.469	7.652
9.666	0.002	0.022	7.543	7.727
9.777	0.002	0.022	7.616	7.801

9.888	0.002	0.022	7.689	7.874
10.00	0.002	0.023	7.761	7.946
10.11	0.002	0.023	7.832	8.018

Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 0.5 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 0.5 in. **Elevation:** 1 ft.
Orifice 3 Diameter: 0.25 in. **Elevation:** 2.5 ft.

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

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:9.05
Total Impervious Area:0.12

Mitigated Landuse Totals for POC #1
Total Pervious Area:3.89
Total Impervious Area:5.23

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.29753
5 year	0.481656
10 year	0.609476
25 year	0.773913
50 year	0.897155
100 year	1.020276

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.109043
5 year	0.14869
10 year	0.179065
25 year	0.222448
50 year	0.258624
100 year	0.298302

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.376	0.134
1950	0.419	0.128
1951	0.621	0.208
1952	0.212	0.078
1953	0.169	0.080
1954	0.242	0.088
1955	0.397	0.094
1956	0.332	0.090
1957	0.293	0.116
1958	0.284	0.087
1959	0.240	0.078
1960	0.452	0.170
1961	0.238	0.103
1962	0.153	0.078
1963	0.209	0.095
1964	0.301	0.084
1965	0.212	0.105
1966	0.195	0.085
1967	0.470	0.125
1968	0.275	0.127
1969	0.262	0.104
1970	0.211	0.102
1971	0.250	0.107
1972	0.476	0.129
1973	0.218	0.077
1974	0.251	0.103
1975	0.361	0.118
1976	0.259	0.096
1977	0.059	0.086
1978	0.216	0.102
1979	0.122	0.120
1980	0.591	0.146
1981	0.184	0.110
1982	0.417	0.180
1983	0.320	0.111
1984	0.199	0.079
1985	0.115	0.102
1986	0.496	0.104
1987	0.453	0.155
1988	0.180	0.078
1989	0.124	0.087
1990	1.073	0.217
1991	0.590	0.165
1992	0.247	0.085
1993	0.223	0.068
1994	0.088	0.065
1995	0.307	0.093
1996	0.732	0.197
1997	0.562	0.187
1998	0.170	0.097
1999	0.639	0.171
2000	0.232	0.102
2001	0.056	0.109
2002	0.279	0.136
2003	0.407	0.117
2004	0.438	0.201

2005	0.321	0.102
2006	0.351	0.094
2007	0.821	0.379
2008	0.967	0.236
2009	0.472	0.119

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	1.0726	0.3791
2	0.9674	0.2356
3	0.8211	0.2166
4	0.7321	0.2075
5	0.6391	0.2014
6	0.6206	0.1974
7	0.5915	0.1874
8	0.5897	0.1795
9	0.5617	0.1710
10	0.4960	0.1705
11	0.4756	0.1646
12	0.4718	0.1548
13	0.4702	0.1456
14	0.4527	0.1357
15	0.4519	0.1338
16	0.4381	0.1286
17	0.4187	0.1282
18	0.4171	0.1266
19	0.4067	0.1246
20	0.3970	0.1199
21	0.3756	0.1192
22	0.3607	0.1180
23	0.3510	0.1172
24	0.3322	0.1160
25	0.3207	0.1113
26	0.3198	0.1102
27	0.3073	0.1087
28	0.3012	0.1073
29	0.2929	0.1054
30	0.2845	0.1044
31	0.2789	0.1037
32	0.2746	0.1032
33	0.2619	0.1029
34	0.2593	0.1022
35	0.2508	0.1021
36	0.2503	0.1019
37	0.2472	0.1017
38	0.2420	0.1016
39	0.2399	0.0970
40	0.2380	0.0955
41	0.2324	0.0950
42	0.2225	0.0942
43	0.2181	0.0937
44	0.2159	0.0931
45	0.2122	0.0904
46	0.2121	0.0881
47	0.2111	0.0869

48	0.2089	0.0869
49	0.1991	0.0864
50	0.1949	0.0853
51	0.1837	0.0845
52	0.1800	0.0843
53	0.1700	0.0797
54	0.1685	0.0786
55	0.1533	0.0784
56	0.1245	0.0783
57	0.1225	0.0782
58	0.1146	0.0779
59	0.0882	0.0772
60	0.0593	0.0680
61	0.0556	0.0655

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1488	15013	327	2	Pass
0.1563	13419	261	1	Pass
0.1639	12170	216	1	Pass
0.1714	10827	159	1	Pass
0.1790	9678	127	1	Pass
0.1866	8834	102	1	Pass
0.1941	7952	81	1	Pass
0.2017	7249	61	0	Pass
0.2092	6534	40	0	Pass
0.2168	6010	33	0	Pass
0.2244	5473	27	0	Pass
0.2319	5050	25	0	Pass
0.2395	4626	22	0	Pass
0.2470	4229	20	0	Pass
0.2546	3888	14	0	Pass
0.2622	3555	12	0	Pass
0.2697	3313	11	0	Pass
0.2773	3041	7	0	Pass
0.2848	2819	7	0	Pass
0.2924	2584	6	0	Pass
0.3000	2387	6	0	Pass
0.3075	2158	6	0	Pass
0.3151	1982	6	0	Pass
0.3226	1814	4	0	Pass
0.3302	1664	4	0	Pass
0.3378	1533	4	0	Pass
0.3453	1380	4	0	Pass
0.3529	1266	4	0	Pass
0.3604	1159	2	0	Pass
0.3680	1069	2	0	Pass
0.3755	1001	2	0	Pass
0.3831	929	0	0	Pass
0.3907	869	0	0	Pass
0.3982	801	0	0	Pass

0.4058	759	0	0	Pass
0.4133	699	0	0	Pass
0.4209	654	0	0	Pass
0.4285	594	0	0	Pass
0.4360	546	0	0	Pass
0.4436	500	0	0	Pass
0.4511	456	0	0	Pass
0.4587	409	0	0	Pass
0.4663	367	0	0	Pass
0.4738	334	0	0	Pass
0.4814	300	0	0	Pass
0.4889	272	0	0	Pass
0.4965	246	0	0	Pass
0.5041	217	0	0	Pass
0.5116	193	0	0	Pass
0.5192	169	0	0	Pass
0.5267	147	0	0	Pass
0.5343	131	0	0	Pass
0.5419	114	0	0	Pass
0.5494	102	0	0	Pass
0.5570	90	0	0	Pass
0.5645	76	0	0	Pass
0.5721	68	0	0	Pass
0.5797	63	0	0	Pass
0.5872	52	0	0	Pass
0.5948	43	0	0	Pass
0.6023	37	0	0	Pass
0.6099	33	0	0	Pass
0.6175	29	0	0	Pass
0.6250	26	0	0	Pass
0.6326	21	0	0	Pass
0.6401	17	0	0	Pass
0.6477	14	0	0	Pass
0.6553	12	0	0	Pass
0.6628	11	0	0	Pass
0.6704	9	0	0	Pass
0.6779	8	0	0	Pass
0.6855	8	0	0	Pass
0.6930	7	0	0	Pass
0.7006	7	0	0	Pass
0.7082	7	0	0	Pass
0.7157	7	0	0	Pass
0.7233	7	0	0	Pass
0.7308	6	0	0	Pass
0.7384	5	0	0	Pass
0.7460	5	0	0	Pass
0.7535	5	0	0	Pass
0.7611	5	0	0	Pass
0.7686	5	0	0	Pass
0.7762	5	0	0	Pass
0.7838	5	0	0	Pass
0.7913	5	0	0	Pass
0.7989	5	0	0	Pass
0.8064	4	0	0	Pass
0.8140	4	0	0	Pass
0.8216	4	0	0	Pass
0.8291	3	0	0	Pass

0.8367	3	0	0	Pass
0.8442	3	0	0	Pass
0.8518	3	0	0	Pass
0.8594	3	0	0	Pass
0.8669	3	0	0	Pass
0.8745	3	0	0	Pass
0.8820	3	0	0	Pass
0.8896	3	0	0	Pass
0.8972	3	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.6867 **acre-feet**
On-line facility target flow: 0.2251 **cfs.**
Adjusted for 15 min: 0.2251 **cfs.**
Off-line facility target flow: 0.1213 **cfs.**
Adjusted for 15 min: 0.1213 **cfs.**

LID Report

LID Technique	Used for Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Infiltration Volume	Percent Water Quality Volume	Percent Volume Infiltrated	Comment Treated
Flow Splitter 1 POC	N	891.55			N	75.65		
Vault 1	N	891.63			N	0.00		
Total Volume Infiltrated		1783.17	0.00	0.00		37.83	0.00	0% No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

POC #2 was not reported because POC must exist in both scenarios and both scenarios must have been run.**Perlnd and Implnd Changes**
No changes have been made.

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5.0 CONVEYANCE SYSTEM ANALYSIS AND DESIGN

5.1 Onsite Conveyance

A full onsite conveyance capacity analysis will be performed in a future submittal.

5.2 Combined Detention/Wetvault Release

The Combined Detention/Wetvault discharge system is comprised of the primary flow intake(s), the Combined Detention/Wetvault detention volume, the Combined Detention/Wetvault outfall and the control structure, and flow splitter.

The vault release conveyance pipe crosses under two gas mains running north south within an Olympic Pipe easement and will be laid at a shallow slope to aid in boring the pipe under the gas mains. Vault release flows enter a flow splitter and flows are split to the north or south discharge points.

The conveyance capacity analysis for the pipe downstream of the Combined Detention/Wetvault was performed as a Manning's equation evaluation of the Combined Detention/Wetvault discharge pipe. The smallest diameter (12") pipe at the shallowest slope was analyzed against the 100-year unmitigated flow. A screen shot of the 100-Year Storm unmitigated release from the Combined Detention/Wetvault (from the WWHM 701 data series) can be found in Appendix 5A. The 12" pipe is adequately sized to convey the 100-year unmitigated peak flow at a minimum 1.00% slope.

Combined Detention/Wetvault Discharge Line Pipe:	
Diameter:	12"
Minimum Slope:	1.00%
Pipe Capacity:	4.64 cfs
100-Year Maximum Pipe Flow:	4.11 cfs (100 yr, Umitigated – WWHM 701 series)
Evaluation:	**System Adequate**

5.3 Existing Downstream Offsite Analysis

As described in the downstream analysis in Section 3.0, onsite runoff is directed into two ravines (North and South) that carry upstream runoff east toward the Willows Park Commercial Development (WCCC). Ravine flows enter a closed conveyance system at four major intake points and eventually converge within the closed conveyance system associated with the WCCC. The conveyance system is an upstream collection flow through line within WCCC that does not enter site detention as ravine flows are routed through to their natural drainage course. A hydrologic capacity analysis of the existing downstream conveyance line associated with the Willow Creek Corporate Center was performed to determine the system's existing capacity and what pipes required upsizing, if any.

In total, approximately 70.45 acres is tributary to the WCCC conveyance system. A total of 10.99 acres of the 70.45-acre tributary area is associated with project onsite parcel (10.53 AC) and tributary frontage (0.46) area. Refer to Figure 8.0 "Downstream Conveyance Map" in Appendix 5-B for a visual representation of the upstream tributary area and location of the four tributary intake points. Shown below are areas designated within each ravine basin (OS-1 to OS-4) and onsite basin (North and South Discharge).

Table 5.3.1 – WCCC Tributary Area

Land Cover	North Discharge Basin (AC)	South Discharge Basin (AC)	OS-1 (AC)	OS-2 (AC)	OS-3 (AC)	OS-4 (AC)
Pervious	Refer below	Refer below	10.31	12.16	3.36	29.59
Impervious	Refer below	Refer below	0.49	0.26	-	1.24
Total	**6.38**	**4.61**	**10.80**	**12.42**	**3.36**	**30.83**

In the existing condition, 8.71 acres of the 10.53-acre site parcel and 0.46 acres of frontage area associated with project will be developed. The 8.71 AC of the 10.53 AC parcel will be developed to a mixture of impervious and pervious area and the remaining 1.82 acres of transmission line easement, wetland buffer, and steep slope buffer area will remain undisturbed. To conservatively model project development impacts to the Willow Creek Corporate Center, developed unmitigated flow rates and increased site impervious area was considered. The 8.71 acres of onsite development was modeled in an onsite stormwater flow control scenario where unmitigated runoff would be introduced to the system, assuming overflow of the flow control system in the 50- and 100-year events. Additionally,

based on WWHM2012 basin areas, approximately 57% of the 8.71 AC developed area has been designed as impervious in the developed condition. An additional 3% of impervious area was modeled for onsite impervious area, totaling 60% or 0.26 acreage of impervious increase to ensure a conservative approach. There onsite areas have been modeled as such:

Table 5.3.2 – North Discharge and South Discharge Conservative Tributary Area

Land Cover	North Discharge Basin (AC)	South Discharge Basin (AC)
Pervious	3.24	2.37
Impervious	3.14	2.24
Total	**6.38**	**4.61**

Analysis was performed to determine if the 50-year developed peak flow overtopped any of the existing catch basins and to show in the 100-year storm event that, if any structure overtopping were to occur, no flooding of existing buildings would occur, as outlined in the Stormwater Technical Notebook. The conveyance line was modeled in StormShed3G using the SBUH design methodology as the area being analyzed totaled more than 20 acres.

Precipitation factors of the 50-year and 100-year 24-hour storm event, 3.7 in/hr and 3.92 in/hr respectively, where derived from NOAA ATLAS 2, VOL IX isopluvial maps. In field survey of the WCCC conveyance line was taken, as review of existing as-built utility data associated to the Willow Creek Corporate Center stormwater infrastructure was not reliable.

Per Stormshed3G analysis, locations of overtopping in the 50-year storm event in the 100-year storm event are at node CB-3. CB-3 is located outside of the WCCC development and in an offsite vegetated low point where ponding of upstream flows ravine is assumed to already occur, therefore, <u>no offsite improvements are warranted</u>.

Shown in Table 5.3.3 is the offsite conveyance analysis table that includes structures and their distance to overtopping. Catch basin labels have been made to replicate the Willow Creek Corporate Center As-Built structure callous to the best extent as shown in Figure 9.0. Refer to Appendix 5-B for StormShed3G outputs and layout.

Table 5.3.3 – 50- and 100-year StormShed3G HGL Outputs

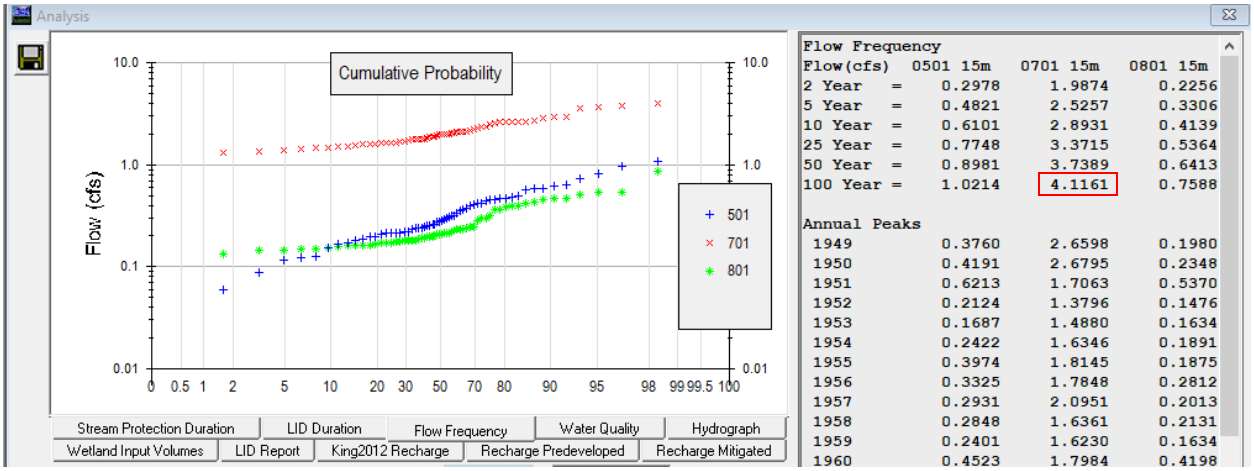
		50-Year HGL		*100-Year HGL*	
Structure	**Rim (ft)**	**HGL (ft)**	**Distance to Overtopping (ft)**	**HGL (ft)**	**Distance to Overtopping (ft)**
113.09	47.38	43.56	3.96	43.78	3.74
111.5	48.42	43.86	4.74	44.17	4.46
108.4	47.71	47.34	0.57	47.70	0.17
CB-B1	54.56	53.44	1.25	53.65	0.25
CB-B2	56.89	54.14	2.99	54.56	1.81
CB-B3	63.63	60.08	3.80	60.56	3.41
CB-B7	61.51	60.13	1.63	60.63	1.22
CB-B8	64.06	59.82	4.49	60.32	4.09
CB-B8a	68.88	63.39	5.49	63.42	5.46
CB-B9	65.21	61.09	4.18	61.19	4.11
CB-B9A	67.75	65.23	2.61	65.26	2.61
CB-B4	68.23	62.04	6.41	63.09	6.07
CB-B5	75.63	74.25	2.08	74.89	1.57
CULV IN*	75.54	74.80	1.70	75.64	1.12
CB-B6	79.94	76.86	3.08	76.90	3.04
CB-B6A	84.61	81.61	3.00	81.76	2.85
CB-2	89.02	85.80	3.22	85.95	3.07
CB-3*	89.55	89.65	OVERTOPPING	89.65	OVERTOPPING

*Intake structures from upgradient flow.

APPENDIX 5-A

VAULT RELEASE CONVEYANCE CAPACITY

701 Series Output WWHM



Flow Frequency

Flow(cfs)	0501 15m	0701 15m	0801 15m
2 Year =	0.2978	1.9874	0.2256
5 Year =	0.4821	2.5257	0.3306
10 Year =	0.6101	2.8931	0.4139
25 Year =	0.7748	3.3715	0.5364
50 Year =	0.8981	3.7389	0.6413
100 Year =	1.0214	4.1161	0.7588

Annual Peaks

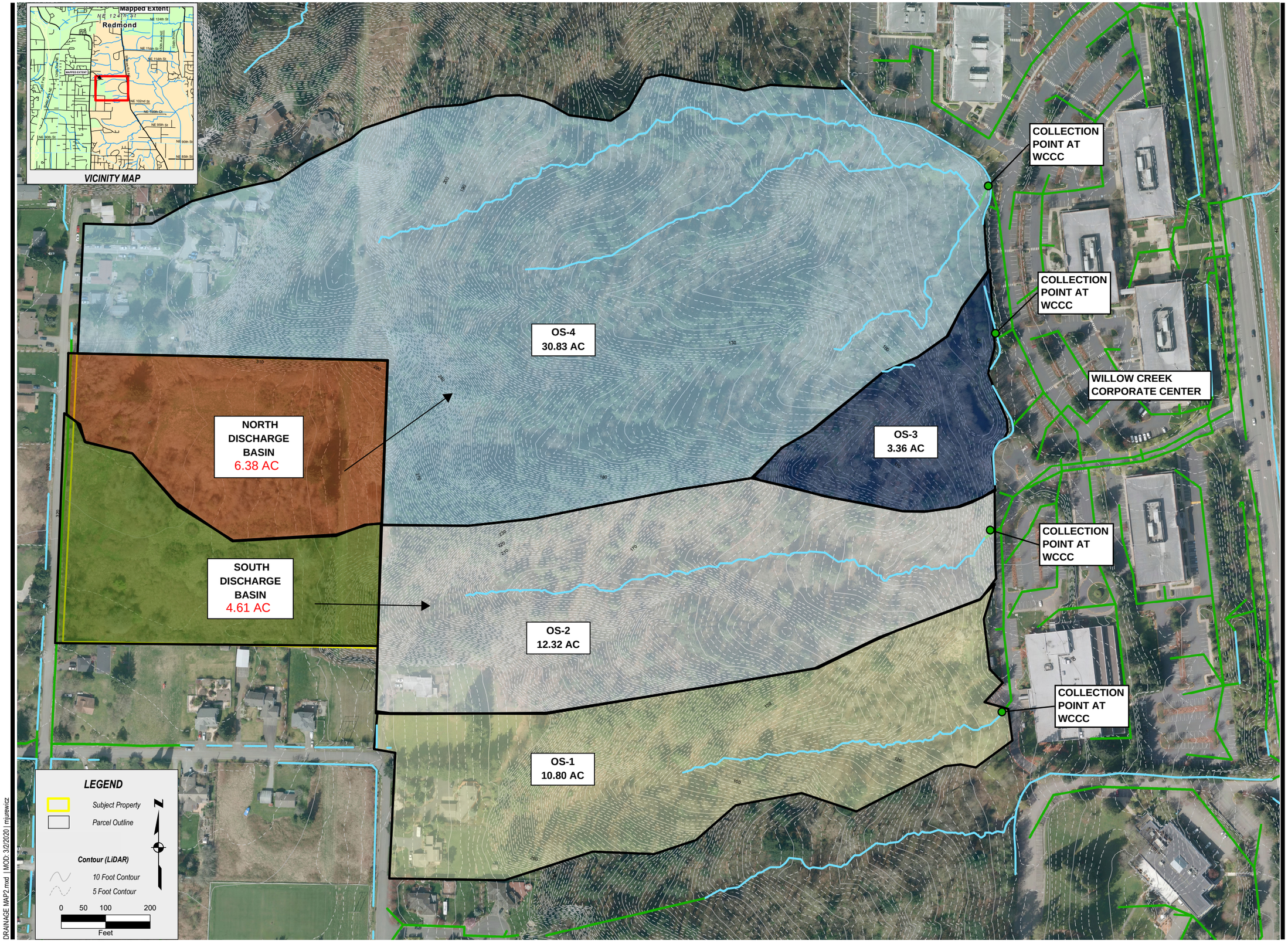
1949	0.3760	2.6598	0.1980
1950	0.4191	2.6795	0.2348
1951	0.6213	1.7063	0.5370
1952	0.2124	1.3796	0.1476
1953	0.1687	1.4880	0.1634
1954	0.2422	1.6346	0.1891
1955	0.3974	1.8145	0.1875
1956	0.3325	1.7848	0.2812
1957	0.2931	2.0951	0.2013
1958	0.2848	1.6361	0.2131
1959	0.2401	1.6230	0.1634
1960	0.4523	1.7984	0.4198

APPENDIX 5-B

FIGURE 9.0 DOWNSTREAM CONVEYANCE CAPACITY MAP

FIGURE 10.0 WCC CONVEYANCE SYSTEM MAP

STORMSHED3G OUTPUT 50- AND 100 -YEAR



DRAINAGE MAP2.mxd | MOD: 3/2/2020 | mjurewicz

SOURCE INFORMATION

SOURCE AGENCY	DESCRIPTION
PUGET SOUND LIDAR CONSORTIUM	CONTOURS - GENERATED FROM BARE EARTH LIDAR (KING COUNTY). THIS DATA HAS A STATED VERTICAL ACCURACY OF APPROXIMATELY 1 FOOT.
KING COUNTY GIS	PARCEL BOUNDARY
KING COUNTY	WETLAND, HYDROLOGY, CONTOUR DATA

15th ANNIVERSARY
LDC
Surveying
Engineering
Planning
20210 142nd Avenue NE
Woodinville, WA 98072
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Fx. 425-482-2800
www.LDCcorp.com

DR HORTON

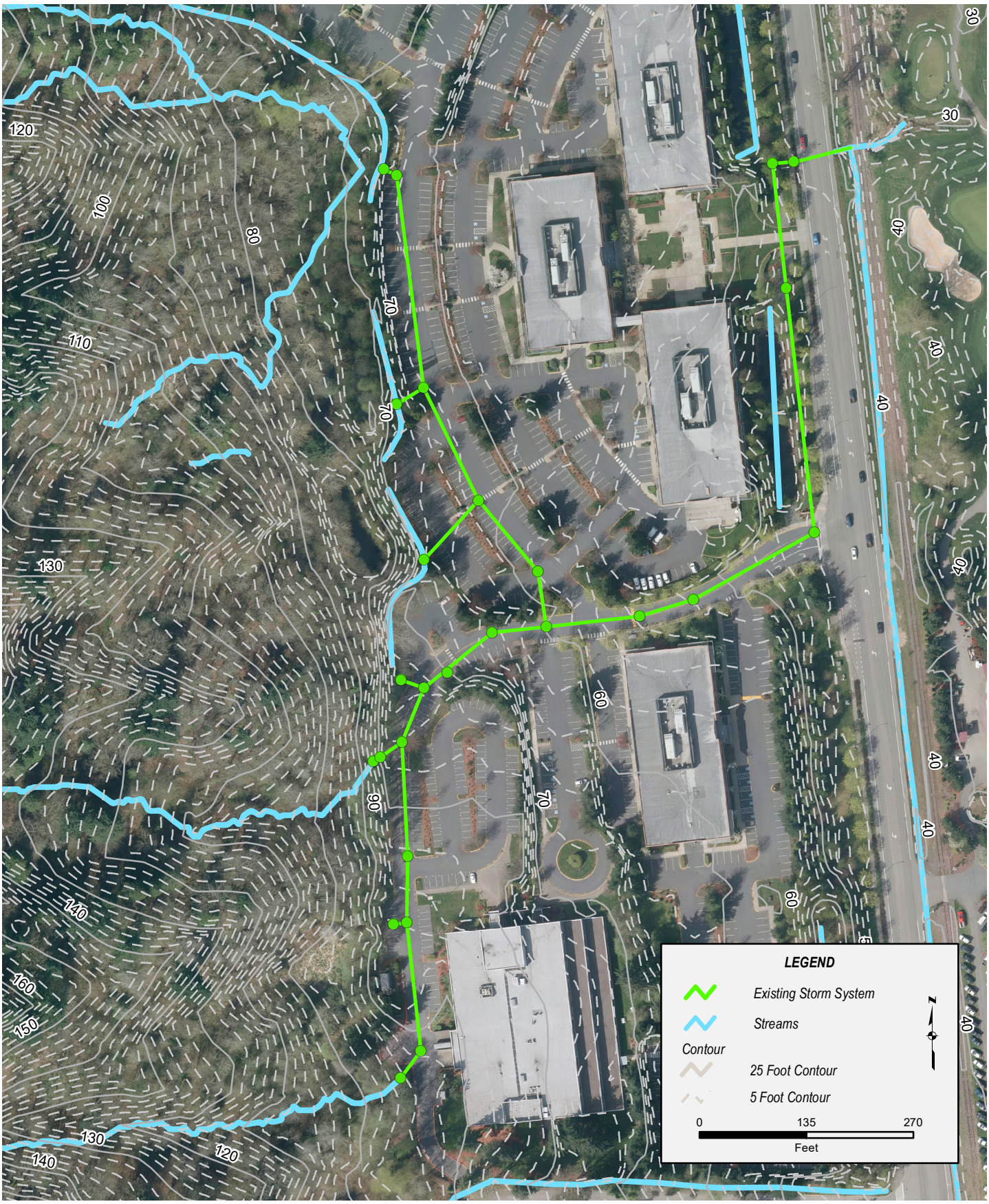
ROSEWOOD COURT
DOWNSTREAM CONVEYANCE MAP P

PROJECTION: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, FEET

REVISION:
JOB NUMBER: 19-104
DRAWING NAME: 19-104F08
DESIGNER: M.COVERT
DRAWING BY: M.JUREWICZ
DATE: 10-08-2019
SCALE: AS SHOWN
JURISDICTION: REDMOND

FIGURE:

9.0



SOURCE INFORMATION

SOURCE AGENCY	DESCRIPTION
KING CO.	5 FT CONTOUR (LiDAR)
SNOHOMISH CO.	1 FT. COLOR AERIAL PHOTOGRAPHY (2002)
SNOHOMISH CO.	PARCEL BOUNDARY

DR HORTON

ROSEWOOD COURT

WCC Conveyance System

LDC | Surveying Engineering Planning

Woodinville
20210 142nd Avenue NE
Woodinville, WA 98072

Kent
1851 Central Pl S, #101
Kent, WA 98030

T 425.806.1869 www.LDCcorp.com F 425.482.2893

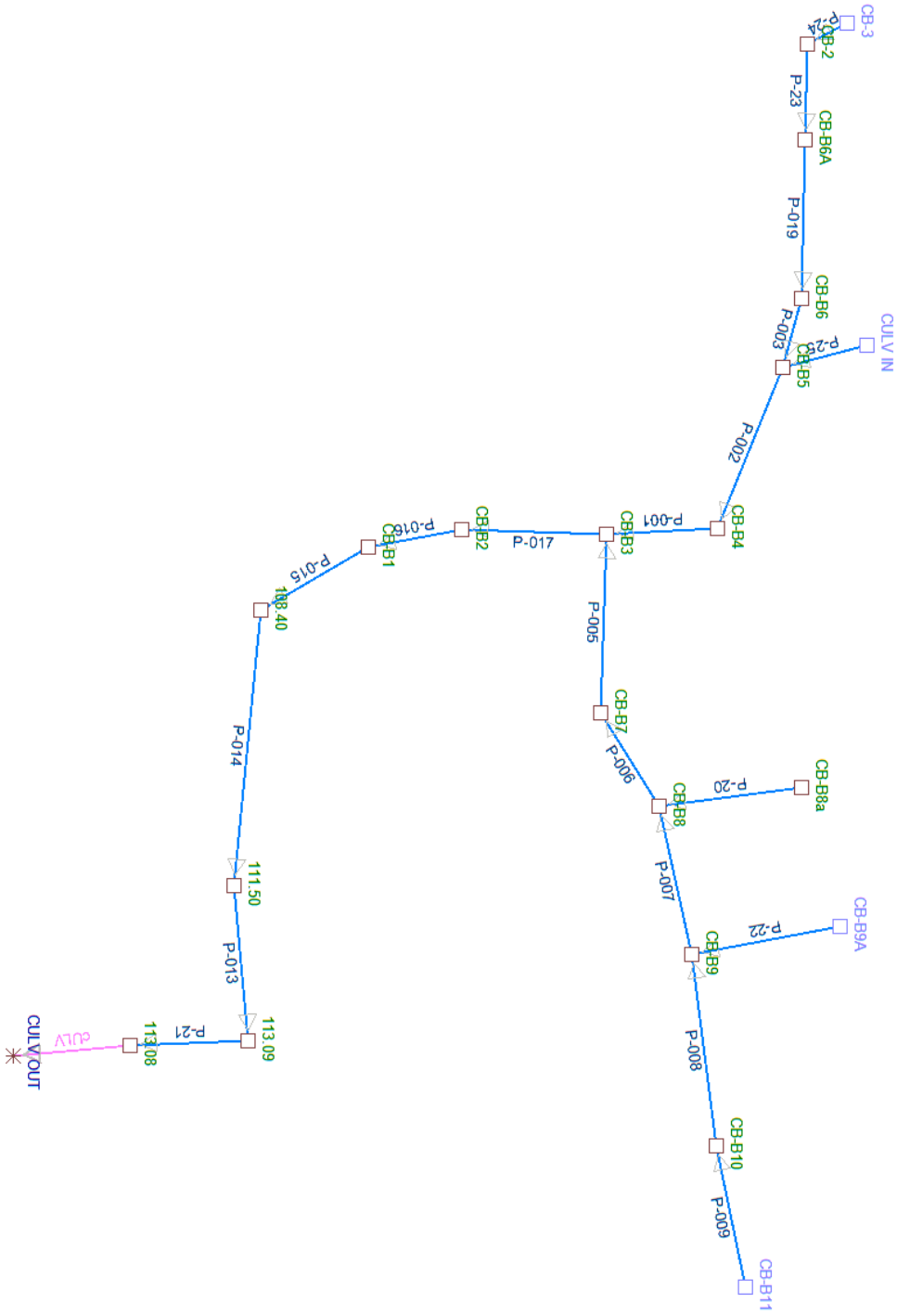
PROJECTION: WASHINGTON STATE PLANE, NORTH ZONE, NAD 83, FEET

JURISDICTION: BOTHELL

FIGURE:

10.0

StormShed3G Layout



StormShed3G *50* Year Output

ROUTEHYD [] THRU [Downstream] USING [50 year] AND [TYPE1a.rac] NOTZERO RELATIVE SCS/SBUH

Gravity Analysis using 24 hr duration storm

Reach ID	Area (ac)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Depth ratio	Size	nVel (ft/s)	fVel (ft/s)	Infil Vol (cf)	CBasin / Hyd
P-20	3.36	0.3061	30.5505	0.01	0.1054	0.0703	18 in Diam	5.5989	17.2881	0.00	OS-3
P-22	6.21	2.2359	48.8502	0.0458	0.2183	0.1456	18 in Diam	14.052	27.6435	0.00	North Basin
P-009	30.83	3.7311	16.9775	0.2198	0.4781	0.3187	18 in Diam	7.6951	9.6073	0.00	OS-4
P-008	30.83	3.7311	11.4861	0.3248	0.5833	0.3888	18 in Diam	5.8708	6.4998	0.00	
P-007	37.04	5.967	20.7223	0.288	0.7349	0.3674	24 in Diam	5.6999	6.5961	0.00	
P-006	40.40	6.2048	23.3987	0.2652	0.703	0.3515	24 in Diam	6.2956	7.448	0.00	
P-005	40.40	6.2048	22.4624	0.2762	0.7186	0.3593	24 in Diam	6.1098	7.15	0.00	
P-25	16.97	2.6287	7.0733	0.3716	0.4223	0.4223	12 in Diam	8.3364	9.006	0.00	OS-2;South Basin
P-24	10.80	1.4289	1.9541	0.7312	0.3177	0.6354	6 in Diam	10.8567	9.952	0.00	OS-1
P-23	10.80	1.4289	8.8769	0.161	0.2712	0.2712	12 in Diam	8.2996	11.3024	0.00	
P-019	21.60	2.8578	10.5438	0.271	0.3556	0.3556	12 in Diam	11.4145	13.4248	0.00	OS-1
P-003	21.60	2.8578	12.5083	0.2285	0.3248	0.3248	12 in Diam	12.9218	15.926	0.00	
P-002	38.57	5.4503	16.9017	0.3225	0.3877	0.3877	12 in Diam	19.3714	21.5199	0.00	
P-001	38.57	5.4503	8.1262	0.6707	0.5997	0.5997	12 in Diam	11.0837	10.3466	0.00	
P-017	78.97	11.6551	31.8321	0.3661	0.6282	0.4188	18 in Diam	16.6119	18.0133	0.00	
P-016	78.97	11.6551	13.35	0.873	1.0859	0.7239	18 in Diam	8.5075	7.5546	0.00	
P-015	78.97	11.6551	31.4745	0.3703	0.6322	0.4215	18 in Diam	16.4713	17.8109	0.00	
P-014	78.97	11.6551	22.2221	0.5245	1.0292	0.5146	24 in Diam	7.1543	7.0735	0.00	
P-013	78.97	11.6551	23.3987	0.4981	0.9979	0.499	24 in Diam	7.4394	7.448	0.00	
P-21	78.97	11.6551	79.9232	0.1458	0.6436	0.2574	30 in Diam	11.6536	16.2818	0.00	
cULV	78.97	11.6551	102.03	0.1142	0.5721	0.2289	30 in Diam	13.762	20.7862	0.00	

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							39.2144
113.08	CULV OUT	41.4710	------	0.0266	------	41.4976	46.0000
113.09	113.08	42.2153	------	1.2144	------	43.4297	47.3800
111.50	113.09	43.8802	0.2137	0.0103	------	43.6768	48.4200
No approach losses at node CB-B1 because inverts and/or crowns are offset.							
108.40	111.50	44.9963	------	2.2173	------	47.2136	47.7100
CB-B1	108.40	53.8551	------	0.0727	------	53.9278	54.5600
CB-B2	CB-B1	55.1578	0.6755	0.0391	------	54.5214	56.8900
CB-B3	CB-B2	59.7162	------	0.0807	0.0307	59.8275	63.6300
CB-B7	CB-B3	59.9271	0.0606	0.0146	------	59.8812	61.5100
No approach losses at node CB-B9 because inverts and/or crowns are offset.							
CB-B8	CB-B7	59.9951	0.5045	0.0534	0.0213	59.5654	64.0600
CB-B8a	CB-B8	63.3940	------	------	------	63.3940	68.8800
CB-B9	CB-B8	60.8155	------	0.0114	0.2059	61.0328	65.2100
CB-B9A	CB-B9	65.1395	------	------	------	65.1395	67.7500
CB-B10	CB-B9	62.6070	------	0.0168	------	62.6238	65.9800
CB-B11	CB-B10	63.1720	------	------	------	63.1720	68.3700
No approach losses at node CB-B5 because inverts and/or crowns are offset.							
CB-B4	CB-B3	61.2735	------	0.5444	------	61.8180	68.2300
CB-B5	CB-B4	73.4413	------	0.0060	0.1075	73.5547	75.6300
CULV IN	CB-B5	73.8449	------	------	------	73.8449	75.5400
CB-B6	CB-B5	76.7238	------	0.1347	------	76.8585	79.9400
CB-B6A	CB-B6	81.6121	------	0.0002	------	81.6123	84.6100
No approach losses at node CB-3 because inverts and/or crowns are offset.							
CB-2	CB-B6A	84.6165	------	1.1826	------	85.7991	89.0200
CB-3	CB-2	89.6166	------	------	------	89.6500	89.5500

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
cULV	1.5910	0.6364	11.66	1.1444	1.1444	0.5721	SuperCrit flow, Inlet end controls
P-21	1.6053	0.6421	11.66	1.2876	1.1444	0.6436	SuperCrit flow, Inlet end controls
P-013	2.9660	1.4830	11.66	2.5097	1.2295	0.9979	Outlet Control
P-014	1.8463	0.9231	11.66	1.9567	1.2295	1.0292	SuperCrit flow, Inlet end controls
P-015	2.4251	1.6168	11.66	3.2436	1.2999	0.6322	SuperCrit flow, Inlet end controls
P-016	3.7265	2.4843	11.66	2.4978	1.2999	1.0859	Outlet Control
P-017	2.4262	1.6174	11.66	2.4414	1.2999	0.6282	SuperCrit flow, Inlet end controls

P-005	2.9052	1.4526	6.20	2.8075	0.8814	0.7186	Outlet Control
P-006	2.6054	1.3027	6.20	2.4912	0.8814	0.7030	Outlet Control
P-20	0.2440	0.1627	0.31	0.4954	0.2016	0.1054	SuperCrit flow, Inlet end controls
P-007	1.2155	0.6077	5.97	0.8636	0.8636	0.7349	SuperCrit flow, Inlet end controls
P-22	0.7095	0.4730	2.24	0.7028	0.5652	0.2183	SuperCrit flow, Inlet end controls
P-008	1.0570	0.7047	3.73	1.0428	0.7382	0.5833	SuperCrit flow, Inlet end controls
P-009	1.0520	0.7013	3.73	1.0638	0.7382	0.4781	SuperCrit flow, Inlet end controls
P-001	2.1635	2.1635	5.45	2.4075	0.9372	0.5997	SuperCrit flow, Inlet end controls
P-002	2.2213	2.2213	5.45	2.4380	0.9372	0.3877	SuperCrit flow, Inlet end controls
P-25	2.6149	2.6149	2.63	2.3247	0.6952	0.4223	Outlet Control
P-003	1.1538	1.1538	2.86	2.2647	0.7253	0.3248	SuperCrit flow, Inlet end controls
P-019	1.1521	1.1521	2.86	1.0885	0.7253	0.3556	SuperCrit flow, Inlet end controls
P-23	0.7165	0.7165	1.43	1.1523	0.5063	0.2712	SuperCrit flow, Inlet end controls
P-24	1.9366	3.8732	1.43	0.4924	0.4924	0.3177	SuperCrit flow, Inlet end controls

Node and Reach invert report

Node	CB-B8a		Out ie	63.15 ft
	Reach	P-20	I.E. Out	63.15 ft
Node	CB-B9A		Out ie	64.43 ft
	Reach	P-22	I.E. Out	64.43 ft
Node	CB-B11		Out ie	62.12 ft
	Reach	P-009	I.E. Out	62.12 ft
Node	CB-B10		Out ie	61.55 ft
	Reach	P-009	I.E. In	61.56 ft
	Reach	P-008	I.E. Out	61.55 ft
Node	CB-B9		Out ie	59.60 ft
	Reach	P-22	I.E. In	60.33 ft
	Reach	P-008	I.E. In	59.99 ft
	Reach	P-007	I.E. Out	59.60 ft
Node	CB-B8		Out ie	57.98 ft
	Reach	P-20	I.E. In	59.07 ft
	Reach	P-007	I.E. In	58.96 ft
	Reach	P-006	I.E. Out	57.98 ft
Node	CB-B7		Out ie	57.35 ft
	Reach	P-006	I.E. In	57.39 ft
	Reach	P-005	I.E. Out	57.35 ft

Node	CULV IN		Out ie	71.82 ft
	Reach	P-25	I.E. Out	71.82 ft
Node	CB-3		Out ie	87.68 ft
	Reach	P-24	I.E. Out	87.68 ft
Node	CB-2		Out ie	83.90 ft
	Reach	P-24	I.E. In	86.70 ft
	Reach	P-23	I.E. Out	83.90 ft
Node	CB-B6A		Out ie	80.46 ft
	Reach	P-23	I.E. In	80.46 ft
	Reach	P-019	I.E. Out	80.46 ft
Node	CB-B6		Out ie	75.57 ft
	Reach	P-019	I.E. In	75.77 ft
	Reach	P-003	I.E. Out	75.57 ft
Node	CB-B5		Out ie	71.22 ft
	Reach	P-25	I.E. In	71.23 ft
	Reach	P-003	I.E. In	71.29 ft
	Reach	P-002	I.E. Out	71.22 ft
Node	CB-B4		Out ie	59.11 ft
	Reach	P-002	I.E. In	59.38 ft
	Reach	P-001	I.E. Out	59.11 ft
Node	CB-B3		Out ie	57.02 ft
	Reach	P-005	I.E. In	57.02 ft
	Reach	P-001	I.E. In	57.42 ft
	Reach	P-017	I.E. Out	57.29 ft
Node	CB-B2		Out ie	51.98 ft
	Reach	P-017	I.E. In	52.08 ft
	Reach	P-016	I.E. Out	51.98 ft
Node	CB-B1		Out ie	51.43 ft
	Reach	P-016	I.E. In	51.43 ft
	Reach	P-015	I.E. Out	51.43 ft
Node	108.40		Out ie	43.15 ft
	Reach	P-015	I.E. In	43.97 ft
	Reach	P-014	I.E. Out	43.15 ft
Node	111.50		Out ie	41.72 ft
	Reach	P-014	I.E. In	41.7201 ft
	Reach	P-013	I.E. Out	41.72 ft
Node	113.09		Out ie	40.61 ft
	Reach	P-013	I.E. In	40.92 ft
	Reach	P-21	I.E. Out	40.61 ft
Node	113.08		Out ie	39.88 ft
	Reach	P-21	I.E. In	40.21 ft
	Reach	cULV	I.E. Out	39.88 ft

StormShed3G *100* Year Output

ROUTEHYD [] THRU [Downstream] USING [100 year] AND [TYPE1a.rac] NOTZERO RELATIVE SCS/SBUH

Gravity Analysis using 24 hr duration storm

Reach ID	Area (ac)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Depth ratio	Size	nVel (ft/s)	fVel (ft/s)	Infil Vol (cf)	CBasin / Hyd
P-20	3.36	0.3585	30.5505	0.0117	0.1143	0.0762	18 in Diam	5.8165	17.2881	0.00	OS-3
P-22	6.38	2.258	48.8502	0.0462	0.2193	0.1462	18 in Diam	14.0965	27.6435	0.00	North Basin
P-009	30.83	4.3941	16.9775	0.2588	0.5205	0.347	18 in Diam	8.0666	9.6073	0.00	OS-4
P-008	30.83	4.3941	11.4861	0.3826	0.6439	0.4293	18 in Diam	6.0613	6.4998	0.00	
P-007	37.21	6.6521	20.7223	0.321	0.774	0.387	24 in Diam	5.9251	6.5961	0.00	
P-006	40.57	6.9422	23.3987	0.2967	0.7468	0.3734	24 in Diam	6.4883	7.448	0.00	
P-005	40.57	6.9422	22.4624	0.3091	0.7626	0.3813	24 in Diam	6.3088	7.15	0.00	
P-25	17.03	2.962	7.0733	0.4188	0.4514	0.4514	12 in Diam	8.6051	9.006	0.00	OS-2;South Basin
P-24	10.80	1.6775	1.9541	0.8585	0.3573	0.7146	6 in Diam	11.1732	9.952	0.00	OS-1
P-23	10.80	1.6775	8.8769	0.189	0.2946	0.2946	12 in Diam	8.6806	11.3024	0.00	
P-019	21.60	3.355	10.5438	0.3182	0.3857	0.3857	12 in Diam	12.0095	13.4248	0.00	OS-1
P-003	21.60	3.355	12.5083	0.2682	0.3536	0.3536	12 in Diam	13.5034	15.926	0.00	
P-002	38.63	6.2834	16.9017	0.3718	0.4224	0.4224	12 in Diam	19.9216	21.5199	0.00	
P-001	38.63	6.2834	8.1262	0.7732	0.6606	0.6606	12 in Diam	11.4146	10.3466	0.00	
P-017	79.20	13.2255	31.8321	0.4155	0.6741	0.4494	18 in Diam	17.1763	18.0133	0.00	
P-016	79.20	13.2255	13.35	0.9907	1.2174	0.8116	18 in Diam	8.6092	7.5546	0.00	
P-015	79.20	13.2255	31.4745	0.4202	0.6785	0.4523	18 in Diam	17.0323	17.8109	0.00	
P-014	79.20	13.2255	22.2221	0.5952	1.1113	0.5557	24 in Diam	7.3763	7.0735	0.00	
P-013	79.20	13.2255	23.3987	0.5652	1.0764	0.5382	24 in Diam	7.6739	7.448	0.00	
P-21	79.20	13.2255	79.9232	0.1655	0.687	0.2748	30 in Diam	12.0661	16.2818	0.00	
cULV	79.20	13.2255	102.03	0.1296	0.6076	0.243	30 in Diam	14.3425	20.7862	0.00	

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							39.2929
113.08	CULV OUT	41.5995	------	0.0285	------	41.6280	46.0000
113.09	113.08	42.3437	------	1.2922	------	43.6359	47.3800
111.50	113.09	44.2177	0.2752	0.0132	------	43.9557	48.4200
No approach losses at node CB-B1 because inverts and/or crowns are offset.							
108.40	111.50	45.1648	------	2.3709	------	47.5357	47.7100
CB-B1	108.40	54.2205	------	0.0936	------	54.3141	54.5600
CB-B2	CB-B1	55.8974	0.8698	0.0503	------	55.0780	56.8900
CB-B3	CB-B2	60.0815	------	0.1010	0.0392	60.2217	63.6300
CB-B7	CB-B3	60.3459	0.0758	0.0183	------	60.2884	61.5100

No approach losses at node CB-B9 because inverts and/or crowns are offset.							
CB-B8	CB-B7	60.4311	0.5451	0.0577	0.0242	59.9679	64.0600
CB-B8a	CB-B8	63.4172	------	------	------	63.4172	68.8800
CB-B9	CB-B8	60.8960	------	0.0121	0.1950	61.1031	65.2100
CB-B9A	CB-B9	65.1439	------	------	------	65.1439	67.7500
CB-B10	CB-B9	62.7202	------	0.0184	------	62.7387	65.9800
CB-B11	CB-B10	63.2852	------	------	------	63.2852	68.3700
No approach losses at node CB-B5 because inverts and/or crowns are offset.							
CB-B4	CB-B3	62.4253	0.9938	0.7236	------	62.1551	68.2300
CB-B5	CB-B4	73.9040	------	0.0082	0.1441	74.0563	75.6300
CULV IN	CB-B5	74.4247	------	------	------	74.4247	75.5400
CB-B6	CB-B5	76.8840	------	0.0189	------	76.9028	79.9400
CB-B6A	CB-B6	81.7620	------	0.0003	------	81.7623	84.6100
No approach losses at node CB-3 because inverts and/or crowns are offset.							
CB-2	CB-B6A	84.6938	------	1.2526	------	85.9464	89.0200
CB-3	CB-2	90.2015	------	------	------	89.6500	89.5500

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
cULV	1.7195	0.6878	13.23	1.2229	1.2229	0.6076	SuperCrit flow, Inlet end controls
P-21	1.7337	0.6935	13.23	1.4180	1.2229	0.6870	SuperCrit flow, Inlet end controls
P-013	3.3035	1.6518	13.23	2.7159	1.3089	1.0764	Outlet Control
P-014	2.0148	1.0074	13.23	2.2356	1.3089	1.1113	SuperCrit flow, Inlet end controls
P-015	2.7905	1.8603	13.23	3.5657	1.3586	0.6785	SuperCrit flow, Inlet end controls
P-016	4.4661	2.9774	13.23	2.8841	1.3586	1.2174	Outlet Control
P-017	2.7915	1.8610	13.23	2.9980	1.3586	0.6741	SuperCrit flow, Inlet end controls
P-005	3.3240	1.6620	6.94	3.2017	0.9347	0.7626	Outlet Control
P-006	3.0413	1.5207	6.94	2.8984	0.9347	0.7468	Outlet Control
P-20	0.2672	0.1781	0.36	0.8979	0.2187	0.1143	SuperCrit flow, Inlet end controls
P-007	1.2960	0.6480	6.65	1.0079	0.9141	0.7740	SuperCrit flow, Inlet end controls
P-22	0.7139	0.4759	2.26	0.7731	0.5681	0.2193	SuperCrit flow, Inlet end controls
P-008	1.1702	0.7802	4.39	1.1131	0.8043	0.6439	SuperCrit flow, Inlet end controls
P-009	1.1652	0.7768	4.39	1.1787	0.8043	0.5205	SuperCrit flow, Inlet end controls
P-001	5.0032	5.0032	6.28	2.8017	0.9621	0.6606	Outlet Control
P-002	2.6840	2.6840	6.28	2.7751	0.9621	0.4224	SuperCrit flow, Inlet end controls
P-25	3.1947	3.1947	2.96	2.8263	0.7381	0.4514	Outlet Control
P-003	1.3140	1.3140	3.35	2.7663	0.7839	0.3536	SuperCrit flow, Inlet end controls
P-019	1.3020	1.3020	3.35	1.1328	0.7839	0.3857	SuperCrit flow, Inlet end controls
P-23	0.7938	0.7938	1.68	1.3023	0.5507	0.2946	SuperCrit flow, Inlet end controls
P-24	2.5215	5.0430	1.68	0.5000	>D	0.3573	SuperCrit flow, Inlet end controls

Node and Reach invert report

Node and Reach invert report				
Node	CB-B8a		Out ie	63.15 ft
	Reach	P-20	I.E. Out	63.15 ft
Node	CB-B9A		Out ie	64.43 ft
	Reach	P-22	I.E. Out	64.43 ft
Node	CB-B11		Out ie	62.12 ft
	Reach	P-009	I.E. Out	62.12 ft
Node	CB-B10		Out ie	61.55 ft
	Reach	P-009	I.E. In	61.56 ft
	Reach	P-008	I.E. Out	61.55 ft
Node	CB-B9		Out ie	59.60 ft
	Reach	P-22	I.E. In	60.33 ft
	Reach	P-008	I.E. In	59.99 ft
	Reach	P-007	I.E. Out	59.60 ft
Node	CB-B8		Out ie	57.98 ft
	Reach	P-20	I.E. In	59.07 ft
	Reach	P-007	I.E. In	58.96 ft
	Reach	P-006	I.E. Out	57.98 ft
Node	CB-B7		Out ie	57.35 ft
	Reach	P-006	I.E. In	57.39 ft
	Reach	P-005	I.E. Out	57.35 ft
Node	CULV IN		Out ie	71.82 ft
	Reach	P-25	I.E. Out	71.82 ft
Node	CB-3		Out ie	87.68 ft
	Reach	P-24	I.E. Out	87.68 ft
Node	CB-2		Out ie	83.90 ft
	Reach	P-24	I.E. In	86.70 ft
	Reach	P-23	I.E. Out	83.90 ft
Node	CB-B6A		Out ie	80.46 ft
	Reach	P-23	I.E. In	80.46 ft
	Reach	P-019	I.E. Out	80.46 ft
Node	CB-B6		Out ie	75.57 ft
	Reach	P-019	I.E. In	75.77 ft
	Reach	P-003	I.E. Out	75.57 ft
Node	CB-B5		Out ie	71.22 ft
	Reach	P-25	I.E. In	71.23 ft
	Reach	P-003	I.E. In	71.29 ft

	Reach	P-002	I.E. Out	71.22 ft
Node	CB-B4		Out ie	59.11 ft
	Reach	P-002	I.E. In	59.38 ft
	Reach	P-001	I.E. Out	59.11 ft
Node	CB-B3		Out ie	57.02 ft
	Reach	P-005	I.E. In	57.02 ft
	Reach	P-001	I.E. In	57.42 ft
	Reach	P-017	I.E. Out	57.29 ft
Node	CB-B2		Out ie	51.98 ft
	Reach	P-017	I.E. In	52.08 ft
	Reach	P-016	I.E. Out	51.98 ft
Node	CB-B1		Out ie	51.43 ft
	Reach	P-016	I.E. In	51.43 ft
	Reach	P-015	I.E. Out	51.43 ft
Node	108.40		Out ie	43.15 ft
	Reach	P-015	I.E. In	43.97 ft
	Reach	P-014	I.E. Out	43.15 ft
Node	111.50		Out ie	41.72 ft
	Reach	P-014	I.E. In	41.7201 ft
	Reach	P-013	I.E. Out	41.72 ft
Node	113.09		Out ie	40.61 ft
	Reach	P-013	I.E. In	40.92 ft
	Reach	P-21	I.E. Out	40.61 ft
Node	113.08		Out ie	39.88 ft
	Reach	P-21	I.E. In	40.21 ft
	Reach	cULV	I.E. Out	39.88 ft

6.0 SPECIAL REPORTS AND STUDIES

The Geotechnical Report by Terra Associates, Inc. and the Critical Area Study and Mitigation Plan by will be submitted as an additional document separately from this Report.

7.0 OTHER PERMITS

Other permits that may be required for the proposed development are as follows:

- Clearing and Grading Permit
- National Pollution Discharge Elimination System (NPDES)
- Right-of-Way permit
- Utility Permit
- Building Permits

8.0 EROSION AND SEDIMENT CONTROL ANALYSIS AND DESIGN

The Stormwater Pollution Prevention Plan for the project, which is written according to the guidelines of Volume II, Section 3 of the 2014 DOE Manual and the requirements of the 2019 Redmond Stormwater Technical Notebook, will be submitted as a separate document as project design progresses.

9.0 BOND QUANTITIES, FACILITY SUMMARIES, AND DECLARATION OF COVENANT

A Bond Quantities Worksheet will be completed as necessary for a future submittal.

10.0 OPERATIONS AND MAINTENANCE MANUAL

The proposed storm drainage system consists of swales, buried pipes, catch basins and a Combined Detention/Wetvault facility, each of which will require periodic maintenance and inspection. An Operations and Maintenance Manual will be submitted to the City as a separate document.

APPENDIX 10-A

OPERATIONS AND MAINTENANCE CRITERIA

No. 4 – Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall.	Structure securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight and show signs of rust.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes--other than designed holes--in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
		Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See “Closed Detention Systems” (No. 3).	See “Closed Detention Systems” (No. 3).	See “Closed Detention Systems” (No. 3).
Catch Basin	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & 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 (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.

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
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 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.

No. 6 – Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe

No. 7 – Energy Dissipaters

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
External:			
Rock Pad	Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a “sheet flow” of water along trench). Intent is to prevent erosion damage.	Trench redesigned or rebuilt to standards.
	Perforations Plugged.	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
	Water Flows Out Top of “Distributor” Catch Basin.	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.	Facility rebuilt or redesigned to standards.
	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Internal:			
Manhole/Chamber	Worn or Damaged Post, Baffles, Side of Chamber	Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure replaced to design standards.
	Other Defects	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).

No. 12 – Wetvaults

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).	Remove trash and debris from vault.
	Sediment Accumulation in Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	Remove sediment from vault.
	Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.	Pipe repaired or replaced to proper working specifications.
	Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
	Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	Maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		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 staff.	Baffles repaired or replaced to specifications.
	Access Ladder Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned. Confined space warning sign missing.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements. Ladder and entry notification complies with OSHA standards.

No. 18 – Catchbasin Inserts

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
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.