PRELIMINARY TECHNICAL INFORMATION REPORT

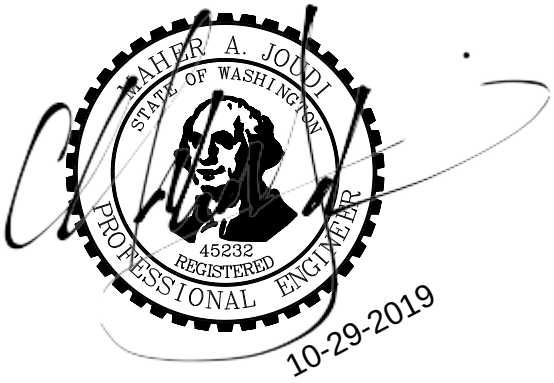
for

LEARY FLOYD SUBDIVISION

Preliminary Plat

24637 & 24649 NE 18th Street

King County, Washington



DRS Project No. 18040
King County File No. PLATXX-XXXX

Owner/Applicant

Toll Bros, Inc.
8815 - 122nd Ave NE, Suite 200
Kirkland, Washington 98033

Report Prepared by

D. R. STRONG Consulting Engineers, Inc.
620 7th Avenue
Kirkland WA 98033
(425) 827-3063

Report Issue Date

October 29, 2019

PRELIMINARY TECHNICAL INFORMATION REPORT

LEARY FLOYD SUBDIVISION

PRELIMINARY PLAT

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SECTION I

PROJECT OVERVIEW

The Project is the subdivision of three existing parcels into 17 single-family residential lots per the King County (County) subdivision process. Each parcel is zoned R4 and sums up to a total Site area of 6.01 acres, known as Tax Parcels 2625069029, 2625069055, and 2625069007. The Project is located at 24637 & 24649 NE 18th Street, Sammamish, Washington. The Project will meet the drainage requirements of the 2016 King County Surface Water Design Manual (Manual).

PREDEVELOPED SITE CONDITIONS

The total area of the three parcels is 6.01 acres. A boundary line adjustment is proposed to provide a parcel totaling 49,802 s.f. for the residence addressed 24649 NE 18th Street. This leaves 4.87 acres for the development of the proposed subdivision.

Predeveloped Site conditions show the Site sloping from west to east. There exists multiple critical areas on the existing Site. The Allen Lake Outfall Channel is located on the westerly portion of the Site, flowing from south to north. There also exists two existing wetlands on Site, as delineated by Raedeke Associates, Inc in the Wetland Delineation Report provided in Appendix B.

The Site is contained within one Threshold Discharge Area (TDA) with two Natural Discharge Areas (NDA): NDA East and NDA West. Both NDAs contain developed areas of landscaping and residences. NDA East drains to the Allen Lake Outfall Channel, which discharges from the Site on the northerly property line. NDA West discharges from the Site as sheet flow over the northerly property line and then flows east along NE 18th Street for approximately 290 ft, where it converges with NDA East in the Allen Lake Outfall Channel, maintaining one TDA. For the purposes of hydrologic calculations, the entire Site is modeled as till forest. See Section III for details.

DEVELOPED SITE CONDITIONS

The applicant is seeking approval to subdivide 5.38 acres into 17 single–family residential lots with sizes ranging from approximately 2,951 s.f. to 5,500 s.f. The Site is divided in to two main areas by the existing wetlands, each with separate access routes and utility designs. The northern section, accessed from NE 18th Street via a fully improved public road, contains Lots 1-15. The southern section, accessed from NE 16th Steet via a joint use driveway, includes lots 16-17. Impervious surfaces include the 17 residences and their driveways, the proposed roadways and recreation space areas. The remainder of the Site will be landscaped and/or left undisturbed. The existing single-family residence located on parcel 2625069029 will be preserved while all other existing improvements located on Site will be demolished or removed during construction.

The Project is located in a Conservation Flow Control area and is required to provide Level 2 Flow Control and Basic Water Quality treatment, per the 2016 KCSWDM (Manual). However, the Project discharges to the east to the Allen Lake Outfall Channel which has been documented as Type 3 severe flooding problem. Therefore, the Project will be required to meet the Level 3 flow control standard for detention design. Surface

water runoff from impervious surfaces will be collected and conveyed to two stormwater detention/water quality vaults in Tract A. Due to topography relative to the available discharge elevations, the Project will be divided into two basins and will meet the flow control requirements at one downstream point of compliance.

Detention/water quality vault 1 will provide flow control for the Project Site frontage (NE 18th Street), and detention/water quality vault 2 will provide flow control for the main Project Site. The vaults will meet Basic Water Quality requirements by provided dead storage for the detention vaults. The two detention wetvaults will outlet to the existing conveyance network in NE 18th Street.

The Project also includes two Lots, Lots 16 and 17, that are separated from the main Site by a critical area tract. The proposed lots will meet water quality and flow control requirements by utilizing full dispersion towards the critical area tracts located on Site. The utilization of full dispersion via gravel filled trenches will meet all requirements set forth by the Manual and will also satisfy Core Requirement 9, Flow Control BMPs.

NATURAL DRAINAGE SYSTEM FUNCTIONS

The Site consists of one Threshold Discharge Area (TDA) and two Natural Discharge Areas (NDAs). Runoff generated from NDA East [parcel: 2625069029, Lot#24649] sheet flows east and enters the Allen Lake Outlet Channel. The channel flows north, leaving the property from the northeast corner through a culvert under NE 18th St. The channel then flows northwest through a second culvert under 247th Pl NE before continuing northwest towards 244th Ave NE. Runoff from NDA West [parcel: 2625069055, Lot#24637] sheet flows east and leaves the Site from the northeast corner. The runoff continues to sheet flow east along the NE 18th St. Right-Of-Way before converging with NDA East in the Allen Lake Outlet Channel.

A review of the SCS soils map for the area (see Figure 4, Soils) indicates Alderwood gravelly sandy loam with 8 to 15 percent slopes (AgC), Everett very gravelly sandy loam with 8 to 15 percent slopes (EvC), and Seattle muck (Sk). Per the Manual, this soil type is classified as “Till”, “Outwash”, and “Wetland” material. The SCS Soil series descriptions follow Figure 4.

King County IMAP and a field topographic survey were used to evaluate the upstream area of the Site. There is an upstream tributary area draining onto the site in two locations. The first is the existing Allen Lake Outlet Channel flowing from the south through the site. This channel conveys water through the Site in a northerly direction. To the west, a small portion of parcel #2625069042 flows onto the Project Site. This parcel is fully developed with a residential home and landscaping, and generally slopes northeast, towards NE 18th Street and the existing drainage swale. Public right-of-ways and existing conveyance systems are found to the north and south of the Site. To the east, the Allen Lake Outfall Channel collects any possible upstream flows and conveys it to the North, away from the Site. To this effect, this upstream runoff can be considered negligible for the scope of this Project. No foreseen negative impacts are anticipated.

FIGURE 1
TIR WORKSHEET

King County Department of Development and Environmental Services

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner: **Toll Bros, Inc.**

Phone: **(206) 825-1955**

Address: **8815 122nd Ave NE, Suite 200 Kirkland, Washington 98033**

Project Engineer: **Maher A. Joudi, P.E.**

Company: **D. R. STRONG Consulting Engineers Inc.**

Phone**:** **(425) 827-3063**

Part 2 PROJECT LOCATION AND DESCRIPTION

Project Name: **Leary Floyd Subdivision**

Permit#:

Location:

Township: **25 North**

Range: **06 East**

Section: **26**

Site Address: **24637,& 24649 NE 18th Street, Sammamish, WA 98074**

Part 3 TYPE OF PERMIT APPLICATION

- ☒ **Landuse** (e.g.,**Subdivision** / Short Subd. / UPD
- ☐ Building (e.g.,M/F / Commercial / SFR)
- ☐ Clearing and Grading
- ☐ Right-of-Way Use
- ☐ Other:

Part 4 OTHER REVIEWS AND PERMITS

- ☐ DFW HPA
- ☐ COE 404
- ☐ DOE Dam Safety
- ☐ FEMA Floodplain
- ☐ COE Wetlands
- ☐ Other: _____
- ☐ Shoreline Mngmt.
- ☒ **Structural /Rockery/Vault**
- ☐ ESA Section 7

Part 5 PLAN AND REPORT INFORMATION

Technical Information Report		**Site Improvement Plan (Engr. Plans)**	
	☒ **Full**	Plan Type (check	☒ **Full**
Type of Drainage Review	☐ Targeted	one):	☐ Modified
(check one):	☐ Simplified		☐ Simplified
	☐ Large Project		
	☐ Directed	Date (include revision dates):	September 9, 2019
Date (include revision dates):	September 9, 2019	Date of Final:	
Date of Final:			

Part 6 ADJUSTMENT APPROVALS

Type (circle one): Standard / Experimental / Blanket
Description: (include conditions in TIR Section 2)
None required or provided.

Approved Adjustment No._____
Date of Approval:_____

Part 7 MONITORING REQUIREMENTS

Monitoring Required: Yes / **No**	Describe_____
Start Date: _____	Re: KCSWDM Adjustment No._____
Completion Date _____	

Part 8 SITE COMMUNITY AND DRAINAGE BASIN

Community Plan: East Sammamish
Special District Overlays: None
Drainage Basin: Evans Creek
Stormwater Requirements: **Level 3 w/ Basic WQ treatment**

Part 9 ONSITE AND ADJACENT SENSITIVE AREAS

☒ River/ Stream_____	☐ Steep Slope_____
☐ Lake _____	☐ Erosion Hazard_____
☒ Wetlands_____	☐ Landslide Hazard_____
☐ Closed Depression _____	☐ Coal Mine Hazard_____
☐ Floodplain _____	☐ Seismic Hazard_____
☐ Other _____	☐ Habitat Protection_____
_____	☐ _____

Part 10 SOILS

Soil Type	Slopes	Erosion Potential
EvC	8-15%	Slight-Moderate
AgC	8-15%	Slight-Moderate
Sk	N/A	N/A

☐ High Groundwater Table (within 5 feet) ☐ Sole Source Aquifer

☐ Other _____ ☐ Seeps/Springs

☐ Additional Sheets Attached

Part 11 DRAINAGE DESIGN LIMITATIONS

REFERENCE	LIMITATION / SITE CONSTRAINT
☒ **Core Requirement #2 – Offsite Analysis**	**None**
☒ **Sensitive/ Critical Areas**	
☒ **SEPA**	
☐ LID Infeasibility	
☐ Other	
☐	
☐ Additional Sheet Attached	

Part 12 TIR SUMMARY SHEET (Provide one TIR Summary Sheet per Threshold Discharge Area)

Threshold Discharge Area: **The Site is comprised of one TDA**
(name or description)

Core Requirements (all 9 apply):

Discharge at Natural Location	Number of Natural Discharge Locations: **2**
Offsite Analysis	Level: **1** / 2 / 3 dated: **July 31, 2019**
Flow Control (include facility summary sheet)	Level: 1 / 2 / **3** or Exemption Number _____ Flow Control BMPS: **Full Dispersion**
Conveyance System	Spill containment located at: **TBD**
Erosion and Sediment Control/ Construction Stormwater Pollution Prevention	CSWPP/CESCL/ESC Site Supervisor: **TBD** Contact Phone: **TBD** After Hours Phone: **TBD**
Maintenance and Operation	Responsibility (circle one): Private / (Public) If Private, Maintenance Log Required: Yes / No
Financial Guarantees and Liability	Provided: **Yes** / No
Water Quality (include facility summary sheet)	Type: (Basic) / Sens Lake / Enhanced Basic / Bog or exemption No. _____ Landscape Management Plan: Yes / **No**

Special Requirements (as applicable)	
Area Specific Drainage Requirements	Type: CDA / SDO / MDP / BP / LMP / Shared Fac./ **None** Name: _____
Floodplain/Floodway Delineation	Type: (circle one): Major / Minor / Exemption / **None** 100-year Base Flood Elevation (or range): _____ Datum: _____
Flood Protection Facilities	Describe: **None required or provided**
Source Control (comm. / industrial land use)	Describe Land use: **Residential** Describe any structural controls: **None required or provided**
Oil Control	High-use Site: Yes / **No** Treatment BMP: _____ Maintenance Agreement: Yes / **No** with whom? _____

Other Drainage Structures

Describe: **Runoff generated by impervious surfaces will be collected and conveyed to detention facilities.**

Part 13 EROSION AND SEDIMENT CONTROL REQUIREMENTS

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION	MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION
☒ **Clearing Limits**	☒ **Stabilize Exposed Surfaces**
☒ **Cover Measures**	☒ **Remove and Restore Temporary ESC Facilities**
☒ **Perimeter Protection**	☒ **Clean and Remove All Silt and Debris, ensure operation of Permanent Facilities, restore operation of Flow Control BMP Facilities as necessary**
☒ **Traffic Area Stabilization**	☒ **Flag Limits of SAO and open space Preservation areas**
☒ **Sediment Retention**	☐ Other _____
☒ **Surface Water Collection**	
☐ Dewatering Control	
☒ **Dust control**	
☒ **Flow Control**	
☒ **Protection of Flow Control BMP Facilities (existing and proposed)**	
☒ **Maintain BMPs / Manage Project**	

Part 14 STORMWATER FACILITY DESCRIPTIONS (Note: Include Facility Summary and Sketch

Flow Control	Type/Description	Water Quality	Type/Description
☒ Detention	**Vault**	☐ Biofiltration	
☐ Infiltration		☒ Wetpool	**Wetvault**
☐ Regional Facility		☐ Media Filtration	
☐ Shared Facility		☐ Oil Control	
☒ Flow Control BMPs	**Full Dispersion**	☐ Spill Control	
☐ Other		☐ Flow Control BMPs	
		☐ Other	

Part 15 EASEMENTS/TRACTS

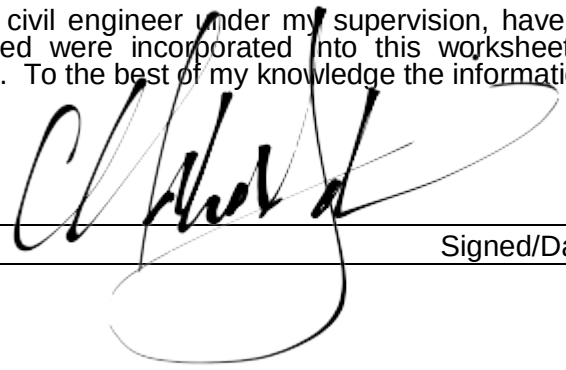
- ☐ Drainage Easement
- ☐ Covenant
- ☐ Native Growth Protection Covenant
- ☒ **Tract**
- ☐ Other:

Part 16 STRUCTURAL ANALYSIS

- ☒ **Cast in Place Vault**
- ☐ Retaining Wall
- ☐ Rockery > 4ôHigh
- ☐ Structural on Steep Slope
- ☐ Other:

Part 17 SIGNATURE OF PROFESSIONAL ENGINEER

I, or a civil engineer under my supervision, have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attached Technical Information Report. To the best of my knowledge the information provided here is accurate.



10/29/2019

Signed/Date

FIGURE 2
VICINITY MAP

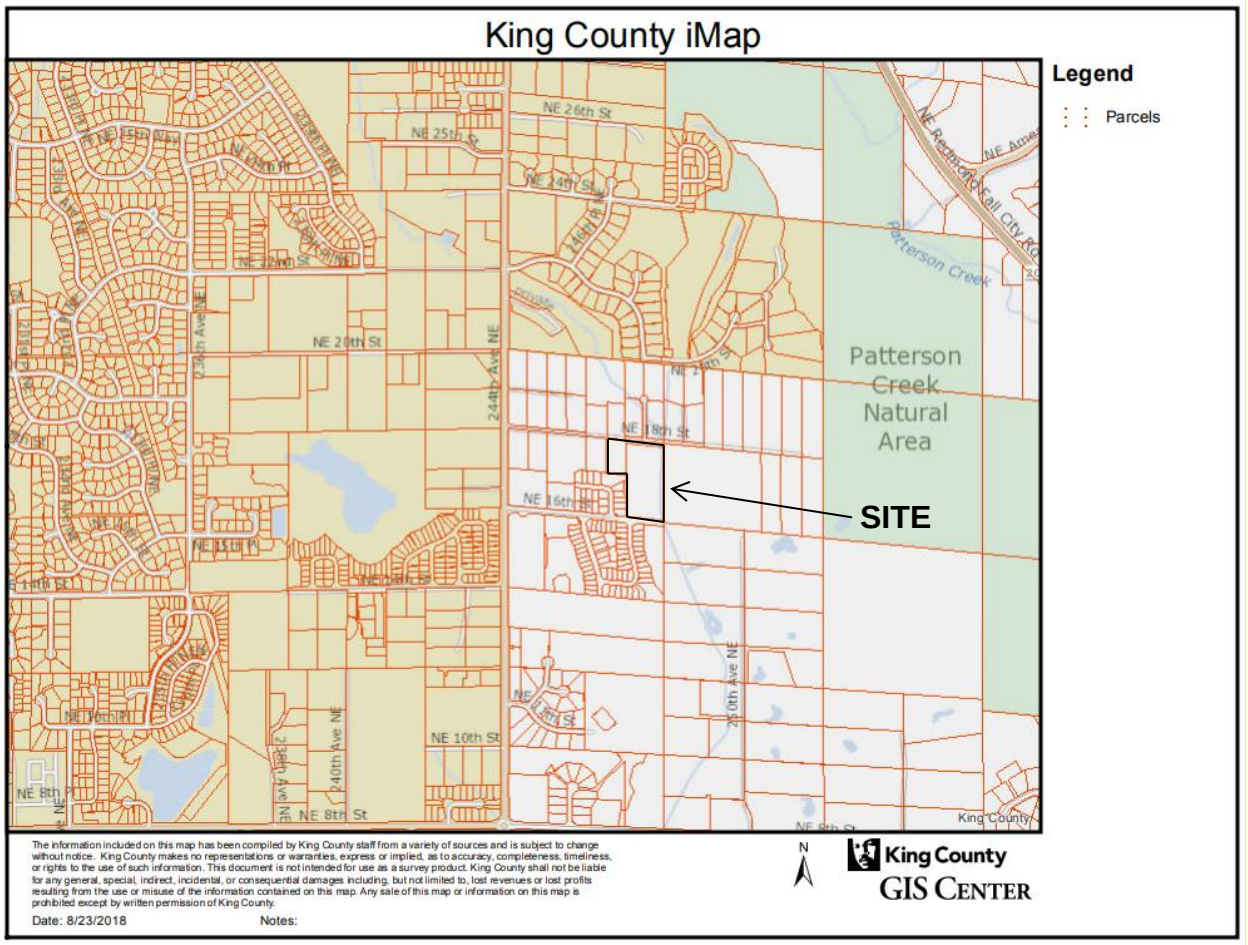


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FIGURE 3
DRAINAGE BASINS, SUBBASINS, AND SITE CHARACTERISTICS MAP

GRAPHIC SCALE
0 50 100 150
1 INCH = 100 FT.

D.R. STRONG
CONSULTING ENGINEERS
ENGINEERS PLANNERS SURVEYORS
620 - 7th AVENUE KIRKLAND, WA 98033
O 425.827.3063 F 425.827.2423

FLOYD LEARY SUBDIVISION

FIGURE 3: DRAINAGE BASINS, SUBBASINS, AND SITE CHARACTERISTICS
24615 & 24637 NE 18TH STREET
SAMMAMISH, WA

DRAFTED BY: CYW
DESIGNED BY: CYW
PROJECT ENGINEER: MAJ
DATE: 09.04.19
PROJECT NO.: 18040

FIGURE: 3

FIGURE 4
SOILS

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 map unit.*

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
- *Other vegetative classification:* Limited Depth Soils (G002XN301WA), Limited
- Depth Soils (G002XS303WA), Limited Depth Soils (G002XF302WA)

Minor Components
Everett

- *Percent of map unit:* 5 percent
- *Landform:* Eskers, kames, moraines
- *Landform position (two-dimensional):* Shoulder, footslope
- *Landform position (three-dimensional):* Crest, base slope
- *Down-slope shape:* Convex
- *Across-slope shape:* Convex

Indianola

- *Percent of map unit:* 5 percent
- *Landform:* Eskers, kames, terraces
- *Landform position (three-dimensional):* Tread
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear

Shalcar

- *Percent of map unit:* 3 percent
- *Landform:* Depressions
- *Landform position (three-dimensional):* Dip
- *Down-slope shape:* Concave
- *Across-slope shape:* Concave

Norma

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

EvC—Everett very gravelly sandy loam, 8 to 15 percent slopes
Map Unit Setting

- *National map unit symbol:* 2t62b
- *Elevation:* 30 to 900 feet
- *Mean annual precipitation:* 35 to 91 inches
- *Mean annual air temperature:* 48 to 52 degrees F
- *Frost-free period:* 180 to 240 days
- *Farmland classification:* Farmland of statewide importance

Map Unit Composition

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

Description of Everett
Setting

- *Landform:* Kames, eskers, moraines
- *Landform position (two-dimensional):* Shoulder, footslope
- *Landform position (three-dimensional):* Crest, base slope
- *Down-slope shape:* Convex
- *Across-slope shape:* Convex
- *Parent material:* Sandy and gravelly glacial outwash

Typical profile

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

Properties and qualities

- *Slope:* 8 to 15 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Somewhat excessively drained
- *Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Low (about 3.2 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 4s
- *Hydrologic Soil Group:* A
- *Forage suitability group:* Droughty Soils (G002XN401WA), Droughty Soils (G002XS403WA), Droughty Soils (G002XF402WA)
- *Hydric soil rating:* No

Minor Components

Alderwood

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

Indianola

- *Percent of map unit:* 10 percent
- *Landform:* Eskers, kames, terraces
- *Landform position (three-dimensional):* Riser
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Hydric soil rating:* No

Sk—Seattle muck

Map Unit Setting

- *National map unit symbol:* 1hmv4
- *Elevation:* 0 to 1,000 feet
- *Mean annual precipitation:* 25 to 50 inches
- *Mean annual air temperature:* 48 to 52 degrees F
- *Frost-free period:* 150 to 250 days
- *Farmland classification:* Prime farmland if drained

Map Unit Composition

- *Seattle and similar soils:* 75 percent
- *Minor components:* 25 percent
- *Estimates are based on observations, descriptions, and transects of the map unit.*

Description of Seattle

Setting

- *Landform:* Depressions
- *Parent material:* Grassy organic material

Typical profile

- *H1 - 0 to 11 inches:* muck
- *H2 - 11 to 60 inches:* stratified mucky peat to muck

Properties and qualities

- *Slope:* 0 to 1 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Very poorly drained
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 01.98 in/hr)
- *Depth to water table:* About 0 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* Frequent
- *Available water storage in profile:* Very high (about 23.5 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 5w
- *Hydrologic Soil Group:* B/D
- *Forage suitability group:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

Minor Components

Shalcar

- *Percent of map unit:* 10 percent
- *Landform:* Depressions
- *Hydric soil rating:* Yes

Tukwila

- *Percent of map unit:* 10 percent
- *Landform:* Depressions
- *Hydric soil rating:* Yes

Bellingham

- *Percent of map unit:* 3 percent
- *Landform:* Depressions
- *Hydric soil rating:* Yes

Norma

- *Percent of map unit:* 2 percent
- *Landform:* Depressions
- *Hydric soil rating:* Yes

SECTION II

CONDITIONS AND REQUIREMENTS SUMMARY

The Project must comply with the following Core and Special Requirements:

- **C.R. #1 – Discharge at the Natural Location:** Existing drainage discharges from the Site in two locations, both of which converge in the Allen Lake Outfall Channel within ¼ mile from the Site. The project is proposing to discharge towards the Allen Lake Outfall Channel, both directly via existing conveyance networks and by full dispersion directly towards the channel and associated sensitive areas. This proposal maintains discharge at the natural location for the Project Site.
- **C.R. #2 – Offsite Analysis:** An offsite analysis is included in Section III. The Analysis describes the Site's runoff pattern in detail.
- **C.R. #3 – Flow Control:** The Project is located in a Conservation Flow Control Area but discharges towards an area with a Type 3 drainage problem, therefore requiring Level 3 flow control. The Site is required to "match developed discharge durations to predeveloped durations for the range of predeveloped discharge rates from 50% of the two-year peak flow up to the full 50-year peak flow. Also match developed peak discharge rates to predeveloped peak discharge rates for the 2 and 10 year return periods, AND match the developed 100-year peak discharge rate to the predeveloped 100-year peak discharge rate for existing site conditions.
- **C.R. #4 – Conveyance System:** New pipe systems and ditches/channels are required to be designed with sufficient capacity to convey and contain (at minimum) the 25-year peak flow, assuming developed conditions for onsite tributary areas and existing conditions for any offsite tributary areas. Pipe system structures and ditches/channels may overtop for runoff events that exceed the 25-year design capacity, provided the overflow from a 100-year runoff event does not create or aggravate a "severe flooding problem" or "severe erosion problem" as defined in C.R. #2. Any overflow occurring onsite for runoff events up to and including the 100-year event must discharge at the natural location for the project Site. In residential subdivisions, such overflow must be contained within an onsite drainage easement, tract, covenant or public right-of-way. The proposed conveyance system was analyzed using the KCBW program, and is capable of conveying the 100-year peak storm without overtopping any structures or channels. This analysis will be performed at time of construction plan preparation.
- **C.R. #5 – Erosion and Sediment Control:** The Project provides the thirteen minimum ESC measures.
- **C.R. #6 – Maintenance and Operations:** Maintenance of the proposed storm drainage facilities will be the responsibility of the County. An Operation and Maintenance Manual will be included in Section X at the time of construction plan preparation.
- **C.R. #7 – Financial Guarantees and Liability:** Prior to commencing construction, the Applicant must post a drainage facilities restoration and Site stabilization

financial guarantee. For any constructed or modified drainage facilities to be maintained and operated by the City, the Applicant must: 1) Post a drainage defect and maintenance financial guarantee for a period of two years, and 2) Maintain the drainage facilities during the two-year period following posting of the drainage defect and maintenance financial guarantee.

- **C.R. #8 – Water Quality:** The Project is located in the Basic Water Quality Treatment area. A wetvault is proposed in combination with the detention vault in order to accommodate the Water Quality Treatment requirement.
- **C.R. #9 – Flow Control BMP's:** The Project falls under Small Lot BMP Requirements, as all proposed lots are smaller than 22,000 s.f. Flow control BMP requirements for small lots requires that all impervious surfaces be evaluated for application of full dispersion. Full dispersion is feasible utilizing gravel filled trenches to disperse towards the existing wetlands located on site. The total impervious area to be fully dispersed is 7,231 s.f. and uses all feasible buffer areas meeting the requirements for full dispersion. Per Section 1.2.9.2.1.5, "BMPs must be implemented, at minimum, for an impervious area equal to at least 10% of the site/lot for site/lot sizes up to 11,000 square feet[…]" The sum of the lot areas proposed for this Project is 62,771 s.f. Therefore, full dispersion has been proposed to manage 11.51% of the lot areas, meeting the Flow Control BMP requirement.
- **S.R. #1 – Other Adopted Area-Specific Requirements:** Not applicable for this Project.
- **S.R. #2 – Floodplain/Floodway Delineation:** The Project parcel is not within a 100-year floodplain defined by any of FEMA's floodplain insurance rate maps. No other specific data exists establishing the base (100-year) flood elevation through the Site.
- **S.R. #3 – Flood Protection Facilities:** Not applicable for this Project.
- **S.R. #4 – Source Control:** Not applicable for this Project.
- **S.R. #5 – Oil Control:** Not applicable for this Project.

SECTION III

OFF-SITE ANALYSIS

An offsite Level One Downstream Analysis was prepared by D.R. STRONG Consulting Engineers Inc. and is included in this Section.

TASK 1: DEFINE AND MAP THE STUDY AREA

This Offsite Analysis was prepared in accordance with Core Requirement #2, Section 1.2.2 of the 2016 King County Surface Water Design Manual (Manual). The Site is located at 24637 and 24649 NE 18th Street, Sammamish, WA.

See Figures 2 through 11 for maps of the study area.

TASK 2: RESOURCE REVIEW

- Adopted Basin Plans: *None at this time.*
- Floodplain/Floodway (FEMA) Map: *No floodplains exist on site, See Figure 10.*
- Other Offsite Analysis Reports: *Kensington Enclave, Mystic Lake, Technical Memorandum; Re: Results of an Update to the 2013 Hydrologic and Hydraulic Allen Lake Feasibility Study*
- Sensitive Areas Folio Maps: *See Figures 4-8 for documentation of the distance downstream from the proposed project to the nearest critical areas. Included, are sections of the King County Sensitive Areas Folio which indicate the following:*
    - **Figure 5 Streams and 100-Year Floodplains and Floodway:** *There are no floodplains onsite. A stream is located within 1 mile of the site along the downstream path*.
    - **Figure 6 Wetlands:** *King County has not identified any wetlands in the immediate vicinity of the project site, however two wetlands have been found on-site. See "Wetland Delineation Report" by Raedeke Associates, Inc. in Appendix B.*
    - **Figure 7 Erosion Hazard:** *There are no mapped Erosion Hazard Areas onsite, however there is one Erosion Hazard Area within one mile of the Site along the downstream path.*
    - **Figure 8 Landslide Hazard:** *There are no mapped Erosion Hazard Areas onsite, however there is one area mapped as a Landside Hazard Area within 1 mile of the site along the downstream path*.
    - **Figure 9 Seismic Hazard:** *There are no mapped Seismic Hazard Areas on the project site; however the Evans Creek area is identified as a Seismic Hazard Areas within one mile of the Site along the downstream path.*
- DNRP Drainage Complaints and Studies: As shown in Figure 11, there are several drainage complaints (10 or more) along the downstream path. All but three complaints are closed and/or were not recorded within the last 10 years.

- Road Drainage Problems: *None noted.*
- USDA King County Soils Survey: *See Figure 4.*
- Wetlands Inventory: *Vol. 1 East (1990) – The wetland inventory revealed no additional wetlands within the downstream path.*
- Migrating River Studies: *None are applicable to the site.*
- Washington State Department of Ecology's latest published Clean Water Act Section 303d list of polluted waters: *None listed along the ¼ mile downstream path. Just past ¼ mile, the unnamed tributary to Evans Creek carries a Category 4A – Temperature, listing for water quality,*
- King County Designated Water Quality Problems: *None at this time.*
- Adopted Stormwater Compliance Plans: *None applicable to this site.*
- Basin Reconnaissance Summary Reports: *No reports available for this area.*

FIGURE 5
STREAMS AND 100-YEAR FLOODPLAINS AND FLOODWAY

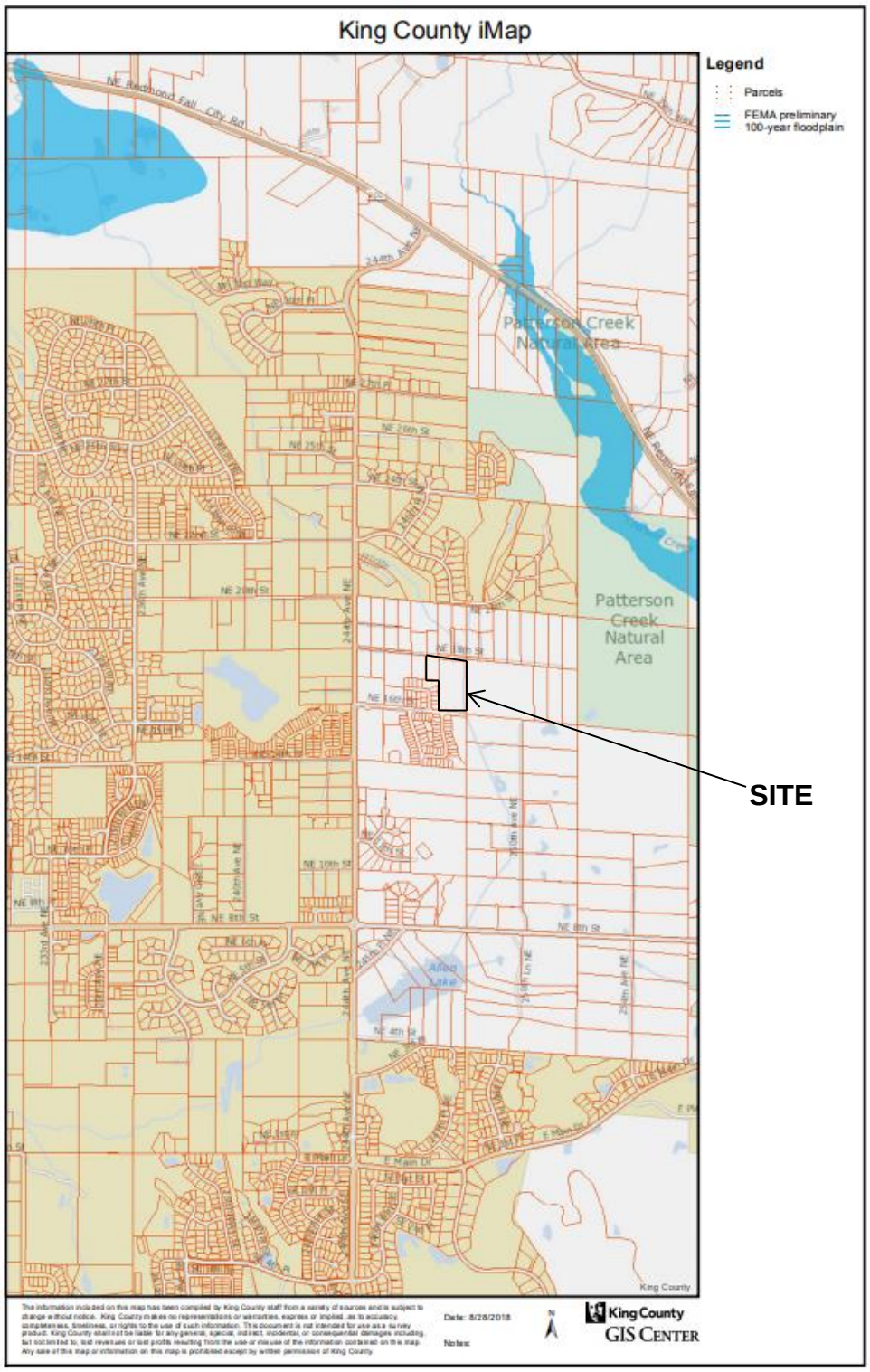


FIGURE 6
WETLANDS

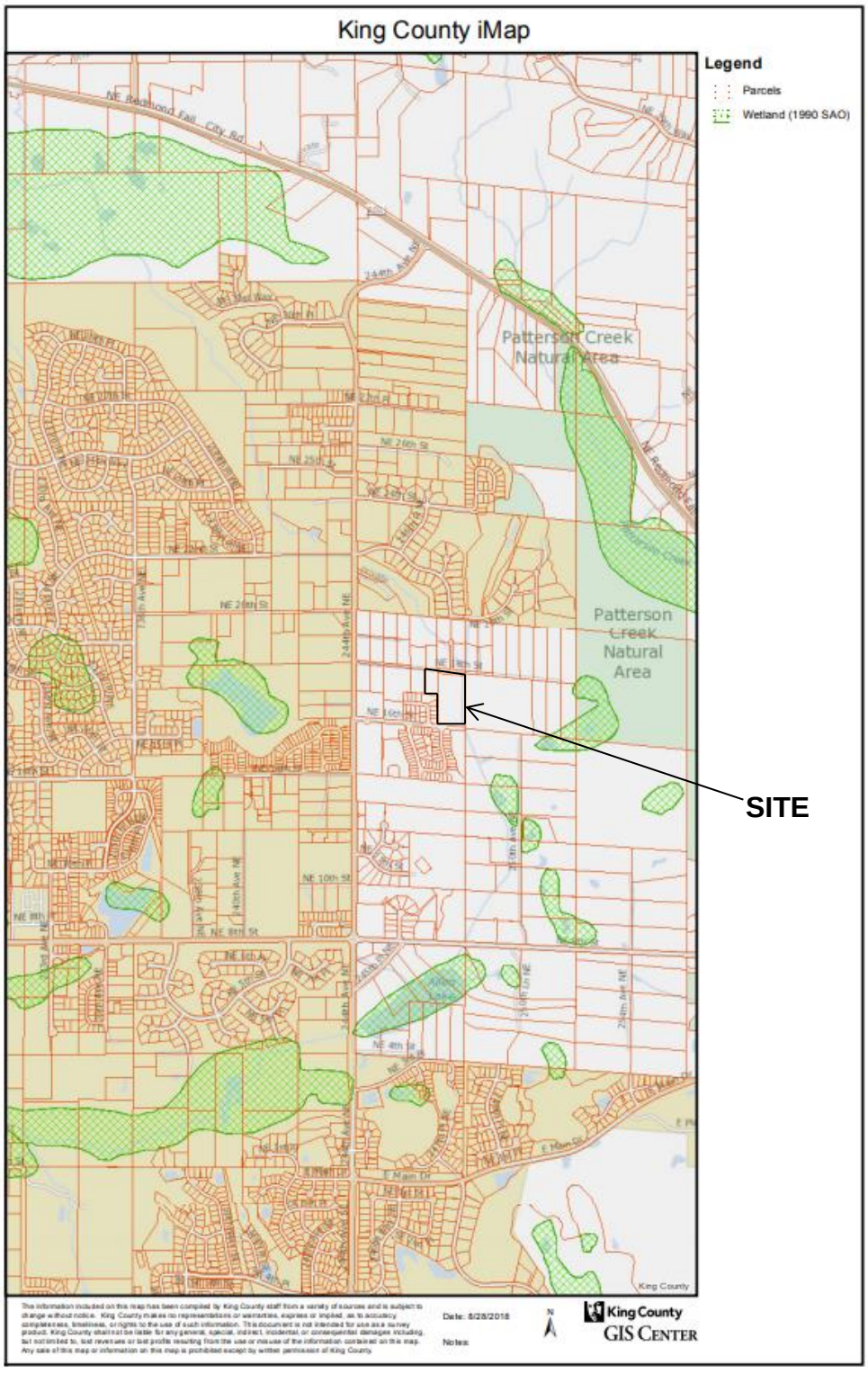


FIGURE 7
EROSION HAZARD AREAS

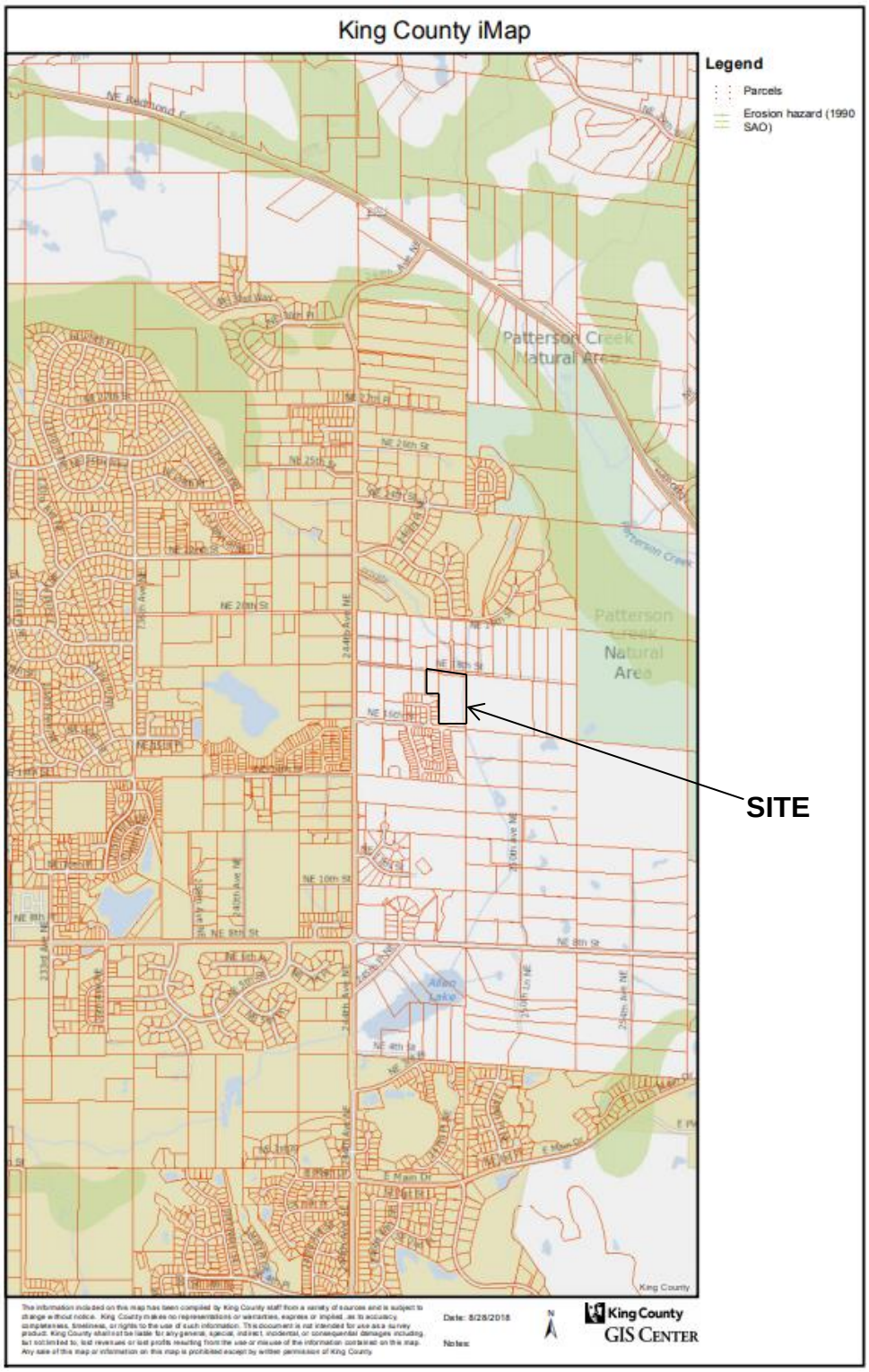


FIGURE 8
LANDSLIDE HAZARD AREAS

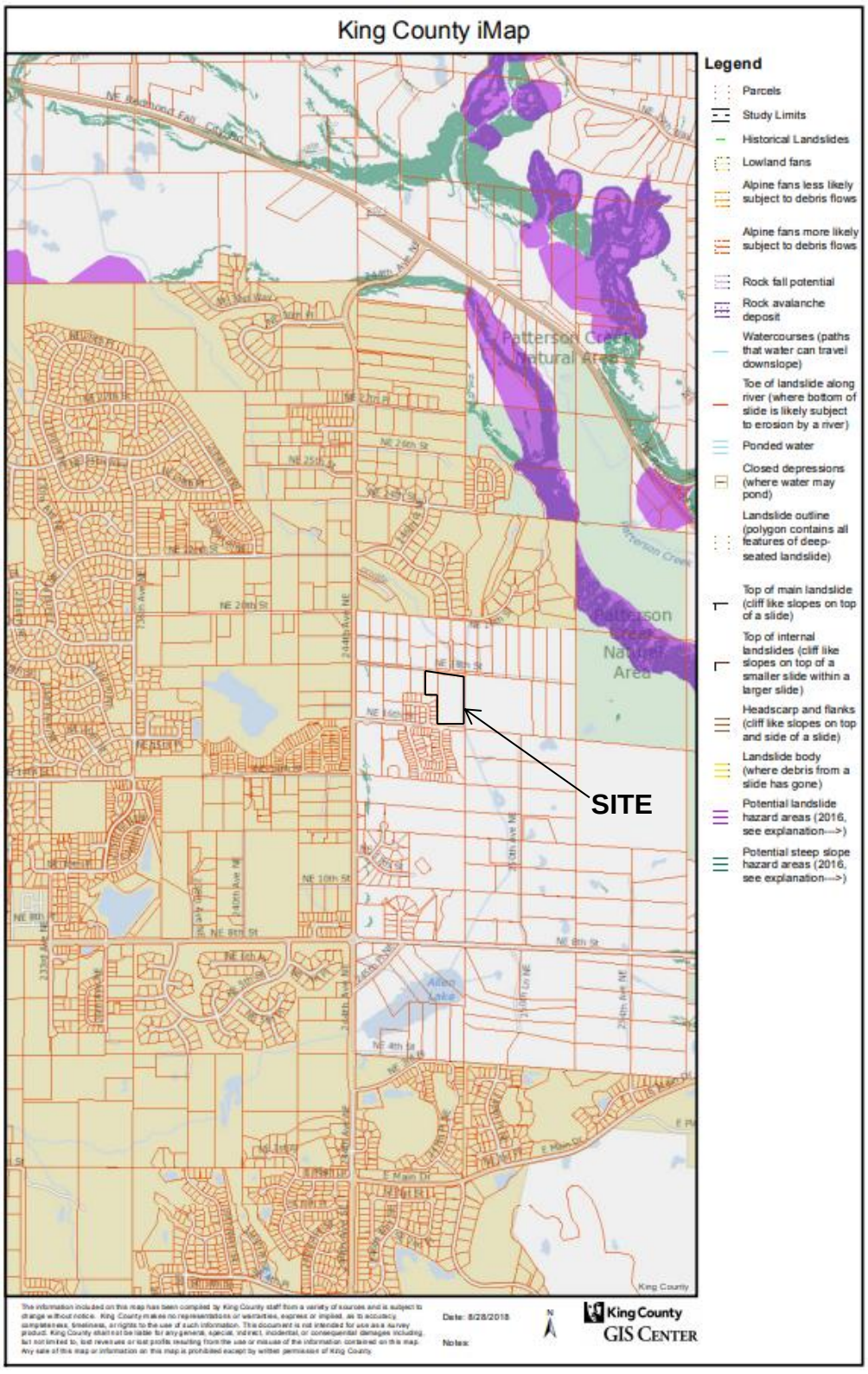


FIGURE 9
SEISMIC HAZARD AREAS

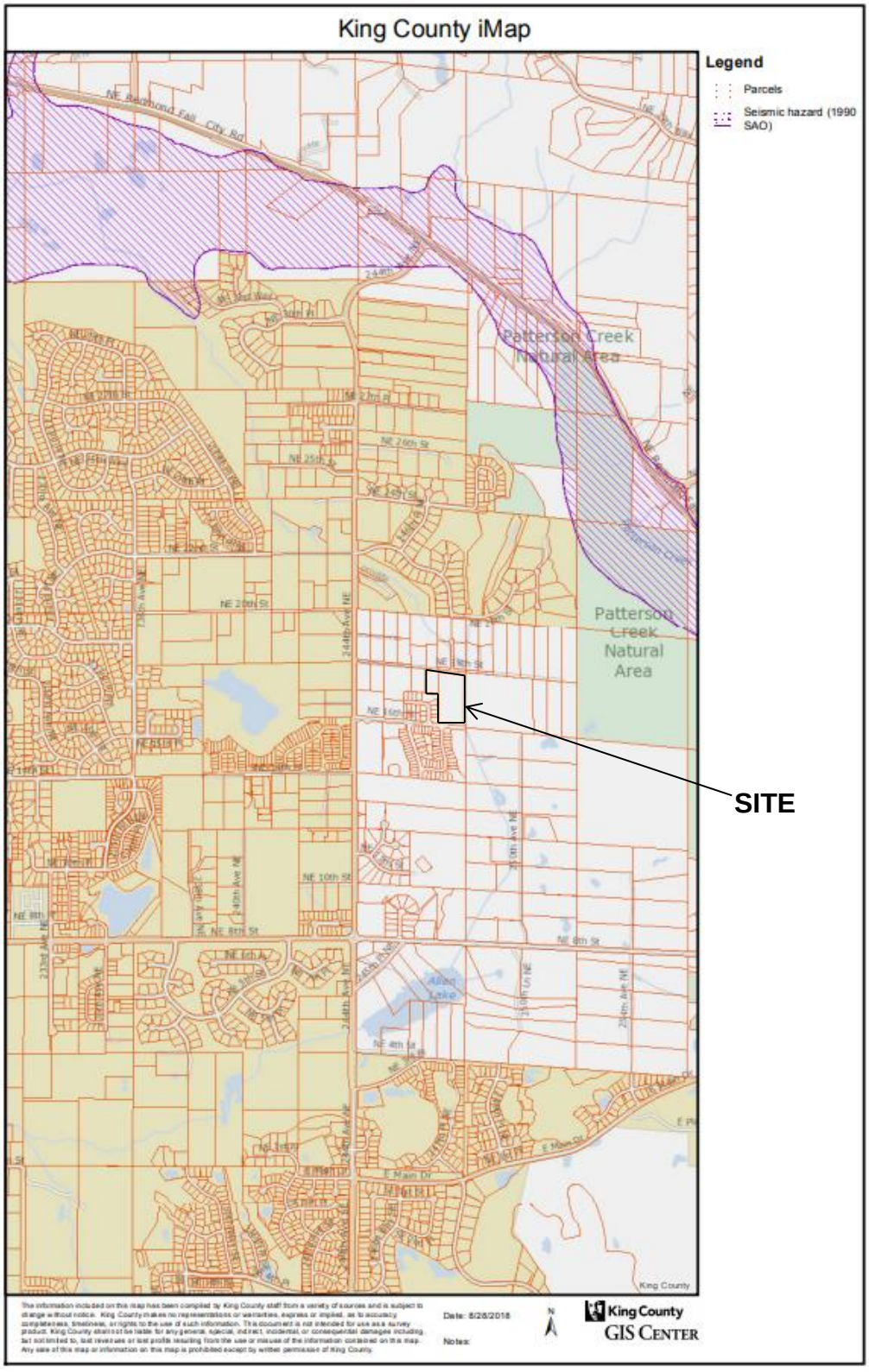


FIGURE 10
FEMA – FLOOD INSURANCE RATE MAP

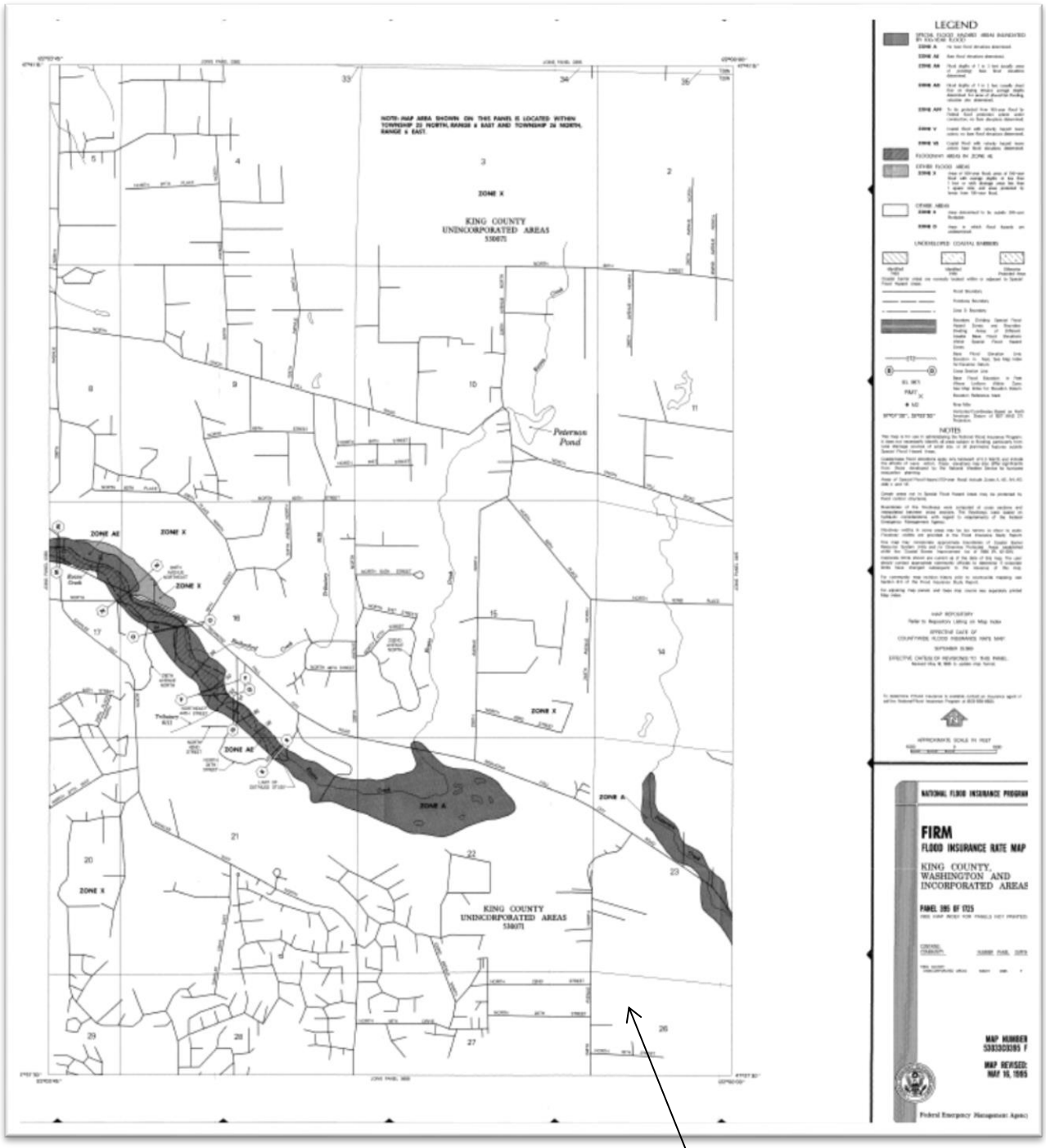
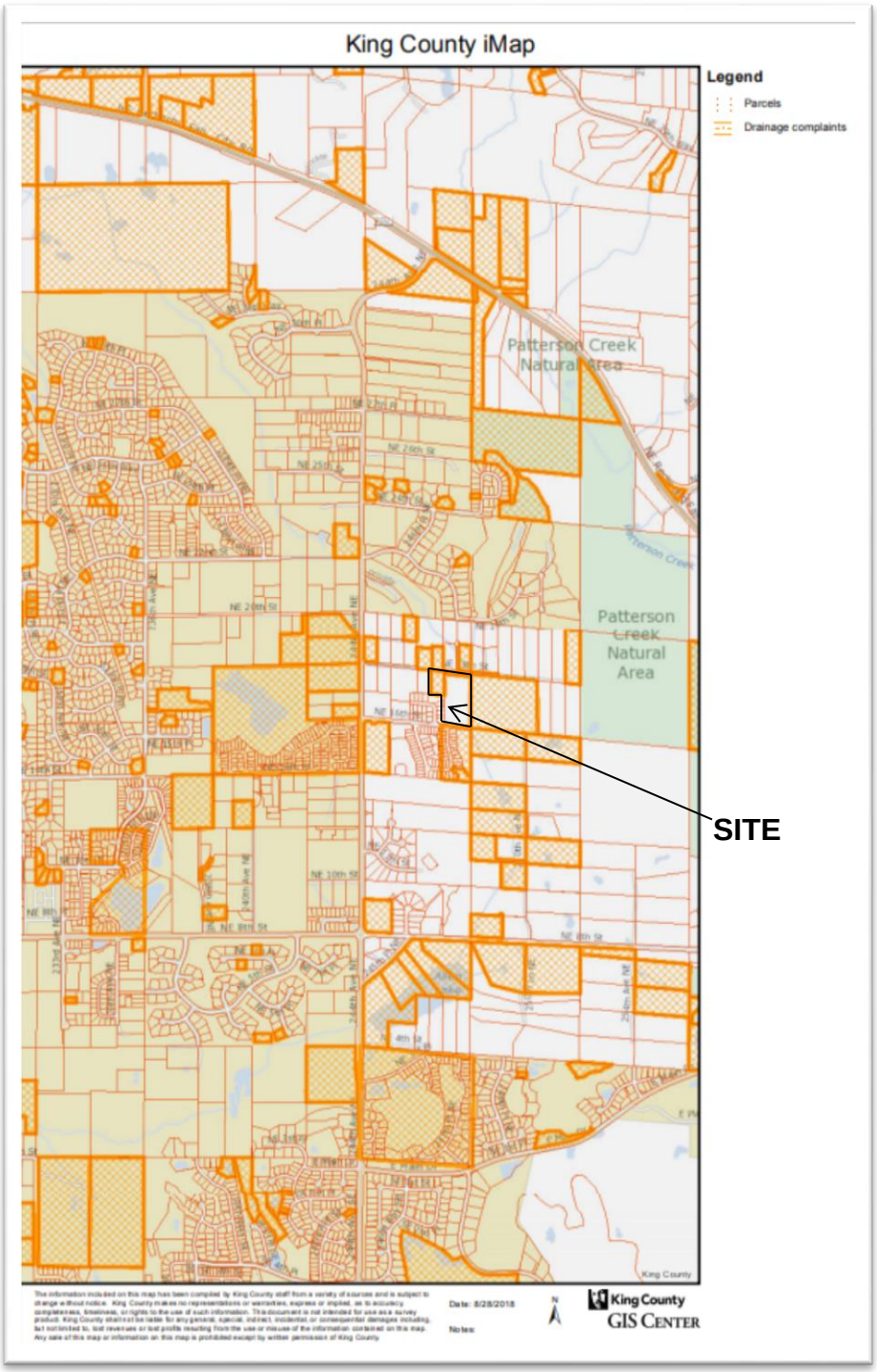


FIGURE 11
DRAINAGE COMPLAINTS



TASK 3: FIELD INSPECTION

UPSTREAM TRIBUTARY AREA

The upstream area was evaluated through examining area topography from the King County iMap, a field topographic survey, and by conducting field reconnaissance on July 31st, 2019. There is an upstream tributary area draining onto the site in two locations. The first is the existing Allen Lake Outlet Channel flowing from the south through the east portion of the site. The second source is runoff sheet flowing from the properties to the west, parvel #2625069042. This property is fully developed and generally slopes to the northeast, towards NE 18th Street and the existing drainage swale. To this effect, all upstream runoff the parcel experiences can be considered negligible for the scope of the project.

GENERAL ONSITE AND OFFSITE DRAINAGE DESCRIPTION

The majority of the site is sloped to the east at slopes ranging from 0%-16%. There is a slight ridge that runs north-south along the east property line of parcel 2625069055 (Lot#24637) and the existing gravel road. This causes the site to have two distinct Natural Drainage Areas (NDAs). The two NDAs, defined as NDA East and NDA West, each have one Natural Drainage Location (NDL). These two NDAs converge within ¼ mile, therefore the site in encompassed within a single Threshold Drainage Area (TDA).

The NDL for NDA East is the Allen Lake Outlet Channel, which flows in a northerly direction through the site. Runoff generated from parcel 2625069029 (Lot#24649) sheet flows east and enters the Allen Lake Outlet Channel. The channel flows north, leaving the property from the northeast corner through a culvert under NE 18th St. The channel then flows northwest through a second culvert under 247th Pl NE before continuing northwest towards 244th Ave NE.

The NDL for NDA West is located on the northern property line of the site. Runoff generated from parcel 2625069055 (Lot#24637) leaves the site and sheet flows east along the north property line and the side of NE 18th St., converging with NDA East in the Allen Lake Outlet Channel at (±290').

TASK 4: DRAINAGE SYSTEM DESCRIPTION AND PROBLEM DESCRIPTIONS

DRAINAGE SYSTEM DESCRIPTION

The downstream analysis is further illustrated and detailed in Figure 12, the Downstream Map. The drainage area is located within the East Sammamish Drainage Basin. The drainage area was evaluated by reviewing available resources described in Task 2, and by conducting a field reconnaissance; See Task 3 for path details.

DOWNSTREAM PATH NDA East

"A1" is a Natural Discharge Location (NDL) for the Site. It is the Allen Lake Outlet Channel located on the northeast corner of the site (±0').

From Point "A1" to Point "B1", runoff flows in a northerly direction as channel flow via the Allen Lake Outlet Channel. The channel dimensions are 4' tall, 6' wide, with 2:1 slide slopes. Ground was damp but no flow was observed (±0'-10').

Point B1 is the inlet of a 6' corrugated metal pipe culvert (±10').

From Point B1 to C1, runoff is conveyed in a northerly direction as pipe flow through 6' corrugated metal pipe culvert. No flow was observed (±10'-30').

Point C1 is the outlet of a 6' corrugated metal pipe culvert (±30').

From Point C1 to D1, runoff is conveyed in a northwesterly direction as channel flow via the Allen Lake Outlet Channel. The channel dimensions are 4' tall, 4'-6' wide, with 2:1 slide slopes. No flow was observed (±30'-215').

Point D1 is the inlet of a 6' corrugated metal pipe culvert (±215').

From Point D1 to E1, runoff is conveyed in a westerly direction as pipe flow through 6' corrugated metal pipe culvert. No flow was observed (±215'-235').

Point E1 is the outlet of a 6' corrugated metal pipe culvert (±235').

From Point E1 to F1, runoff is conveyed in a northwesterly direction as channel flow via the Allen Lake Outlet Channel. The channel dimensions are 4' tall, 4'-6' wide, with 2:1 slide slopes. No flow was observed (±235'-1,365').

Point F1 is the inlet to an approx. 100' wide "meadow" and is the end of the downstream path (±1,365').

DOWNSTREAM PATH NDA West

"A2" is a Natural Discharge Location (NDL) for the Site. It is located on the northern property line of the site (±0').

From Point A2 to B1, runoff is conveyed in an easterly direction as sheet flow along the side of the NE 18th St (±0'-290').

Point B1 is the inlet of a 6' corrugated metal pipe culvert (±290'). Point B1 is the convergence point of NDA West and NDA East. From this location, runoff continues in a northwesterly direction through the Allen Lake Outlet Channel.

TASK 5: MITIGATION OF EXISTING OR POTENTIAL PROBLEMS

A review of the King County Water and Land Resources Division – Drainage Services Section *Documented Drainage Complaints* within one mile of the downstream flow paths revealed one complaint within the last ten years that has since been closed and was with regard to a fee inquiry. There are several older complaints that can be seen in Figure 11.

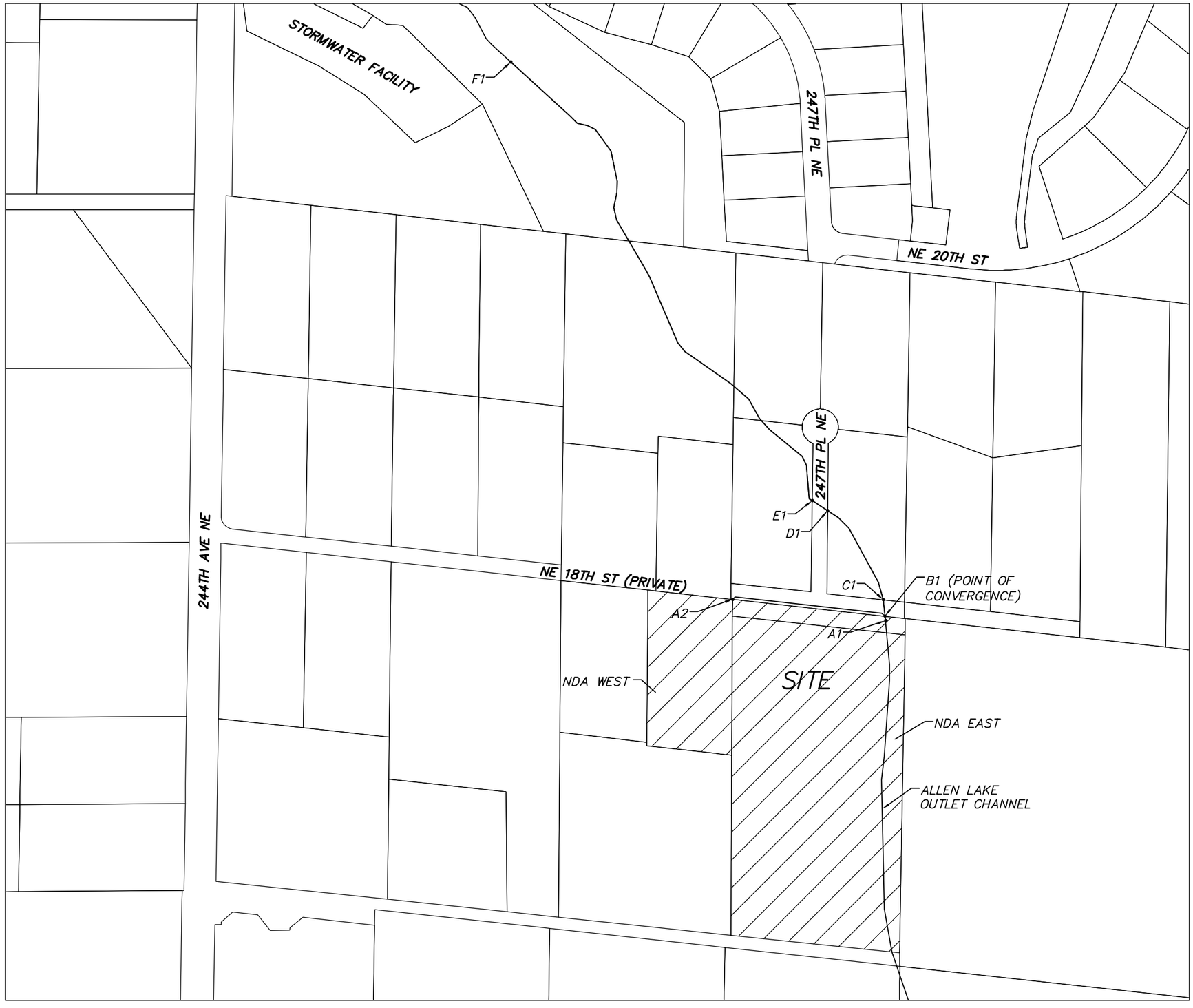
The project should not create any problems as specified in Section 1.2.2.1 of the Manual and therefore is not required to provide Drainage Problem Impact Mitigation subject to the requirements of Section 1.2.2.2.

The project drains to an unnamed tributary of Evans Creek (Allen Lake Outlet Channel) which has been assessed with a category 4A listing for Temperature (Type 3). However, mitigation is not required due the Project proximity to the assessed water body (greater than ¼ mile).

The complaints shown below are all those that occurred in the last 10 years along the drainage path within 1 mile from site] It should also be noted that according to the residents of Lot#24649, the Allen Lake Outlet Channel floods seasonally and overtops its banks.

Complaint	Parcel Number	Summary	Recurring	Type	Required Mitigation
1997-1422	2625069055	Flooding due to Allen Lake Outlet Channel obstruction	Yes	R, C, NDA	Complaint was closed 7/15/2019. Level 3 Flow Control.
2018-0952	2625069007	“DDM” Temporary construction easement project from 2000	No	NDA-F	Complaint has been closed. None

FIGURE 12
OFFSITE ANALYSIS DOWNSTREAM MAP



NORTH

GRAPHIC SCALE

0 100 200 400

1 INCH = 200 FT.

D.R. STRONG
CONSULTING ENGINEERS

DRS

ENGINEERS PLANNERS SURVEYORS
620 - 7th AVENUE KIRKLAND, WA 98033
O 425.827.3063 F 425.827.2423

DOWNSTREAM MAP

LEARY FLOYD SUBDIVISION
24637 & 24649 NE 18TH STREET
KING COUNTY, WASHINGTON

DRAFTED BY: NBM
DESIGNED BY: CYW
PROJECT ENGINEER: MAJ
DATE: 09.03.19
PROJECT NO.: 18040

FIGURE: 12

FIGURE 13
OFFSITE ANALYSIS DOWNSTREAM TABLE
NDA East

Symbol	Drainage Component Type, Name, and Size	Drainage Component Description	Slope	Distance From site Discharge	Existing Problems	Potential Problems	Observations of field inspector resource reviewer, or resident
See map	Type: sheet flow, swale, Stream, channel, pipe, Pond; Size: diameter Surface area	drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mile = 1,320 feet	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion		Tributary area, likelihood of problem, overflow pathways, potential impacts.
A1	Natural discharge location -Channel	Runoff exits site across the northern property line as northerly channel flow.		±0’	None Observed	None Anticipated	No flow observed. Property owner reported seasonal flooding along Allen Lake Outlet Channel
A1-B1	Northerly channel flow	4’ tall 6’ wide channel 2:1 side slopes			None Observed	None Anticipated	No flow observed
B1	Pipe inlet	6’ CMP Culvert		±10	None Observed	None Anticipated	No flow observed
B1-C1	Northerly pipe flow	6’ CMP Culvert			None Observed	None Anticipated	No flow observed
C1	Pipe outlet	6’ CMP Culvert		±30’	None Observed	None Anticipated	No flow observed
C1-D1	Northwesterly channel flow	4’ tall 6’ wide channel 2:1 side slopes			None Observed	None Anticipated	No flow observed
D1	Pipe inlet	6’ CMP Culvert		±215	None Observed	None Anticipated	No flow observed
D1-E1	Westerly pipe flow	6’ CMP Culvert			None Observed	None Anticipated	No flow observed
E1	Pipe outlet	6’ CMP Culvert		±235	None Observed	None Anticipated	No flow observed
E1-F1	Northwesterly channel flow	4’ tall 6’ wide channel 2:1 side slopes			None Observed	None Anticipated	No flow observed
F1	Meadow inlet, end of downstream path	Approx.. 100’ wide, end of downstream path		±1,365	None Observed	None Anticipated	No flow observed

NDA West

Symbol	Drainage Component Type, Name, and Size	Drainage Component Description	Slope	Distance From site Discharge	Existing Problems	Potential Problems	Observations of field inspector resource reviewer, or resident
See map	Type: sheet flow, swale, Stream, channel, pipe, Pond; Size: diameter Surface area	drainage basin, vegetation, cover, depth, type of sensitive area, volume	%	1/4 mile = 1,320 feet	Constrictions, under capacity, ponding, overtopping, flooding, habitat or organism destruction, scouring, bank sloughing, sedimentation, incision, other erosion		Tributary area, likelihood of problem, overflow pathways, potential impacts.
A2	Natural discharge location	Runoff exits site across the northern property line as easterly sheet flow.		±0'	None Observed	None Anticipated	No flow observed.
A2-B1	Easterly sheet flow	Gravel/topsoil			None Observed	None Anticipated	No flow observed
B1	Pipe inlet, convergence point	6' CMP Culvert, convergence point and end of downstream path		±290	None Observed	None Anticipated	No flow observed. This is the convergence point of NDA West and NDA East

SECTION IV

FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

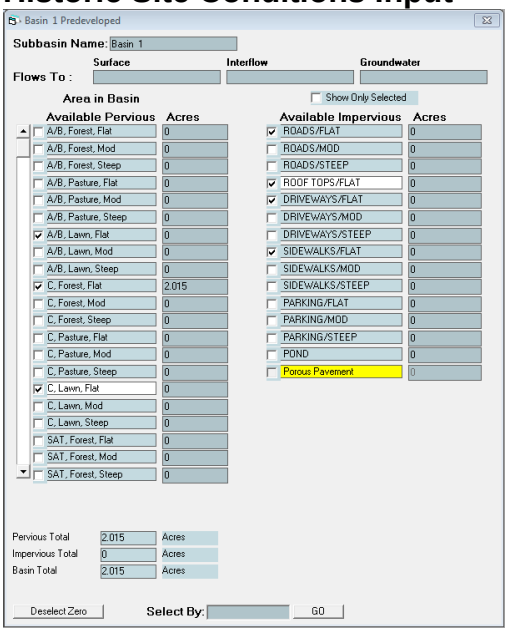
EXISTING SITE HYDROLOGY (PART A)

WWHM was used to model the peak runoff from the Site. Per Figure 4, Soils, the existing Site soil is divided in two parts: Everett very gravelly sandy loam and Alderwood gravelly sandy loam. As observed in the predeveloped area map, the portion of the Site to be developed is primarily contained within the section listed as Alderwood gravelly sandy loam. The portion of the Site within the Everett classification of soils is to be fully dispersed, which excludes these areas from drainage calculations. Per Table 3.2.2.A in the Manual, Alderwood SCS soil type is modeled as a "C" SCS hydrologic soil group. Therefore, the entire predeveloped Site is modeled as "C, Forest, Flat."

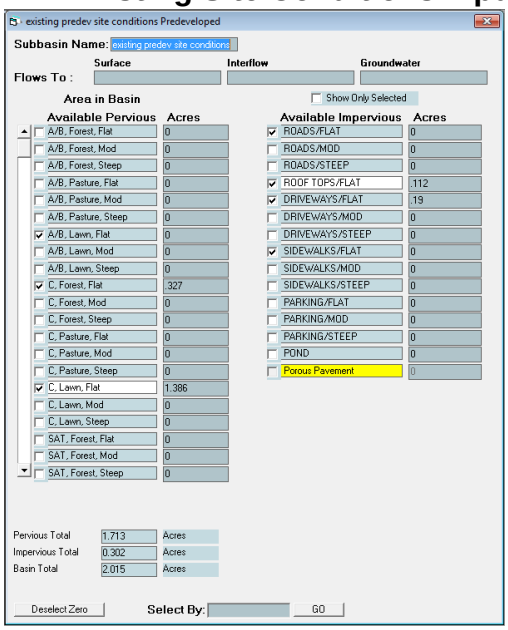
The Geotechnical Engineering Report by Associated Earth Sciences, Inc, found evidence of Vashon Recessional Outwash and Vashon Lodgement Till at various locations of the Site, consistent with the results of the USDA Soil Survey shows in Figure 4. Additionally, the test pits dug encountered groundwater and groundwater seepage at shallow depths. These findings indicate that the use of "C" SCS hydrologic group will be the most accurate model for predeveloped conditions.

In order to meet Flood Problem Flow Control Areas requirements, the project is required by Section 1.2.3.1 (C) in the Manual to "match the developed 100-year peak discharge rate to the predeveloped 100-year peak discharge rate. […] for the purposes of matching 100-year peak discharge rates, *existing site conditions* may be assumed." The existing project area has been modeled using "C, Forest, Flat," "C, Lawn, Flat," "Rooftops, Flat," and "Driveways, Flat" as applicable to find the peak existing site discharge rates. The results of both historic and existing site conditions can be found below.

Historic Site Conditions Input



Existing Site Conditions Input



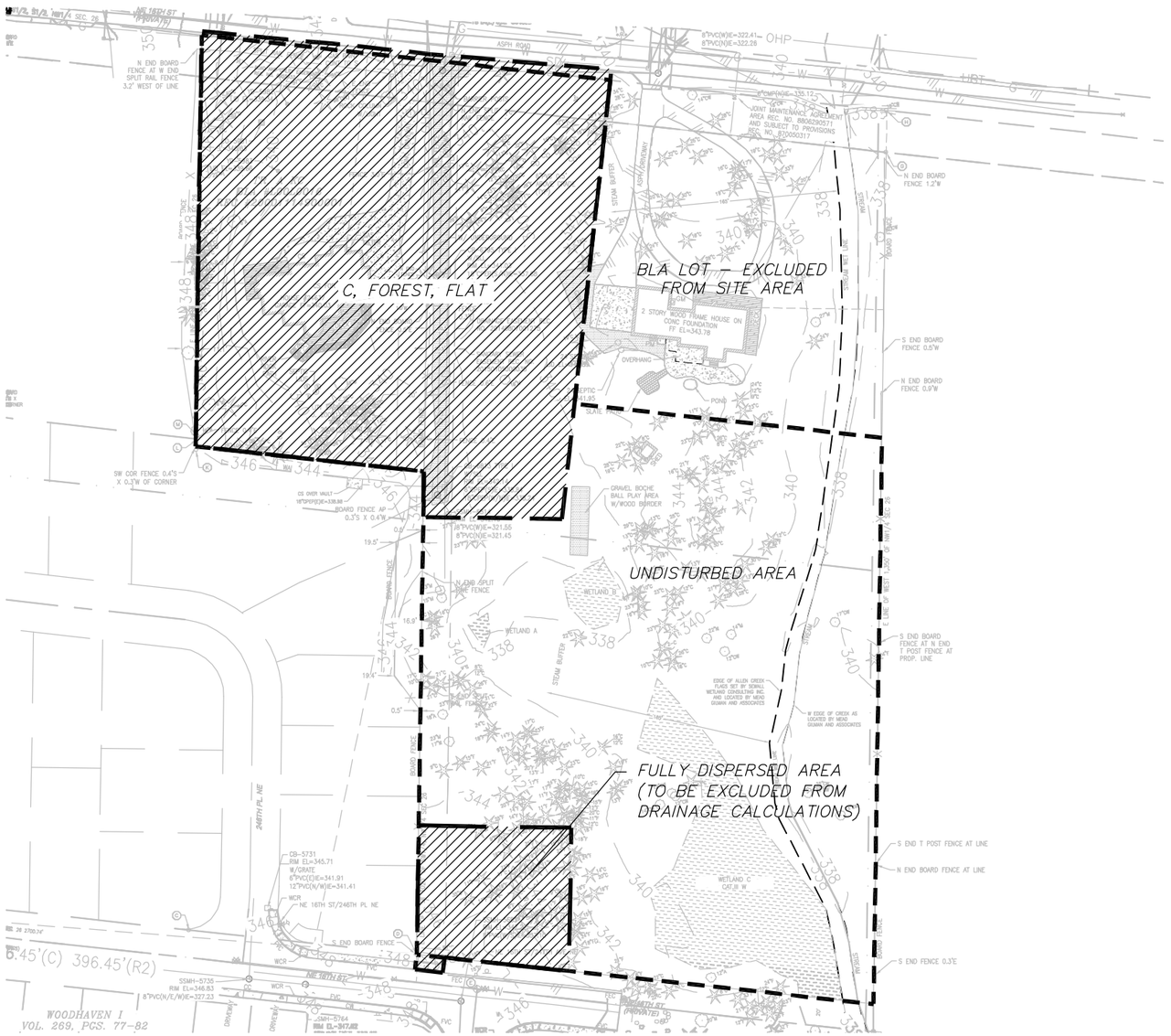
Historic Site Conditions Output:

```
Flow Frequency
Flow(cfs)  Predeveloped
2 Year   =     0.0592
5 Year   =     0.0930
10 Year  =     0.1121
25 Year  =     0.1324
50 Year  =     0.1450
100 Year =     0.1557
```

Existing Site Conditions Output:

```
Flow Frequency
Flow(cfs)  Predeveloped
2 Year   =     0.2207
5 Year   =     0.3359
10 Year  =     0.4243
25 Year  =     0.5501
50 Year  =     0.6544
100 Year =     0.7682
```

FIGURE 14
PREDEVELOPMENT AREA MAP



LEGEND:

▨	PROJECT AREA (FORESTED) 98,736 S.F. (2.267 ACRES)	
– – –	TOTAL SITE AREA:	212,020 S.F. (4.867 AC)
— —	TOTAL PROJECT AREA:	98,736 S.F. (2.267 AC)

NORTH

GRAPHIC SCALE
0 50 100 150
1 INCH = 100 FT.

D.R. STRONG CONSULTING ENGINEERS
ENGINEERS PLANNERS SURVEYORS
620 - 7th AVENUE KIRKLAND, WA 98033
O 425.827.3063 F 425.827.2423

FIGURE 14: PRE-DEVELOPED AREA MAP

FLOYD LEARY SUBDIVISION
24637 & 24649 NE 18TH STREET
KING COUNTY, WA

DRAFTED BY: ZLJ
DESIGNED BY: MAJ
PROJECT ENGINEER: MAJ
DATE: 08.08.19
PROJECT NO.: 18040

FIGURE: 15

DEVELOPED SITE AREA HYDROLOGY (PART B)

WWHM was used to model the developed peak runoff from the Site. The soil types are unchanged from the pre-developed conditions. Results of the WWHM analysis are included in this section. Tract D was excluded from these calculations as it will be designated a Critical Area Tract and will remain undisturbed. Tract C and approximately 9,928 sf of lot area located in the southern portion of the Project Area will be fully dispersed towards the critical areas and will be excluded from drainage calculations.

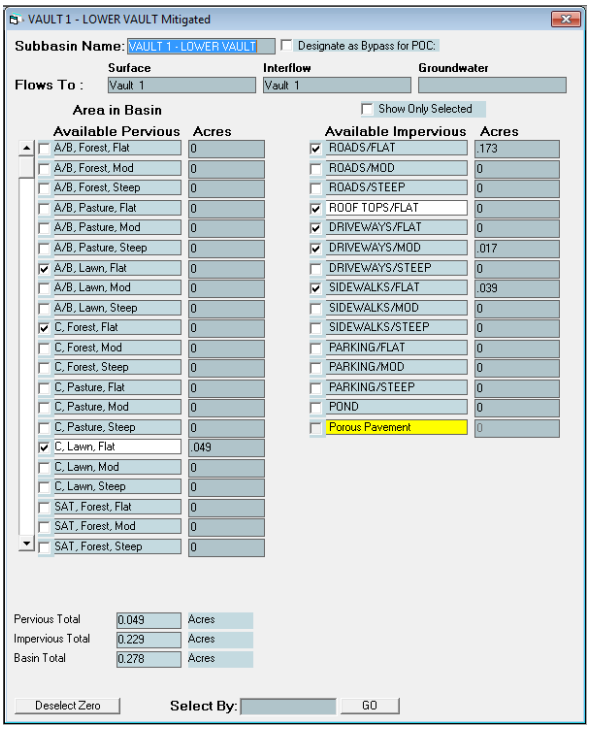
Due to existing topography, the Project requires two separate detention facilities in order to serve the lower elevation right-of-way and the high elevation main project site developable area. The right-of-way area and a portion of Lots 13-15 will be collected and conveyed to a vault with 2.50 feet of live storage titled “Vault 1.”

The remainder of the project area will be collected and conveyed to a detention vault with 6 feet of live storage titled “Vault 2.” Although these vaults provide flow control for two separate areas, they share a point of compliance and will therefore be modeled together.

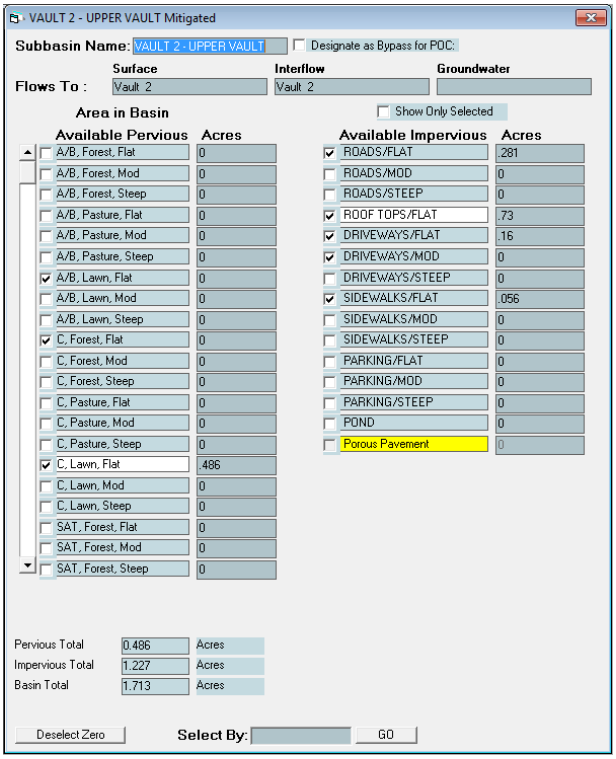
A Section of the project area right-of-way frontage improvements cannot be feasibly collected and routed to the proposed detention facilities. This area has been designated as bypass. See Figure 15.

Lot impervious areas were assumed to be 70% of lot area per King County zoning code.

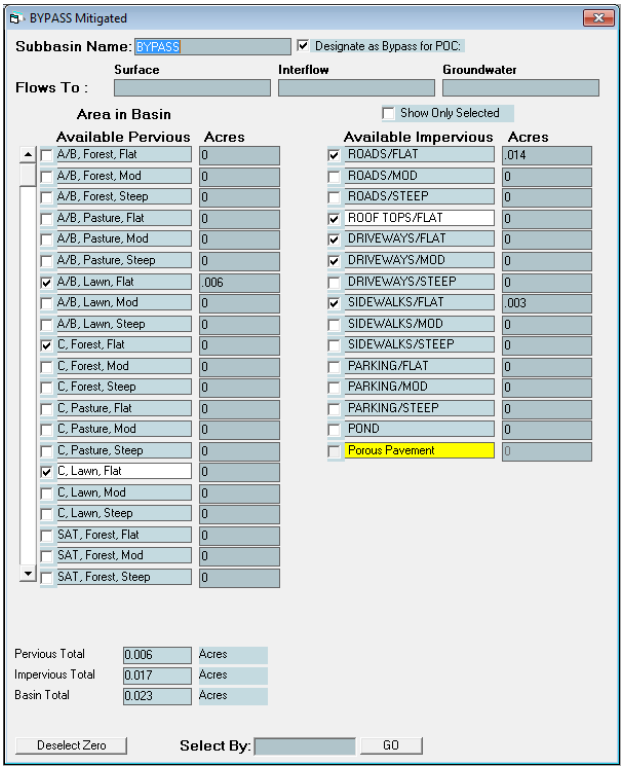
Vault 1 Developed Site Conditions Input



Vault 2 Developed Site Conditions Input



Bypass Developed Site Conditions Input



Vault 1 Developed Site Conditions Output:

```
Flow Frequency
Flow(cfs)
2 Year   =    0.0913
5 Year   =    0.1165
10 Year  =    0.1337
25 Year  =    0.1562
50 Year  =    0.1735
100 Year =    0.1912
```

Vault 2 Developed Site Conditions Output:

```
Flow Frequency
Flow(cfs)
2 Year   =    0.4989
5 Year   =    0.6419
10 Year  =    0.7405
25 Year  =    0.8698
50 Year  =    0.9698
100 Year =    1.0729
```

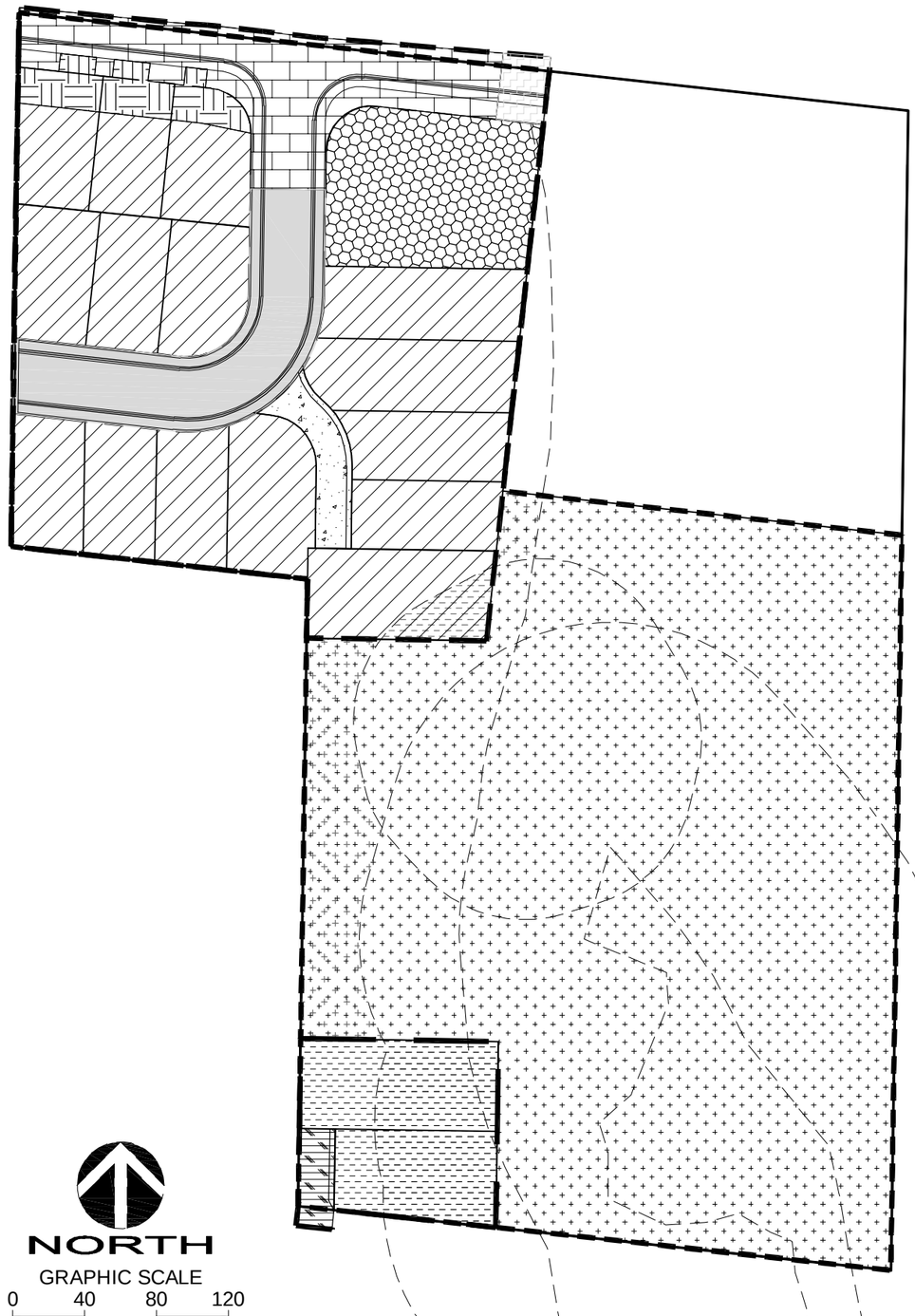
Bypass Developed Site Conditions Output:

```
Flow Frequency
Flow(cfs)
2 Year   =    0.0065
5 Year   =    0.0083
10 Year  =    0.0095
25 Year  =    0.0111
50 Year  =    0.0124
100 Year =    0.0137
```

FIGURE 15
DEVELOPED AREA MAP

AREA BREAKDOWN

TOTAL EXISTING SITE AREA:	212,020 S.F. (4.867 AC)
TOTAL PROJECT AREA:	98,736 S.F. (2.267 AC)
VAULT 1 COLLECTED	14,270 S.F. (0.328 AC)
LOT 13–15 FRONTAGE:	3,061 S.F. (0.070 AC)
DRIVEWAYS/MOD:	1,560 S.F. (0.036 AC)
C, LAWN, FLAT:	1,501 S.F. (0.034 AC)
ROW AREA:	11,209 S.F. (0.257 AC)
SIDEWALKS/FLAT:	1,714 S.F. (0.039 AC)
ROADS/FLAT:	7,523 S.F. (0.173 AC)
C, LAWN, FLAT:	1,972 S.S. (0.045 AC)
VAULT 2 COLLECTED	72,444 S.F. (1.663 AC)
LOTS 1–15	50,300 S.F. (1.155 AC)
ROOF TOPS/FLAT:	30,290 S.F. (0.695 AC)
DRIVEWAYS/FLAT:	4,920 S.F. (0.113 AC)
C, LAWN, FLAT:	15,090 S.F. (0.346 AC)
TRACT A STORM DRAINAGE & RECREATION:	9,904 S.F. (0.227 AC)
ROADS/FLAT:	4,952 S.F. (0.114 AC)
C, LAWN, FLAT:	4,952 S.F. (0.114 AC)
ROW AREA:	10,186 S.F. (0.234 AC)
ROADS/MOD:	7,276 S.F. (0.167 AC)
SIDEWALKS/FLAT:	2,425 S.F. (0.056 AC)
C, LAWN, FLAT:	485 S.F. (0.011 AC)
TRACT B PRIVATE ACCESS TRACT:	2,054 S.F. (0.047 AC)
DRIVEWAYS/FLAT:	2,054 S.F. (0.047 AC)
BYPASS (UNCOLLECTED)	993 S.F. (0.022 AC)
ROW AREA:	993 S.F. (0.022 AC)
SIDEWALKS/FLAT:	132 S.F. (0.003 AC)
ROADS/FLAT:	596 S.F. (0.014 AC)
C, LAWN, FLAT:	265 S.F. (0.006 AC)
LOTS 16–17 AREA:	11,029 S.F. (0.253 AC)
(FULL DISPERSION–TO BE EXCLUDED FROM DRAINAGE CALCULATIONS)	
LOTS 16–17:	9,928 S.F. (0.228 AC)
ROOF TOPS/FLAT:	6,130 S.F. (0.141 AC)
DRIVEWAYS/FLAT:	820 S.F. (0.019 AC)
C, LAWN, FLAT:	2,978 S.F. (0.068 AC)
TRACT C JOINT USE DRIVEWAY:	1,101 S.F. (0.025 AC)
DRIVEWAYS/FLAT:	1,101 S.F. (0.025 AC)
UNDISTURBED AREAS:	194,736 S.F. (4.471 AC)
(UNDISTURBED–TO BE EXCLUDED FROM DRAINAGE CALCULATIONS)	



NORTH

GRAPHIC SCALE

0 40 80 120

1 INCH = 80 FT.

D.R. STRONG CONSULTING ENGINEERS
DRS
ENGINEERS PLANNERS SURVEYORS
620 - 7th AVENUE KIRKLAND, WA 98033
O 425.827.3063 F 425.827.2423

FIGURE 15: DEVELOPED AREA MAP

LEARY FLOYD SUBDIVISION
24637 & 24649 NE 18TH STREET
REDMOND, WA

DRAFTED BY: CYW
DESIGNED BY: MAJ
PROJECT ENGINEER: MAJ
DATE: 08.08.19
PROJECT NO.: 18040

FIGURE: 16

PERFORMANCE STANDARDS (PART C)

The Project is required to adhere to Level 3 Flow Control criteria. The Level 3 performance criteria requires that the developed condition's durations must match the predeveloped durations ranging from 50% of the two-year peak flow up to the full 50-year peak flow and also match developed peak discharge rates to predeveloped peak discharge rates for the 2-year and 10-year return periods. Also match the developed 100-year peak to the existing 100-year peak. (KCSWDM, Sec. 1.2).

The flow frequency comparison below shows that the mitigated peak frequency flows have been reduced from the historic peak frequency flows for the 2-year and 10-year return periods.

Flow Frequency Flow(cfs) Predeveloped (Historic)			Flow Frequency Flow(cfs) Mitigated		
2 Year	**=**	**0.0592**	**2 Year**	**=**	**0.0389**
5 Year	=	0.0930	5 Year	=	0.0612
10 Year	**=**	**0.1121**	**10 Year**	**=**	**0.0799**
25 Year	=	0.1324	25 Year	=	0.1087
50 Year	=	0.1450	50 Year	=	0.1344
100 Year	=	0.1557	100 Year	=	0.1641

The flow frequency comparison below shows that the mitigated peak frequency flow has been reduced from the existing peak frequency flows for the 100-year return period.

Flow Frequency Flow(cfs) Predeveloped (Existing)			Flow Frequency Flow(cfs) Mitigated		
2 Year	=	0.2207	2 Year	=	0.0389
5 Year	=	0.3359	5 Year	=	0.0612
10 Year	=	0.4243	10 Year	=	0.0799
25 Year	=	0.5501	25 Year	=	0.1087
50 Year	=	0.6544	50 Year	=	0.1344
100 Year	**=**	**0.7682**	**100 Year**	**=**	**0.1641**

The Basic Water Quality Treatment goal is to remove 80% of TSS for flows or volumes up to and including the WQ design flow or volume.

Conveyance criteria for the Project require that all new pipes be designed to convey and contain (at minimum) the 25-year peak flow. The conveyance system design will be analyzed at time of final engineering.

FLOW CONTROL SYSTEM (PART D)

The Site will utilize two detention vaults meeting the Level 3 Flow Control Criteria. The Western Washington Hydrologic Model (WWHM2012) software was used to size the detention facilities. The vault design information is included in this section.

Name : Vault 1
Width : 44.731 ft.
Length : 44.731 ft.
Depth: 3.5 ft.
Discharge Structure
Riser Height: 2.5 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.345 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 0.5 in. **Elevation:** 1.5075 ft.
Orifice 3 Diameter: 0.72 in. **Elevation:** 2.222 ft.

Name : Vault 2
Width : 66 ft.
Length : 66 ft.
Depth: 7 ft.
Discharge Structure
Riser Height: 6 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.73 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 1.1 in. **Elevation:** 3.72 ft.
Orifice 3 Diameter: 0.91 in. **Elevation:** 4.5 ft.

FLOW CONTROL BMP SELECTION

Subdivision projects are required to mitigate for impervious surfaces per the requirements laid out in Section 1.2.9.2 pf the KCSWDM. The project falls under the "Small Lot BMP Requirements" due to all proposed lots having lot areas less than 22,000 square feet. Available BMPs were evaluated in order of preference as specified in the Manual, and full dispersion was selected to be utilized.

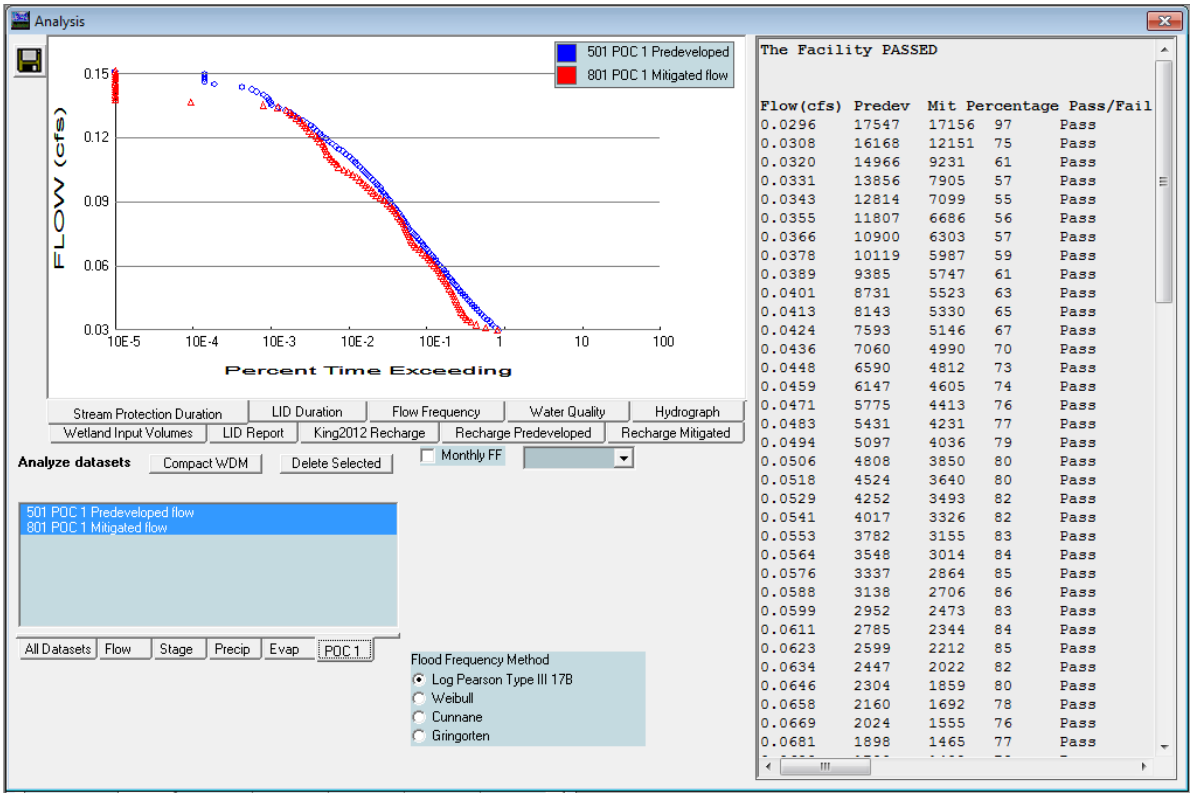
Lots 16 and 17 and the associated joint use driveway's impervious and pervious areas will be fully dispersed utilizing the wetland buffers of the existing wetlands located in Tract D, where feasible. This area results in 8,051 square feet of impervious area, and 2,978 square feet of pervious area being dispersed in the available native growth areas.

Per Section C.2.1.5 of the Manual, the amount of area available to disperse is proportional to the length of gravel filled trench and the corresponding flow path length. Gravel filled dispersion trench 1 is the maximum allowed 50' in length, and has a minimum flowpath of 160 linear feet, resulting in an available 8,000 square feet of impervious area to be dispersed. Gravel filled dispersion trench 2 is 25 feet in length and has the minimum allowed 100 linear foot flow path. This allows a maximum of 3,500 square feet of impervious area to be dispersed. Gravel filled trench 2 will serve the roof and driveway areas of Lot 16, and gravel filled dispersion trench 1 will disperse the joint use driveway and all lot impervious areas resulting from Lot 17, meeting all requirements set forth by the Manual for full dispersion.

The proposed gravel filled trenches utilize all the feasible space to fully disperse stormwater for the project site, meeting the flow control BMP requirement.

FLOW CONTROL FACILITY DESIGN OUTPUT

Below shows the duration curve comparing the predeveloped historic flows to the mitigated, developed flows of the two detention facilities and the associated bypass area.

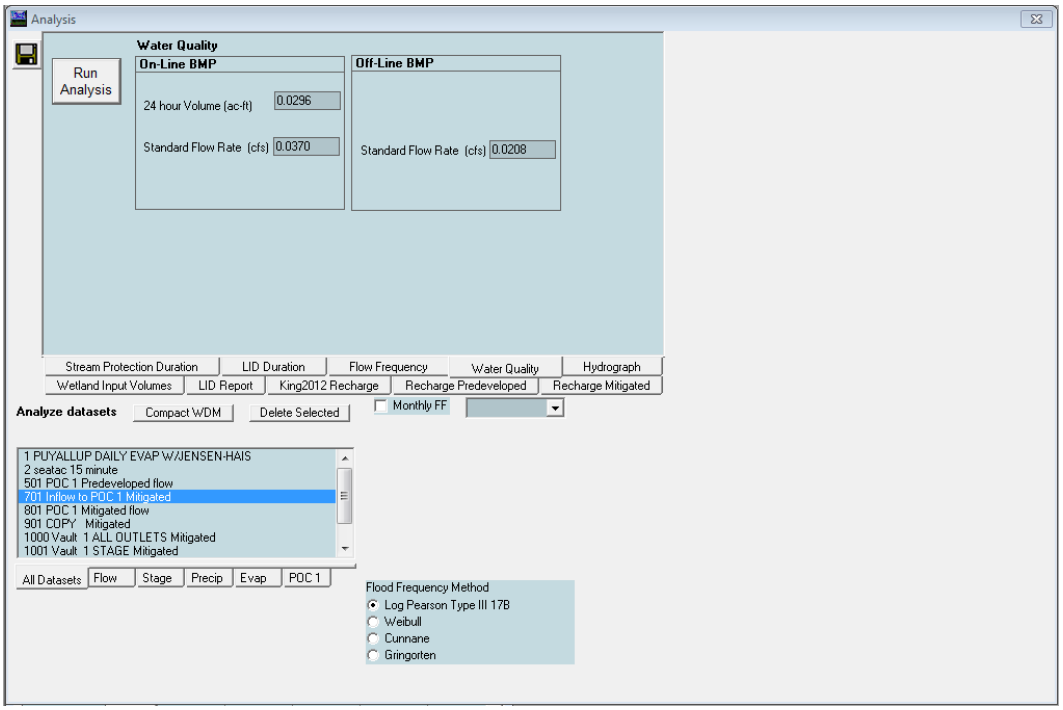


WATER QUALITY TREATMENT SYSTEM (PART E)

The Project is located in the Basic Water Quality Treatment area. The treatment goal is 80% removal of total suspend solids for a typical rainfall year, assuming typical pollutant concentrations in urban runoff.

The project site will utilize the available dead storage space in both proposed detention vaults in order to meet the water quality requirements per the requirements set forth in the Manual for wetvaults.

Vault 1, mainly serving the frontage right-of-way, requires a volume of 1,289 cubic feet to meet water quality requirements. Detention vault 1 is proposing 5 feet of water quality depth across the entire vault footprint, resulting in 10,250 cubic feet of water quality storage. This meets the water quality requirement for Vault 1. See below for WWHM Water Quality volume analysis.



Vault 2, serving the main project developed site, requires a volume of 7,240 cubic feet to meet water quality requirements. Detention vault 2 is proposing 5 feet of water quality depth across half of the vault footprint. Detention vault 2 will contain two bays, and only one will contain water quality storage. This results in 10,920 cubic feet of water quality storage. This meets the water quality requirement for Vault 2. See below for WWHM Water Quality volume analysis.

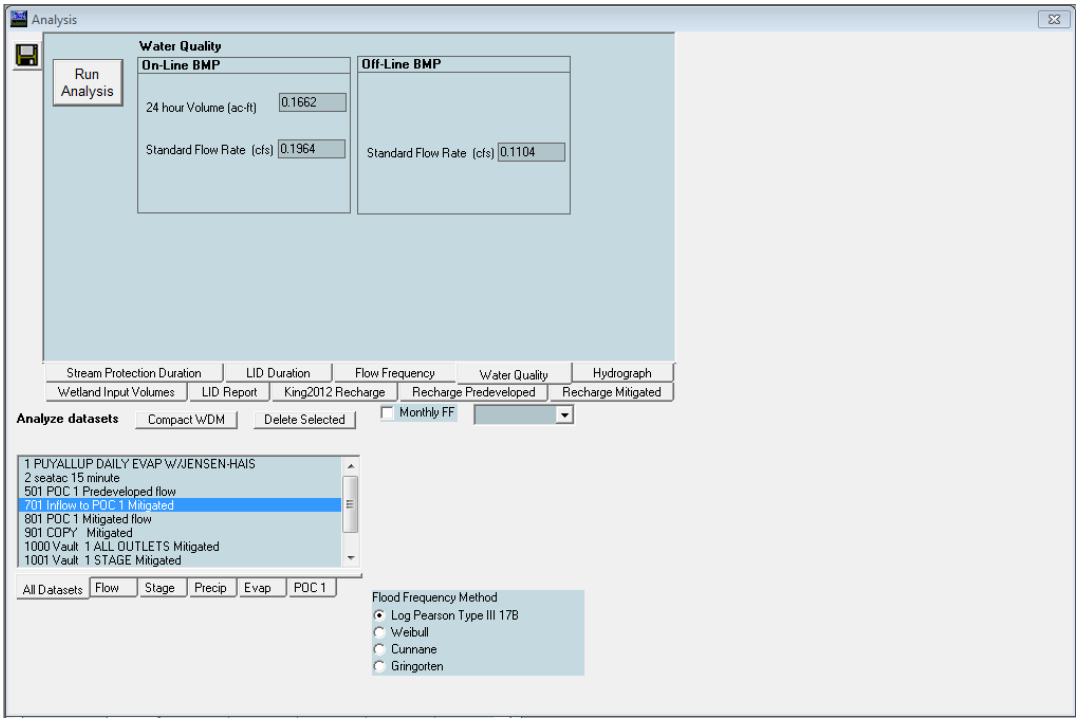


FIGURE 16
DETENTION & WATER QUALITY FACILITY DETAILS

Detention facility details will be provided at final engineering.

SECTION V

CONVEYANCE SYSTEM ANALYSIS AND DESIGN

Per C.R. #4 of the KCSWDM, the conveyance system must be analyzed and designed for existing tributary and developed onsite runoff from the proposed project. Pipe systems shall be designed to convey the 100-year design storm. The Rational Method will be used to calculate the Q-Ratio for each pipe node.

Analysis will be performed at final engineering.

BACKWATER ANALYSIS

A backwater analysis will be provided at time of final engineering.

SECTION VI

SPECIAL REPORTS AND STUDIES

The following report and studies have been provided with this submittal.

1. Wetland Delineation Report – Raedeke Associates, Inc. April 18, 2019
2. Traffic Impact Analysis – TENW, September 9, 2019
3. Preliminary Geotechnical Engineering Report – Associated Earth Sciences, Inc., June 25, 2019

SECTION VII

OTHER PERMITS, VARIANCES AND ADJUSTMENTS

None at this time.

SECTION VIII

ESC PLAN ANALYSIS AND DESIGN (PART A)

The Erosion and Sedimentation Control Design will meet the 13 minimum King County requirements:

1. **Clearing Limits:** Areas to remain undisturbed shall be delineated with a high visibility plastic fence prior to any site clearing or grading.
2. **Cover Measures:** Site disturbed areas shall be covered with mulch and seeded, as appropriate, for temporary or permanent measures.
3. **Perimeter Protection:** Silt fences will be provided downslope of all disturbed areas.
4. **Traffic Area Stabilization**: A stabilized construction entrance will be located at the point of ingress/egress (i.e. onsite access road).
5. **Sediment Retention:** The permanent detention facilities (detention vaults) will act as temporary sediment traps once bottom and walls are constructed.
6. **Surface Water Collection:** Surface water from disturbed areas will sheet flow to or be collected by interceptor swales and conveyed to the sediment trap.
7. **Dewatering Control:** Not applicable for this site.
8. **Dust Control:** Dust control shall be provided by spraying exposed soils with water until wet. This is required when exposed soils are dry to the point that wind transport is possible, which would impact roadways, drainage ways, surface waters, or neighboring residences.
9. **Flow Control:** Runoff collected in the sediment traps will discharge to the permanent outfall systems once the floors and walls have been constructed.
10. **Control Pollutants:** All pollutants, including waste materials and demolitions debris that occur on-site, shall be handled and disposed of in a manner that does not cause contamination of stormwater. Woody debris may be chopped and spread on site. Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, and non-inert wastes present on the Site (see chapter 173-304 WAS for the definition of inert waste). On-site fueling tanks shall include secondary containment.
11. **Protect Existing and Proposed Flow Control BMPs:** All existing, temporary, and permanent flow control BMPs shall be protected from disturbance during construction. There are no existing BMPs to remain on site.
12. **Maintain BMPs:** All BMPs shall be inspected, maintained, and repaired as needed to assure continued performance of their intended function. The SWPPP shall be modified whenever there is a significant change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state
13. **Manage the Project:** The construction project is being phased to the maximum extent practicable to prevent soil erosion, and to the maximum extent possible, the transport of sediment from the site during construction. The SWPPP shall be retained on-site at all times. Make any changes or additions necessary per the city inspector or CSWPP supervisor to ensure accordance with all 13 King County requirements.

SWPPS PLAN DESIGN (PART B)

Construction activities that could contribute pollutants to surface and storm water include the following, with applicable BMP's listed for each item:

1. **Storage and use of chemicals:** Utilize source control, and soil erosion and sedimentation control practices, such as using only recommended amounts of chemical materials applied in the proper manner; neutralizing concrete wash water, and disposing of excess concrete material only in areas prepared for concrete placement, or return to batch plant; disposing of wash-up waters from water-based paints in sanitary sewer; disposing of wastes from oil-based paints, solvents, thinners, and mineral spirits only through a licensed waste management firm, or treatment, storage, and disposal (TSD) facility.
2. **Material delivery and storage:** Locate temporary storage areas away from vehicular traffic, near the construction entrance, and away from storm drains. Material Safety Data Sheets (MSDS) should be supplied for all materials stored, and chemicals kept in their original labeled containers. Maintenance, fueling, and repair of heavy equipment and vehicles shall be conducted using spill prevention and control measures. Contaminated surfaces shall be cleaned immediately following any spill incident. Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other potentially hazardous materials.
3. **Sawcutting:** Slurry and cuttings shall be vacuumed during the activity to prevent migration offsite and must not remain on permanent concrete or asphalt paving overnight. Collected slurry and cuttings shall be disposed of in a manner that does not violate ground water or surface water quality standards.
4. **Demolition:** Protect stormwater drainage system from sediment-laden runoff and loose particles. To the extent possible, use dikes, berms, or other methods to protect overland discharge paths from runoff. Street gutter, sidewalks, driveways, and other paved surfaces in the immediate area of demolition must be swept daily to collect and properly dispose of loose debris and garbage. Spray the minimum amount of water to help control windblown fine particles such as concrete, dust, and paint chips. Avoid excessive spraying so that runoff from the site does not occur, yet dust control is achieved. Oils must never be used for dust control.

The complete CSWPPP will be submitted at the time of final engineering.

SECTION IX

BOND QUANTITIES, FACILITY SUMMARIES, AND DECLARATION OF COVENANT

1. Bond Quantity Worksheet – to be submitted at final engineering.
2. The Stormwater Facility Summary Sheet – submitted at final engineering.
3. Declaration of Covenant – will be provided prior to final engineering approval.

SECTION X

OPERATIONS AND MAINTENANCE MANUAL

Excerpts from the 2016 KCSWDM will be provided at final engineering.

APPENDICES

APPENDIX A WWHM OUTPUT

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Floyd Leary - Vault
Site Name:	Floyd Leary
Site Address:	24615 & 24637 NE 18th St
City:	Redmond
Report Date:	9/4/2019
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2018/07/12
Version:	4.2.15

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	2.015
Pervious Total	2.015
Impervious Land Use	acre
Impervious Total	0
Basin Total	2.015

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

BYPASS

Bypass:	Yes
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.006
Pervious Total	0.006

Impervious Land Use	acre
ROADS FLAT	0.014
SIDEWALKS FLAT	0.003
Impervious Total	0.017
Basin Total	0.023

Element Flows To:

Surface	Interflow	Groundwater

VAULT 1 - LOWER VAULT

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Flat	0.049
Pervious Total	0.049

Impervious Land Use	acre
ROADS FLAT	0.173
DRIVEWAYS MOD	0.017
SIDEWALKS FLAT	0.039
Impervious Total	0.229
Basin Total	0.278

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

VAULT 2 - UPPER VAULT

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Flat	0.486
Pervious Total	0.486

Impervious Land Use	acre
ROADS FLAT	0.281
ROOF TOPS FLAT	0.73
DRIVEWAYS FLAT	0.16
SIDEWALKS FLAT	0.056
Impervious Total	1.227
Basin Total	1.713

Element Flows To:

Surface	Interflow	Groundwater
Vault 2	Vault 2	

Routing Elements
Predeveloped Routing

Mitigated Routing

Vault 1

Width: 44.731 ft.
Length: 44.731 ft.
Depth: 3.5 ft.
Discharge Structure
Riser Height: 2.5 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.345 in. Elevation:0 ft.
Orifice 2 Diameter: 0.5 in. Elevation:1.5075 ft.
Orifice 3 Diameter: 0.72 in. Elevation:2.222 ft.
Element Flows To:
Outlet 1 Outlet 2

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.045	0.000	0.000	0.000
0.0389	0.045	0.001	0.000	0.000
0.0778	0.045	0.003	0.000	0.000
0.1167	0.045	0.005	0.001	0.000
0.1556	0.045	0.007	0.001	0.000
0.1944	0.045	0.008	0.001	0.000
0.2333	0.045	0.010	0.001	0.000
0.2722	0.045	0.012	0.001	0.000
0.3111	0.045	0.014	0.001	0.000
0.3500	0.045	0.016	0.001	0.000
0.3889	0.045	0.017	0.002	0.000
0.4278	0.045	0.019	0.002	0.000
0.4667	0.045	0.021	0.002	0.000
0.5056	0.045	0.023	0.002	0.000
0.5444	0.045	0.025	0.002	0.000
0.5833	0.045	0.026	0.002	0.000
0.6222	0.045	0.028	0.002	0.000
0.6611	0.045	0.030	0.002	0.000
0.7000	0.045	0.032	0.002	0.000
0.7389	0.045	0.033	0.002	0.000
0.7778	0.045	0.035	0.002	0.000
0.8167	0.045	0.037	0.002	0.000
0.8556	0.045	0.039	0.003	0.000
0.8944	0.045	0.041	0.003	0.000
0.9333	0.045	0.042	0.003	0.000
0.9722	0.045	0.044	0.003	0.000
1.0111	0.045	0.046	0.003	0.000
1.0500	0.045	0.048	0.003	0.000
1.0889	0.045	0.050	0.003	0.000
1.1278	0.045	0.051	0.003	0.000
1.1667	0.045	0.053	0.003	0.000
1.2056	0.045	0.055	0.003	0.000
1.2444	0.045	0.057	0.003	0.000
1.2833	0.045	0.058	0.003	0.000
1.3222	0.045	0.060	0.003	0.000
1.3611	0.045	0.062	0.003	0.000
1.4000	0.045	0.064	0.003	0.000
1.4389	0.045	0.066	0.003	0.000

1.4778	0.045	0.067	0.003	0.000
1.5167	0.045	0.069	0.004	0.000
1.5556	0.045	0.071	0.005	0.000
1.5944	0.045	0.073	0.006	0.000
1.6333	0.045	0.075	0.006	0.000
1.6722	0.045	0.076	0.006	0.000
1.7111	0.045	0.078	0.007	0.000
1.7500	0.045	0.080	0.007	0.000
1.7889	0.045	0.082	0.007	0.000
1.8278	0.045	0.084	0.008	0.000
1.8667	0.045	0.085	0.008	0.000
1.9056	0.045	0.087	0.008	0.000
1.9444	0.045	0.089	0.009	0.000
1.9833	0.045	0.091	0.009	0.000
2.0222	0.045	0.092	0.009	0.000
2.0611	0.045	0.094	0.009	0.000
2.1000	0.045	0.096	0.009	0.000
2.1389	0.045	0.098	0.010	0.000
2.1778	0.045	0.100	0.010	0.000
2.2167	0.045	0.101	0.010	0.000
2.2556	0.045	0.103	0.013	0.000
2.2944	0.045	0.105	0.014	0.000
2.3333	0.045	0.107	0.015	0.000
2.3722	0.045	0.109	0.016	0.000
2.4111	0.045	0.110	0.017	0.000
2.4500	0.045	0.112	0.018	0.000
2.4889	0.045	0.114	0.019	0.000
2.5278	0.045	0.116	0.093	0.000
2.5667	0.045	0.117	0.294	0.000
2.6056	0.045	0.119	0.565	0.000
2.6444	0.045	0.121	0.890	0.000
2.6833	0.045	0.123	1.258	0.000
2.7222	0.045	0.125	1.659	0.000
2.7611	0.045	0.126	2.085	0.000
2.8000	0.045	0.128	2.525	0.000
2.8389	0.045	0.130	2.970	0.000
2.8778	0.045	0.132	3.411	0.000
2.9167	0.045	0.134	3.837	0.000
2.9556	0.045	0.135	4.241	0.000
2.9944	0.045	0.137	4.615	0.000
3.0333	0.045	0.139	4.950	0.000
3.0722	0.045	0.141	5.245	0.000
3.1111	0.045	0.142	5.495	0.000
3.1500	0.045	0.144	5.704	0.000
3.1889	0.045	0.146	5.877	0.000
3.2278	0.045	0.148	6.023	0.000
3.2667	0.045	0.150	6.234	0.000
3.3056	0.045	0.151	6.390	0.000
3.3444	0.045	0.153	6.542	0.000
3.3833	0.045	0.155	6.690	0.000
3.4222	0.045	0.157	6.836	0.000
3.4611	0.045	0.159	6.978	0.000
3.5000	0.045	0.160	7.118	0.000
3.5389	0.045	0.162	7.255	0.000
3.5778	0.000	0.000	7.389	0.000

Vault 2

Width: 66 ft.
Length: 66 ft.
Depth: 7 ft.
Discharge Structure
Riser Height: 6 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.73 in. Elevation:0 ft.
Orifice 2 Diameter: 1.1 in. Elevation:3.72 ft.
Orifice 3 Diameter: 0.91 in. Elevation:4.5 ft.
Element Flows To:
Outlet 1 Outlet 2

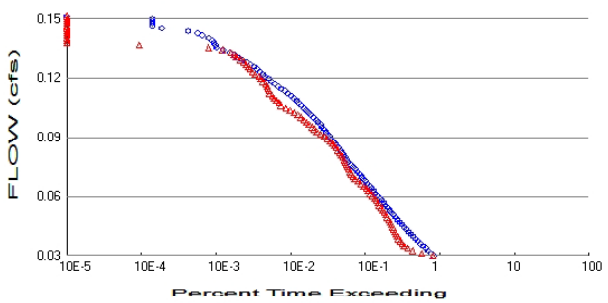
Vault Hydraulic Table

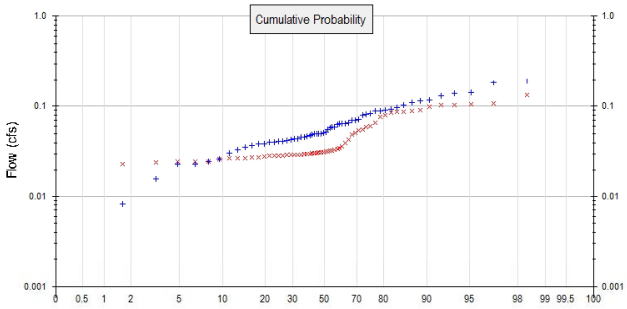
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.100	0.000	0.000	0.000
0.0778	0.100	0.007	0.004	0.000
0.1556	0.100	0.015	0.005	0.000
0.2333	0.100	0.023	0.007	0.000
0.3111	0.100	0.031	0.008	0.000
0.3889	0.100	0.038	0.009	0.000
0.4667	0.100	0.046	0.009	0.000
0.5444	0.100	0.054	0.010	0.000
0.6222	0.100	0.062	0.011	0.000
0.7000	0.100	0.070	0.012	0.000
0.7778	0.100	0.077	0.012	0.000
0.8556	0.100	0.085	0.013	0.000
0.9333	0.100	0.093	0.014	0.000
1.0111	0.100	0.101	0.014	0.000
1.0889	0.100	0.108	0.015	0.000
1.1667	0.100	0.116	0.015	0.000
1.2444	0.100	0.124	0.016	0.000
1.3222	0.100	0.132	0.016	0.000
1.4000	0.100	0.140	0.017	0.000
1.4778	0.100	0.147	0.017	0.000
1.5556	0.100	0.155	0.018	0.000
1.6333	0.100	0.163	0.018	0.000
1.7111	0.100	0.171	0.018	0.000
1.7889	0.100	0.178	0.019	0.000
1.8667	0.100	0.186	0.019	0.000
1.9444	0.100	0.194	0.020	0.000
2.0222	0.100	0.202	0.020	0.000
2.1000	0.100	0.210	0.021	0.000
2.1778	0.100	0.217	0.021	0.000
2.2556	0.100	0.225	0.021	0.000
2.3333	0.100	0.233	0.022	0.000
2.4111	0.100	0.241	0.022	0.000
2.4889	0.100	0.248	0.022	0.000
2.5667	0.100	0.256	0.023	0.000
2.6444	0.100	0.264	0.023	0.000
2.7222	0.100	0.272	0.023	0.000
2.8000	0.100	0.280	0.024	0.000
2.8778	0.100	0.287	0.024	0.000
2.9556	0.100	0.295	0.024	0.000
3.0333	0.100	0.303	0.025	0.000

3.1111	0.100	0.311	0.025	0.000
3.1889	0.100	0.318	0.025	0.000
3.2667	0.100	0.326	0.026	0.000
3.3444	0.100	0.334	0.026	0.000
3.4222	0.100	0.342	0.026	0.000
3.5000	0.100	0.350	0.027	0.000
3.5778	0.100	0.357	0.027	0.000
3.6556	0.100	0.365	0.027	0.000
3.7333	0.100	0.373	0.031	0.000
3.8111	0.100	0.381	0.038	0.000
3.8889	0.100	0.388	0.042	0.000
3.9667	0.100	0.396	0.045	0.000
4.0444	0.100	0.404	0.047	0.000
4.1222	0.100	0.412	0.050	0.000
4.2000	0.100	0.420	0.052	0.000
4.2778	0.100	0.427	0.054	0.000
4.3556	0.100	0.435	0.056	0.000
4.4333	0.100	0.443	0.058	0.000
4.5111	0.100	0.451	0.062	0.000
4.5889	0.100	0.458	0.068	0.000
4.6667	0.100	0.466	0.072	0.000
4.7444	0.100	0.474	0.075	0.000
4.8222	0.100	0.482	0.079	0.000
4.9000	0.100	0.490	0.081	0.000
4.9778	0.100	0.497	0.084	0.000
5.0556	0.100	0.505	0.087	0.000
5.1333	0.100	0.513	0.089	0.000
5.2111	0.100	0.521	0.092	0.000
5.2889	0.100	0.528	0.094	0.000
5.3667	0.100	0.536	0.096	0.000
5.4444	0.100	0.544	0.098	0.000
5.5222	0.100	0.552	0.100	0.000
5.6000	0.100	0.560	0.102	0.000
5.6778	0.100	0.567	0.104	0.000
5.7556	0.100	0.575	0.106	0.000
5.8333	0.100	0.583	0.108	0.000
5.9111	0.100	0.591	0.110	0.000
5.9889	0.100	0.598	0.112	0.000
6.0667	0.100	0.606	0.387	0.000
6.1444	0.100	0.614	0.984	0.000
6.2222	0.100	0.622	1.754	0.000
6.3000	0.100	0.630	2.620	0.000
6.3778	0.100	0.637	3.507	0.000
6.4556	0.100	0.645	4.338	0.000
6.5333	0.100	0.653	5.048	0.000
6.6111	0.100	0.661	5.594	0.000
6.6889	0.100	0.668	5.976	0.000
6.7667	0.100	0.676	6.333	0.000
6.8444	0.100	0.684	6.642	0.000
6.9222	0.100	0.692	6.937	0.000
7.0000	0.100	0.700	7.219	0.000
7.0778	0.100	0.707	7.491	0.000
7.1556	0.000	0.000	7.754	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 2.015
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.541
Total Impervious Area: 1.473

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.059243
5 year	0.093043
10 year	0.112198
25 year	0.132491
50 year	0.145049
100 year	0.15573

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.038905
5 year	0.061221
10 year	0.07994
25 year	0.108759
50 year	0.134441
100 year	0.164145

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.058	0.027
1950	0.073	0.034
1951	0.130	0.109
1952	0.041	0.025
1953	0.033	0.032
1954	0.051	0.029
1955	0.081	0.029
1956	0.065	0.061
1957	0.052	0.029
1958	0.059	0.032

1959	0.051	0.028
1960	0.088	0.087
1961	0.050	0.043
1962	0.031	0.024
1963	0.043	0.031
1964	0.056	0.035
1965	0.040	0.056
1966	0.039	0.029
1967	0.081	0.033
1968	0.050	0.030
1969	0.049	0.029
1970	0.041	0.031
1971	0.043	0.032
1972	0.097	0.087
1973	0.044	0.051
1974	0.048	0.031
1975	0.065	0.030
1976	0.047	0.029
1977	0.006	0.027
1978	0.041	0.033
1979	0.025	0.023
1980	0.092	0.091
1981	0.037	0.030
1982	0.071	0.066
1983	0.063	0.031
1984	0.039	0.026
1985	0.023	0.027
1986	0.103	0.036
1987	0.091	0.077
1988	0.036	0.029
1989	0.023	0.027
1990	0.190	0.089
1991	0.114	0.081
1992	0.044	0.033
1993	0.046	0.025
1994	0.015	0.023
1995	0.066	0.040
1996	0.139	0.102
1997	0.116	0.103
1998	0.026	0.028
1999	0.109	0.085
2000	0.046	0.032
2001	0.008	0.025
2002	0.050	0.049
2003	0.064	0.029
2004	0.083	0.106
2005	0.059	0.030
2006	0.070	0.060
2007	0.141	0.132
2008	0.182	0.099
2009	0.089	0.055

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1899	0.1324
2	0.1818	0.1086
3	0.1410	0.1056

4	0.1388	0.1030
5	0.1305	0.1023
6	0.1160	0.0991
7	0.1143	0.0912
8	0.1088	0.0894
9	0.1027	0.0870
10	0.0972	0.0870
11	0.0921	0.0847
12	0.0908	0.0807
13	0.0893	0.0770
14	0.0882	0.0658
15	0.0829	0.0612
16	0.0814	0.0599
17	0.0806	0.0555
18	0.0726	0.0549
19	0.0708	0.0514
20	0.0701	0.0491
21	0.0659	0.0432
22	0.0649	0.0398
23	0.0648	0.0361
24	0.0640	0.0349
25	0.0634	0.0342
26	0.0595	0.0334
27	0.0589	0.0329
28	0.0582	0.0328
29	0.0560	0.0321
30	0.0523	0.0317
31	0.0511	0.0316
32	0.0505	0.0315
33	0.0502	0.0312
34	0.0502	0.0309
35	0.0498	0.0305
36	0.0492	0.0305
37	0.0479	0.0303
38	0.0469	0.0299
39	0.0459	0.0299
40	0.0458	0.0296
41	0.0441	0.0294
42	0.0441	0.0293
43	0.0434	0.0293
44	0.0425	0.0292
45	0.0412	0.0290
46	0.0411	0.0289
47	0.0405	0.0289
48	0.0401	0.0287
49	0.0392	0.0285
50	0.0385	0.0278
51	0.0368	0.0274
52	0.0358	0.0273
53	0.0332	0.0271
54	0.0310	0.0269
55	0.0262	0.0263
56	0.0249	0.0250
57	0.0234	0.0248
58	0.0232	0.0245
59	0.0154	0.0242
60	0.0082	0.0232
61	0.0056	0.0226

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0296	17547	17156	97	Pass
0.0308	16168	12151	75	Pass
0.0320	14966	9231	61	Pass
0.0331	13856	7905	57	Pass
0.0343	12814	7099	55	Pass
0.0355	11807	6686	56	Pass
0.0366	10900	6303	57	Pass
0.0378	10119	5987	59	Pass
0.0389	9385	5747	61	Pass
0.0401	8731	5523	63	Pass
0.0413	8143	5330	65	Pass
0.0424	7593	5146	67	Pass
0.0436	7060	4990	70	Pass
0.0448	6590	4812	73	Pass
0.0459	6147	4605	74	Pass
0.0471	5775	4413	76	Pass
0.0483	5431	4231	77	Pass
0.0494	5097	4036	79	Pass
0.0506	4808	3850	80	Pass
0.0518	4524	3640	80	Pass
0.0529	4252	3493	82	Pass
0.0541	4017	3326	82	Pass
0.0553	3782	3155	83	Pass
0.0564	3548	3014	84	Pass
0.0576	3337	2864	85	Pass
0.0588	3138	2706	86	Pass
0.0599	2952	2473	83	Pass
0.0611	2785	2344	84	Pass
0.0623	2599	2212	85	Pass
0.0634	2447	2022	82	Pass
0.0646	2304	1859	80	Pass
0.0658	2160	1692	78	Pass
0.0669	2024	1555	76	Pass
0.0681	1898	1465	77	Pass
0.0693	1790	1402	78	Pass
0.0704	1688	1332	78	Pass
0.0716	1585	1271	80	Pass
0.0728	1483	1225	82	Pass
0.0739	1380	1193	86	Pass
0.0751	1292	1155	89	Pass
0.0763	1219	1113	91	Pass
0.0774	1154	1072	92	Pass
0.0786	1098	1026	93	Pass
0.0798	1048	966	92	Pass
0.0809	997	909	91	Pass
0.0821	930	870	93	Pass
0.0833	883	824	93	Pass
0.0844	837	775	92	Pass
0.0856	789	728	92	Pass
0.0868	743	658	88	Pass
0.0879	713	601	84	Pass
0.0891	668	540	80	Pass
0.0903	630	478	75	Pass

0.0914	595	444	74	Pass
0.0926	565	414	73	Pass
0.0937	539	374	69	Pass
0.0949	496	348	70	Pass
0.0961	473	320	67	Pass
0.0972	434	293	67	Pass
0.0984	399	267	66	Pass
0.0996	366	238	65	Pass
0.1007	348	210	60	Pass
0.1019	323	184	56	Pass
0.1031	297	159	53	Pass
0.1042	273	149	54	Pass
0.1054	256	137	53	Pass
0.1066	235	128	54	Pass
0.1077	217	121	55	Pass
0.1089	195	111	56	Pass
0.1101	181	110	60	Pass
0.1112	158	106	67	Pass
0.1124	145	104	71	Pass
0.1136	130	99	76	Pass
0.1147	119	90	75	Pass
0.1159	109	84	77	Pass
0.1171	97	80	82	Pass
0.1182	91	71	78	Pass
0.1194	82	65	79	Pass
0.1206	76	61	80	Pass
0.1217	69	58	84	Pass
0.1229	62	54	87	Pass
0.1241	55	50	90	Pass
0.1252	48	45	93	Pass
0.1264	41	40	97	Pass
0.1276	38	37	97	Pass
0.1287	33	34	103	Pass
0.1299	27	26	96	Pass
0.1311	22	17	77	Pass
0.1322	21	2	9	Pass
0.1334	20	0	0	Pass
0.1346	19	0	0	Pass
0.1357	17	0	0	Pass
0.1369	14	0	0	Pass
0.1381	12	0	0	Pass
0.1392	9	0	0	Pass
0.1404	4	0	0	Pass
0.1416	3	0	0	Pass
0.1427	3	0	0	Pass
0.1439	3	0	0	Pass
0.1450	3	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Vault 1 POC	☐	36.32			☐	0.00			
Vault 2 POC	☐	210.54			☐	0.00			
Total Volume Infiltrated		246.86	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result – Failed

Model Default Modifications

Total of 0 changes have been made.

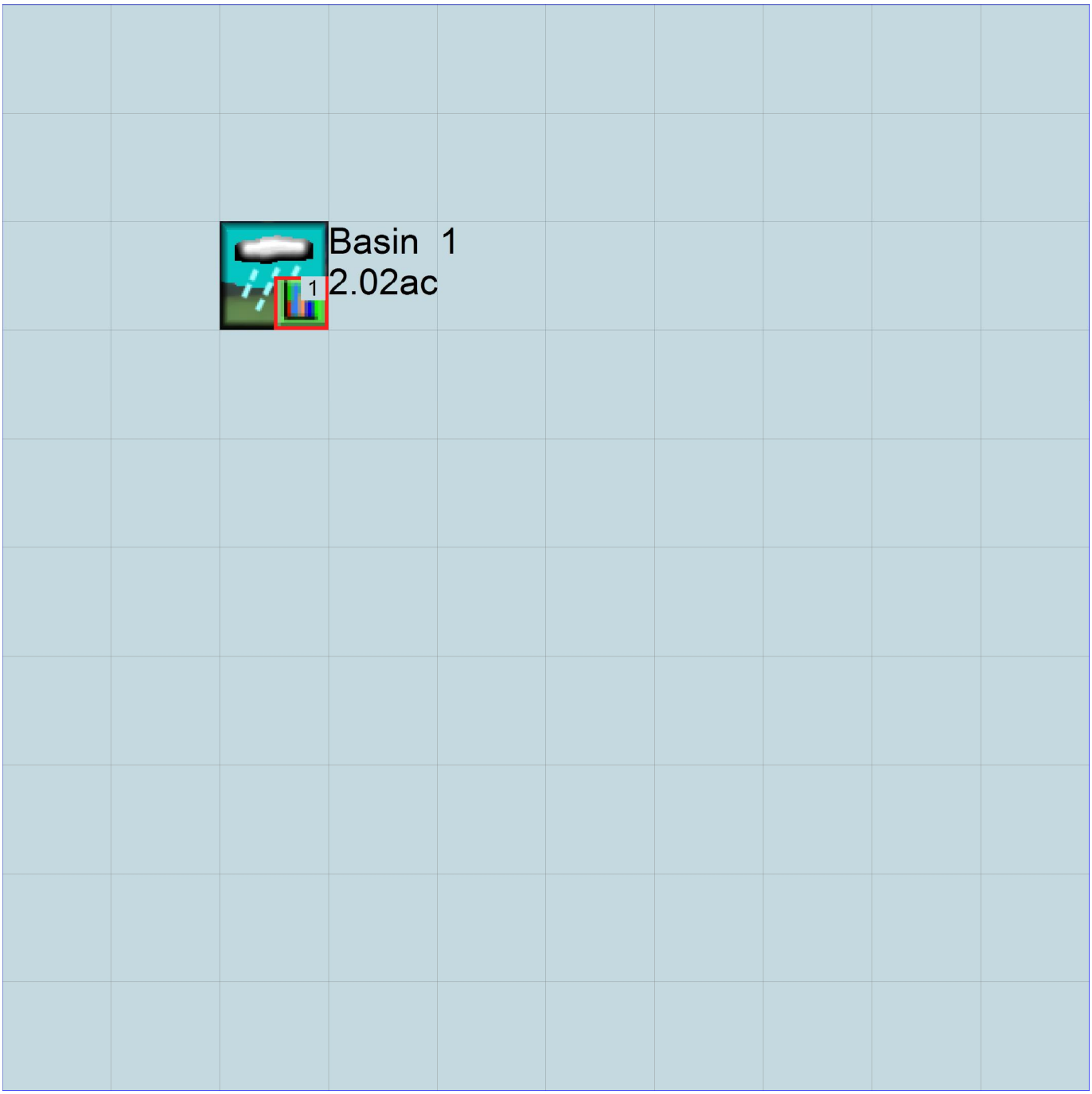
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

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   Floyd Leary - Vault.wdm
MESSU       25   PreFloyd Leary - Vault.MES
            27   PreFloyd Leary - Vault.L61
            28   PreFloyd Leary - Vault.L62
            30   POCFloyd Leary - Vault1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    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           ***
   10     C, Forest, Flat         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 ***
   10         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  *********
   10         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 ***
   10         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
   10             0       4.5      0.08       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
   10             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10          0.2       0.5      0.35         6       0.5       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
   10             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           ***
  END GEN-INFO
  *** Section IWATER***

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

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

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

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  10                       2.015     COPY   501     12
PERLND  10                       2.015     COPY   501     13

******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
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  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


END MASS-LINK

END RUN
```

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   Floyd Leary - Vault.wdm
MESSU       25   MitFloyd Leary - Vault.MES
            27   MitFloyd Leary - Vault.L61
            28   MitFloyd Leary - Vault.L62
            30   POCFloyd Leary - Vault1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND        7
      IMPLND        1
      IMPLND        8
      PERLND       16
      IMPLND        6
      IMPLND        4
      IMPLND        5
      RCHRES        1
      RCHRES        2
      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           ***
    7     A/B, Lawn, Flat         1    1    1    1   27    0
   16     C, Lawn, Flat           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 ***
    7         0    0    1    0    0    0    0    0    0    0    0
   16         0    0    1    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  *********
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   16         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 ***
    7         0    0    0    0    0    0    0    0    0    0    0
   16         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
    7              0         5       0.8       400      0.05       0.3     0.996
   16              0       4.5      0.03       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
    7              0         0         2         2         0         0         0
   16              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                            ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7          0.1       0.5      0.25         0       0.7      0.25
   16          0.1      0.25      0.25         6       0.5      0.25
  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
    7              0         0         0         0         3         1         0
   16              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
    8      SIDEWALKS/FLAT         1    1    1   27    0
    6      DRIVEWAYS/MOD          1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    5      DRIVEWAYS/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
    8         0    0    1    0    0    0
    6         0    0    1    0    0    0
```

```
    4          0    0    1    0    0    0
    5          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
    8          0    0    4    0    0    0    1    9
    6          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
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1          0    0    0    0    0
    8          0    0    0    0    0
    6          0    0    0    0    0
    4          0    0    0    0    0
    5          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
    8            400      0.01       0.1       0.1
    6            400      0.05       0.1      0.08
    4            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    8              0         0
    6              0         0
    4              0         0
    5              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    8              0         0
    6              0         0
    4              0         0
    5              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
VAULT 1 - LOWER VAULT***
PERLND  16                       0.049     RCHRES   1      2
PERLND  16                       0.049     RCHRES   1      3
IMPLND   1                       0.173     RCHRES   1      5
IMPLND   6                       0.017     RCHRES   1      5
IMPLND   8                       0.039     RCHRES   1      5
VAULT 2 - UPPER VAULT***
PERLND  16                       0.486     RCHRES   2      2
PERLND  16                       0.486     RCHRES   2      3
IMPLND   1                       0.281     RCHRES   2      5
IMPLND   4                        0.73     RCHRES   2      5
```

```
IMPLND   5                        0.16     RCHRES   2      5
IMPLND   8                       0.056     RCHRES   2      5
BYPASS***
PERLND   7                       0.006     COPY   501     12
PERLND   7                       0.006     COPY   601     12
PERLND   7                       0.006     COPY   501     13
PERLND   7                       0.006     COPY   601     13
IMPLND   1                       0.014     COPY   501     15
IMPLND   1                       0.014     COPY   601     15
IMPLND   8                       0.003     COPY   501     15
IMPLND   8                       0.003     COPY   601     15

******Routing******
PERLND  16                       0.049     COPY     1     12
IMPLND   1                       0.173     COPY     1     15
IMPLND   6                       0.017     COPY     1     15
IMPLND   8                       0.039     COPY     1     15
PERLND  16                       0.049     COPY     1     13
PERLND  16                       0.486     COPY     1     12
IMPLND   1                       0.281     COPY     1     15
IMPLND   4                        0.73     COPY     1     15
IMPLND   5                        0.16     COPY     1     15
IMPLND   8                       0.056     COPY     1     15
PERLND  16                       0.486     COPY     1     13
RCHRES   1                           1     COPY   501     16
RCHRES   2                           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
    2     Vault  2                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
    2         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
    2         4    0    0    0    0    0    0    0    0    0    1    9
  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
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
    2        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      0.01       0.0       0.0       0.5        0.0
    2              2      0.01       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
    2            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
   92    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.045933  0.000000  0.000000
  0.038889  0.045933  0.001786  0.000637
  0.077778  0.045933  0.003573  0.000901
  0.116667  0.045933  0.005359  0.001103
  0.155556  0.045933  0.007145  0.001274
  0.194444  0.045933  0.008932  0.001424
  0.233333  0.045933  0.010718  0.001560
  0.272222  0.045933  0.012504  0.001685
  0.311111  0.045933  0.014290  0.001802
  0.350000  0.045933  0.016077  0.001911
  0.388889  0.045933  0.017863  0.002014
  0.427778  0.045933  0.019649  0.002113
  0.466667  0.045933  0.021436  0.002206
  0.505556  0.045933  0.023222  0.002297
  0.544444  0.045933  0.025008  0.002383
  0.583333  0.045933  0.026795  0.002467
  0.622222  0.045933  0.028581  0.002548
  0.661111  0.045933  0.030367  0.002626
  0.700000  0.045933  0.032153  0.002702
  0.738889  0.045933  0.033940  0.002776
  0.777778  0.045933  0.035726  0.002849
  0.816667  0.045933  0.037512  0.002919
  0.855556  0.045933  0.039299  0.002988
  0.894444  0.045933  0.041085  0.003055
  0.933333  0.045933  0.042871  0.003120
  0.972222  0.045933  0.044658  0.003185
  1.011111  0.045933  0.046444  0.003248
  1.050000  0.045933  0.048230  0.003310
  1.088889  0.045933  0.050016  0.003370
  1.127778  0.045933  0.051803  0.003430
  1.166667  0.045933  0.053589  0.003489
  1.205556  0.045933  0.055375  0.003546
  1.244444  0.045933  0.057162  0.003603
  1.283333  0.045933  0.058948  0.003659
  1.322222  0.045933  0.060734  0.003714
  1.361111  0.045933  0.062521  0.003768
  1.400000  0.045933  0.064307  0.003822
  1.438889  0.045933  0.066093  0.003874
  1.477778  0.045933  0.067879  0.003926
  1.516667  0.045933  0.069666  0.004627
  1.555556  0.045933  0.071452  0.005516
  1.594444  0.045933  0.073238  0.006079
  1.633333  0.045933  0.075025  0.006535
  1.672222  0.045933  0.076811  0.006930
  1.711111  0.045933  0.078597  0.007286
```

```
1.750000  0.045933  0.080384  0.007614
1.788889  0.045933  0.082170  0.007919
1.827778  0.045933  0.083956  0.008206
1.866667  0.045933  0.085742  0.008479
1.905556  0.045933  0.087529  0.008739
1.944444  0.045933  0.089315  0.008988
1.983333  0.045933  0.091101  0.009229
2.022222  0.045933  0.092888  0.009460
2.061111  0.045933  0.094674  0.009685
2.100000  0.045933  0.096460  0.009903
2.138889  0.045933  0.098247  0.010115
2.177778  0.045933  0.100033  0.010321
2.216667  0.045933  0.101819  0.010522
2.255556  0.045933  0.103606  0.013296
2.294444  0.045933  0.105392  0.014697
2.333333  0.045933  0.107178  0.015793
2.372222  0.045933  0.108964  0.016736
2.411111  0.045933  0.110751  0.017582
2.450000  0.045933  0.112537  0.018359
2.488889  0.045933  0.114323  0.019084
2.527778  0.045933  0.116110  0.093457
2.566667  0.045933  0.117896  0.294111
2.605556  0.045933  0.119682  0.565482
2.644444  0.045933  0.121469  0.890621
2.683333  0.045933  0.123255  1.258510
2.722222  0.045933  0.125041  1.659701
2.761111  0.045933  0.126827  2.085007
2.800000  0.045933  0.128614  2.525074
2.838889  0.045933  0.130400  2.970325
2.877778  0.045933  0.132186  3.411096
2.916667  0.045933  0.133973  3.837914
2.955556  0.045933  0.135759  4.241857
2.994444  0.045933  0.137545  4.614991
3.033333  0.045933  0.139332  4.950874
3.072222  0.045933  0.141118  5.245098
3.111111  0.045933  0.142904  5.495895
3.150000  0.045933  0.144690  5.704771
3.188889  0.045933  0.146477  5.877192
3.227778  0.045933  0.148263  6.023299
3.266667  0.045933  0.150049  6.234265
3.305556  0.045933  0.151836  6.390092
3.344444  0.045933  0.153622  6.542204
3.383333  0.045933  0.155408  6.690855
3.422222  0.045933  0.157195  6.836272
3.461111  0.045933  0.158981  6.978656
3.500000  0.045933  0.160767  7.118190
3.538889  0.045933  0.162553  7.255039
END FTABLE  1
FTABLE      2
 92    4
   Depth      Area    Volume  Outflow1 Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
0.000000  0.100000  0.000000  0.000000
0.077778  0.100000  0.007778  0.004033
0.155556  0.100000  0.015556  0.005704
0.233333  0.100000  0.023333  0.006985
0.311111  0.100000  0.031111  0.008066
0.388889  0.100000  0.038889  0.009018
0.466667  0.100000  0.046667  0.009879
0.544444  0.100000  0.054444  0.010670
0.622222  0.100000  0.062222  0.011407
0.700000  0.100000  0.070000  0.012099
0.777778  0.100000  0.077778  0.012754
0.855556  0.100000  0.085556  0.013376
0.933333  0.100000  0.093333  0.013971
1.011111  0.100000  0.101111  0.014541
1.088889  0.100000  0.108889  0.015090
1.166667  0.100000  0.116667  0.015620
1.244444  0.100000  0.124444  0.016132
1.322222  0.100000  0.132222  0.016629
```

1.400000	0.100000	0.140000	0.017111
1.477778	0.100000	0.147778	0.017580
1.555556	0.100000	0.155556	0.018036
1.633333	0.100000	0.163333	0.018482
1.711111	0.100000	0.171111	0.018917
1.788889	0.100000	0.178889	0.019342
1.866667	0.100000	0.186667	0.019758
1.944444	0.100000	0.194444	0.020165
2.022222	0.100000	0.202222	0.020565
2.100000	0.100000	0.210000	0.020956
2.177778	0.100000	0.217778	0.021341
2.255556	0.100000	0.225556	0.021719
2.333333	0.100000	0.233333	0.022090
2.411111	0.100000	0.241111	0.022455
2.488889	0.100000	0.248889	0.022814
2.566667	0.100000	0.256667	0.023168
2.644444	0.100000	0.264444	0.023516
2.722222	0.100000	0.272222	0.023860
2.800000	0.100000	0.280000	0.024198
2.877778	0.100000	0.287778	0.024532
2.955556	0.100000	0.295556	0.024861
3.033333	0.100000	0.303333	0.025186
3.111111	0.100000	0.311111	0.025507
3.188889	0.100000	0.318889	0.025824
3.266667	0.100000	0.326667	0.026137
3.344444	0.100000	0.334444	0.026446
3.422222	0.100000	0.342222	0.026752
3.500000	0.100000	0.350000	0.027054
3.577778	0.100000	0.357778	0.027353
3.655556	0.100000	0.365556	0.027649
3.733333	0.100000	0.373333	0.031733
3.811111	0.100000	0.381111	0.038143
3.888889	0.100000	0.388889	0.042012
3.966667	0.100000	0.396667	0.045110
4.044444	0.100000	0.404444	0.047786
4.122222	0.100000	0.412222	0.050186
4.200000	0.100000	0.420000	0.052386
4.277778	0.100000	0.427778	0.054433
4.355556	0.100000	0.435556	0.056358
4.433333	0.100000	0.443333	0.058181
4.511111	0.100000	0.451111	0.062289
4.588889	0.100000	0.458889	0.068286
4.666667	0.100000	0.466667	0.072362
4.744444	0.100000	0.474444	0.075844
4.822222	0.100000	0.482222	0.078985
4.900000	0.100000	0.490000	0.081892
4.977778	0.100000	0.497778	0.084623
5.055556	0.100000	0.505556	0.087212
5.133333	0.100000	0.513333	0.089684
5.211111	0.100000	0.521111	0.092058
5.288889	0.100000	0.528889	0.094345
5.366667	0.100000	0.536667	0.096557
5.444444	0.100000	0.544444	0.098701
5.522222	0.100000	0.552222	0.100784
5.600000	0.100000	0.560000	0.102812
5.677778	0.100000	0.567778	0.104790
5.755556	0.100000	0.575556	0.106721
5.833333	0.100000	0.583333	0.108610
5.911111	0.100000	0.591111	0.110458
5.988889	0.100000	0.598889	0.112270
6.066667	0.100000	0.606667	0.387742
6.144444	0.100000	0.614444	0.984781
6.222222	0.100000	0.622222	1.754449
6.300000	0.100000	0.630000	2.620450
6.377778	0.100000	0.637778	3.507129
6.455556	0.100000	0.645556	4.338567
6.533333	0.100000	0.653333	5.048279
6.611111	0.100000	0.661111	5.594007
6.688889	0.100000	0.668889	5.976020
6.766667	0.100000	0.676667	6.333815

```
  6.844444  0.100000  0.684444  6.642480
  6.922222  0.100000  0.692222  6.937277
  7.000000  0.100000  0.700000  7.219927
  7.077778  0.100000  0.707778  7.491821
  END FTABLE  2
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
RCHRES   2 HYDR   RO     1 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
END EXT TARGETS

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
```

Predeveloped HSPF Message File

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1999/ 9/30 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-7.834E-03     0.00000  0.0000E+00     0.00000  -6.399E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 2002/ 8/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-7.804E-02     0.00000  0.0000E+00     0.00000  -5.977E-10

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
```

DATE/TIME: 2006/ 7/31 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-8.911E-02	0.00000	0.0000E+00	0.00000	-5.173E-10

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

Disclaimer

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Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com