



C and G Property

City of Kirkland, Washington

Preliminary Technical Information Report

Prepared for
Camwest – A Toll Brothers Company
9720 NE 120th PI Suite 100
Kirkland, WA 98034

Original Date: **June 11th, 2012**
Revision Date: **January 23rd, 2013**

Blueline Job No. 11-070

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The subject project's drainage facilities were designed using the guidelines and requirements established in the 2009 King County Surface Water Design Manual (2009 KCSWDM) as adopted by the City of Kirkland. "Level 2 Flow Control" and "Basic Water Quality Treatment" are required.

Section 2 Conditions and Requirements Summary

CONDITIONS OF APPROVAL

1. All public improvements associated with this project including street and utility improvements, must meet the City of Kirkland Public Works Pre-Approved Plans and Policies Manual. A Public Works Pre-Approved Plans and Policies manual can be purchased from the Public Works Department, or it may be retrieved from the Public Works Department's page at the City of Kirkland's web site at www.ci.kirkland.wa.us.

2. This project will be subject to Public Works Permit and Connection Fees. At the pre-application stage, the fees can only be estimated. It is the applicant's responsibility to contact the Public Works Department by phone or in person to determine the fees. The fees can also be review the City of Kirkland web site at www.ci.kirkland.wa.us. The applicant should anticipate the following fees:
 - o Water and Sewer connection Fees (paid with the issuance of a Building Permit)
 - o Side Sewer Inspection Fee (paid with the issuance of a Building Permit)
 - o Septic Tank Abandonment Inspection Fee (if required)
 - o Water Meter Fee (paid with the issuance of a Building Permit)
 - o Right-of-way Fee
 - o Review and Inspection Fee (for utilities and street improvements).
 - o Traffic, Park and School Impact Fee (paid with the issuance of Building Permit). For additional information, see notes below.

3. All street and utility improvements shall be permitted by obtaining a Land Surface Modification (LSM) Permit. If a Building Permit for a new house is applied for prior to applying for the LSM Permit, the Building Permit will not be issued until a complete LSM Permit is applied for.

4. Prior to submittal of a Building or Zoning Permit, the applicant must apply for a Concurrency Test Notice. Contact Thang Nguyen, Transportation Engineer, at 425-587-3869 for more information. A separate Concurrency Permit will be created.

5. Building Permits associated with this proposed project will be subject to the traffic, park, and school impact fees per Chapter 27 of the Kirkland Municipal Code. The impact fees shall be paid prior to issuance of the Building Permit(s).

6. All civil engineering plans which are submitted in conjunction with a building, grading, or right-of-way

permit must conform to the Public Works Policy titled ENGINEERING PLAN REQUIREMENTS. This policy is contained in the Public Works Pre-Approved Plans and Policies manual.

7. All street improvements and underground utility improvements (storm, sewer, and water) must be designed by a Washington State Licensed Engineer; all drawings shall bear the engineers stamp.

8. All plans submitted in conjunction with a building, grading or right-of-way permit must have elevations which are based on the King County datum only (NAVD 88).

9. The required tree plan shall include any significant tree in the public right-of-way along the property frontage.

10. All subdivision recording mylar's shall include the following note:

Utility Maintenance: Each property owner shall be responsible for maintenance of the sanitary sewer or storm water stub from the point of use on their own property to the point of connection in the City sanitary sewer main or storm water main. Any portion of a sanitary sewer or surface water stub, which jointly serves more than one property, shall be jointly maintained and repaired by the property owners sharing such stub. The joint use and maintenance shall "run with the land" and will be binding on all property owners within this subdivision, including their heirs, successors and assigns.

Public Right-of-way Sidewalk and Vegetation Maintenance: Each property owner shall be responsible for keeping the sidewalk abutting the subject property clean and litter free. The property owner shall also be responsible for the maintenance of the vegetation within the abutting landscape strip. The maintenance shall "run with the land" and will be binding on all property owners within this subdivision, including their heirs, successors and assigns.

Sanitary Sewer Conditions:

1. There is existing sewer main on the north and south end of this property. The developer shall design a sewer main extension(s) that provides a 6-inch minimum gravity side sewer connection to each lot.
2. If the sewer main extension is outside of the public right-of-way, it shall be encompassed in a 20 foot wide public sanitary sewer easement.

Water System Conditions:

1. There is inadequate fire flow in and around the project site. A fire flow analysis will need to be conducted, but it appears that at a minimum, the 6-inch water mains along NE 75th Street and 128th Ave. NE will need to be replaced with new 8-inch water mains; this includes the existing 6-inch main along the east property line. When the new water system is designed, the new access road shall contain an 8-inch minimum main that loops through between NE 75th St and NE 80th St.

2. Provide a separate 1" minimum water service from the water main to the meter for each lot; City of Kirkland will set the water meter.

Surface Water Conditions:

2009 KCSWDM - The entire drainage report shall be submitted with the PUD application.

1. Provide temporary and permanent storm water control per the 2009 King County Surface Water Design Manual and the Kirkland Addendum. See Policies D-2 and D-3 in the PW Pre-Approved Plans for drainage review information, or contact city of Kirkland Surface Water staff at (425) 587-3800 for help in determining drainage review requirements. Summarized below are the levels of drainage review based on site and project characteristics:

" Full Drainage Review

- " A full drainage review is required for any proposed project, new or redevelopment, that will:
- " Add or replaces 5,000ft² or more of new impervious surface area,
- " Propose 7,000ft² or more of land disturbing activity, or,
- " Be a redevelopment project on a single or multiple parcel site in which the total of new plus replaced impervious surface area is 5,000ft² or more and whose valuation of proposed improvements (including interior improvements but excluding required mitigation and frontage improvements) exceeds 50% of the assessed value of the existing site improvements.

2. Evaluate the feasibility and applicability of dispersion, infiltration, and other stormwater low impact development facilities on-site (per section 5.2 in the 2009 King County Surface Water Design Manual).

If feasible, stormwater low impact development facilities are required. See PW Pre-Approved Plan Policy L-1 for more information on this requirement.

3. Because this project site is one acre or greater, the following conditions apply:

" Amended soil requirements (per Ecology BMP T5.13) must be used in all landscaped areas.

" If the project meets minimum criteria for water quality treatment (5,000ft² pollution generating impervious surface area), the enhanced level of treatment is required if the project is multi-family residential, commercial, or industrial. Enhanced treatment targets the removal of metals such as copper and zinc.

" The applicant is responsible to apply for a Construction Stormwater General Permit from Washington State Department of Ecology. Provide the City with a copy of the Notice of Intent for the permit. Permit Information can be found at the following website:

<http://www.ecy.wa.gov/programs/wq/stormwater/construction/>

o Among other requirements, this permit requires the applicant to prepare a Storm Water Pollution Prevention Plan (SWPPP) and identify a Certified Erosion and Sediment Control Lead (CESCL) prior to the start of construction. The CESCL shall attend the City of Kirkland PW Dept. pre-construction meeting with a completed SWPPP.

" Turbidity monitoring by the developer/contractor is required if a project contains a lake, stream, or wetland.

" A Stormwater Pollution Prevention and Spill (SWPPS) Plan must be kept on site during all phases of construction and shall address construction-related pollution generating activities. Follow the guidelines in the 2009 King County Surface Water Design Manual for plan preparation.

4. The storm water detention system shall be designed to Level II standards. Historic (forested) conditions shall be used as the pre-developed modeling condition.

5. Storm detention calculations for the entire site are required.

6. Any off-site storm water must by-pass the on-site storm water detention system or accounted for in the design of the detention system.

7. The developer has been given notice that the Army Corps of Engineers (COE) has asserted jurisdiction over upland ditches draining to streams. Either an existing Nationwide COE permit or an Individual COE permit may be necessary for work within ditches, depending on the project activities. Applicants should

obtain the applicable COE permit; information about COE permits can be found at: U.S. Army Corps of Engineers, Seattle District Regulatory Branch

http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=mainpage_NWPs

Specific questions can be directed to: Seattle District, Corps of Engineers, Regulatory Branch, CENWS-OD-RG, Post Office Box 3755, Seattle, WA 98124-3755, Phone: (206) 764-3495

8. Provide an erosion control report and plan with Building or Land Surface Modification Permit application. The plan shall be in accordance with the 2009 King County Surface Water Design Manual.

9. Construction drainage control shall be maintained by the developer and will be subject to periodic inspections. During the period from May 1 and September 30, all denuded soils must be covered within 7 days; between October 1 and April 30, all denuded soils must be covered within 12 hours. Additional erosion control measures may be required based on site and weather conditions. Exposed soils shall be stabilized at the end of the workday prior to a weekend, holiday, or predicted rain event.

10. Provide collection and conveyance of right-of-way storm drainage

11. Unless the lot is not connected to the storm system (it is using infiltration instead), then as part of the roof and driveway drainage conveyance system for each new house, each lot shall contain a 10 ft. long (min.) perforated tight line connection with an overflow to the public storm drain system (COK Plan No. CK-D.39). The tight line connections shall be installed with the individual new houses.

12. Provide a separate storm drainage connection for each lot.

Street and Pedestrian Improvement Conditions:

1. The subject property abuts NE 75th Street, a Neighborhood Access type street. In addition, the project requires a public road for access built to Neighborhood Access design standards. Zoning Code sections 110.10 and 110.25 require the applicant to make half-street improvements in rights-of-way abutting the subject property. Section 110.30-110.50 establishes that this street must be improved with the following:

NE 75th St

- A. Widen the street to 28 ft. from the existing curb on the south side of the street to the new face of curb; the new curb should align with the existing curb to the east.
- B. Install storm drainage, curb and gutter, a 4.5 ft. planter strip with street trees 30 ft. on-center, and a 5 ft. wide sidewalk.
- C. Dedicate right-of-way to encompass the said improvements.

New Access Road

- D. Dedicate a minimum of 45 ft of right-of-way through the property and install a 24 ft wide street (R-24 standard) with storm drainage, curb and gutter, landscape strip with street trees 30 ft on-center, and 5 ft wide sidewalks each side.
 - E. The new access road shall connect NE 75th Street to NE 80th Street. The portion of the connection that will be located in the 128th Ave. NE ROW shall be improved with same improvements as noted within the project.
 - F. The intersections at NE 80th Street and NE 75th Street shall be analyzed within the traffic study.
2. The proposed private access tracts shall meet the standards within chapter 105 of the KZC.
 3. A 2-inch asphalt street overlay will be required where three or more utility trench crossings occur within 150 lineal ft. of street length or where utility trenches parallel the street centerline. Grinding of the existing asphalt to blend in the overlay will be required along all match lines.
 4. The driveway for each lot shall be long enough so that parked cars do not extend into the access easement or right-of-way (20 ft. min.)
 5. All street and driveway intersections shall not have any visual obstructions within the sight distance triangle. See Public Works Pre-approved Policy R.13 for the sight distance criteria and specifications.
 6. Prior to the final of the building or grading permit, pay for the installation of stop and street signs at the new intersections.
 7. The City may require the installation of "NO PARKING ANYTIME" signs along one side of the new street depending on driveway locations.
 8. Install new monuments at the new intersections and all other points as directed by the land surveyor.

9. It shall be the responsibility of the applicant to relocate any above-ground or below-ground utilities which conflict with the project associated street or utility improvements.

10. Underground all new and existing on-site utility lines and overhead transmission lines.

11. New street lights may be required per Puget Power design and Public Works approval. Contact the INTO Light Division at PSE for a lighting analysis. If lighting is necessary, design must be submitted prior to issuance of a grading or building permit.

****Fire Department Conditions****

1. Fire department access roads are required when any portion of exterior wall of first story is located more than 150 feet from fire apparatus access.

Requirements for the new main access shall be as determined by the Public Works Department. For those access tracts serving 3 or 4 lots, the unobstructed paved width shall be 20 feet minimum. If this cannot be provided, the houses on those lots may be sprinklered.

2. Additional hydrants shall be installed to meet the requirements of Kirkland Fire Department Operating Policy 4. There shall be a hydrant within 300 feet of the front of any building lot. All hydrants, both existing and new, which will serve the property shall be equipped with 5" Stortz adapters.

Fire flow in the area is less than 1,000 gpm and is inadequate. Upgrades to the water system which are required in order to improve fire flow to adequate levels shall be determined by the Public Works Department.

CORE REQUIREMENTS

Core Requirement #1: Discharge at the Natural Location

Discharge from the site is to the existing natural discharge location. See Section 3 of this report for the downstream Analysis.

Core Requirement #2: Off-site Analysis

See Section 3 of this Report for the offsite analysis.

Core Requirement #3: Flow Control

See Section 4 of this Report for design of the flow control facility. See Preliminary Civil Plans under separate cover for location of the flow control facility.

Core Requirement #4: Conveyance System

Sizing of the proposed conveyance system will be completed during final design. A preliminary layout of the conveyance system is shown on the Preliminary Civil Plans under separate cover.

Core Requirement #5: Erosion and Sediment Control

This Core Requirement will be address during final design.

Core Requirement #6: Operations and Maintenance

This Core Requirement will be address during final design.

Core Requirement #7: Financial Guarantees and Liability

This Core Requirement will be address during final design.

Core Requirement #8: Water Quality

See Section 4 of this Report for design of the water quality treatment facility. See Preliminary Civil Plans under separate cover for location of the water quality treatment facility.

Section 3 Offsite Analysis

Resource Review

The best available resource information was reviewed for existing or potential problems. The following is a summary of the findings.

- The site does not contain any identified Wetlands.
- The site is located near Streams and/or Flood Plains.
- The site is not located in an Erosion Hazard Area.
- The site is not located in a Landslide Hazard Area.
- The site is not located in a Seismic Hazard Area.
- Drainage complaints dated prior to 1996 have been archived and were not immediately available from DDES. There is one drainage complaint immediately past the ¼ mile downstream point. This complaint has been closed as it was due to a maintenance issue. The following is a brief description of the downstream drainage complaints.

1978-0053: Fill material blocking the natural drainage swale.

Upstream Basin

There is an upstream basin to the site that totals approximately 4.84 acres. All upstream flows are conveyed to the site via a 24" culvert that discharges onto the south end of the middle portion of the site. This culvert is over 80% buried. The upstream flows shall be collected and bypassed to the natural discharge location at the north end of the site in the developed condition

Field Investigation

A field investigation was conducted on Tuesday, February 28th, 2012, on an overcast and cold day with a temperature of approximately 41 degrees.

The existing ground cover is predominantly lawn with a few groupings of trees on the north and south end of the project. In the existing conditions, drainage generally flows towards the northern portion of the subject property where it is collected by a buried 12" concrete pipe located centrally at the north end of the subject site.

This 12" concrete pipe conveys the flows north approximately 20 feet north to a manhole on the south end of the cul-de-sac on 127th Place NE. From here the flows travel 520 feet north through a series of

12" concrete pipe and catch basins until it reaches NE 80th St. From here the flows turn west and travel approximately 490 feet via catch basins and 12" concrete pipe. From here, the flows continue west in a 12" corrugated metal pipe (CMP). The flows then meet at a catch basin with tributary flows to the west, turn north via 12" CMP, and drain to a manhole. This manhole has a restrictor in place, with an overflow that sheetflows on to adjacent properties. This manhole marks the end of the ¼ mile downstream point. There was no other evidence of erosion or overtopping along the downstream drainage path to the ¼ mile downstream point.

Drainage Course Pictures



Looking East at the northern part of the site, mostly pervious land near the buried outlet pipe.



Looking South at the manhole that connects the buried 12" concrete pipe



Looking NorthWest on 80th St.



Looking West on 8-0th St where the 12" Concrete pipe changes to 12" CMP.



Looking North on NE 80th St.

OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE
SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin:	Juanita Creek	Subbasin Name:	Cedar River / Lake Washington	Subbasin Number:	8		
Symbol	Drainage Component 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	%	¼ ml = 1,320 ft	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
See Map (1)	Interflow catchment	Vegetated Cover; Interflow to be caught by the buried pipe underground.	-	0 ft	None Observed	None	None
See Map (2)	12" Concrete Pipe	Starts onsite, and proceeds north; Covered by 7 th Place NE	0-2%	520 ft	None Observed	None	None
See Map (3)	12" Concrete Pipe	NE 80 th Street	0-2%	520-1,010 ft	None Observed	None	None
See Map (4)	12" Corrugated Metal Pipe (CMP)	NE 80 th Street	0-2%	1,010-1,325 ft <u>(this concludes the ¼ mile downstream point)</u>	None Observed	None	None
See Map (5)	18" CMP	NE 80 th Street		1,325-1,385 ft	None Observed	None	None

B

Section 4 Detention and Water Quality Design

Flow control and water quality treatment will be accommodated for in a combined detention/water quality vault. Live storage within the vault will be designed according to Level 2 Flow Control. Dead storage within the vault will be designed according to the Basic Water Quality Treatment Menu.

A. Hydraulic Analysis

The drainage analysis was modeled using the King County Runoff Time Series software. The site soils are Alderwood gravelly sandy loam (AgC), KCRTS group Till. See Soils Map on the following pages. The site is located in the Seatac rainfall region with a location scale factor of 1.0.

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Map Unit Legend			
King County Area, Washington (WA633)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 6 to 15 percent slopes	7.8	100.0%
Totals for Area of Interest		7.8	100.0%

CREATING A TIME SERIES FILE (EXAMPLE)

**TABLE III-1
EQUIVALENCE BETWEEN SOIL TYPES CLASSIFIED BY U.S. SOIL
CONSERVATION SERVICE AND KING COUNTY RUNOFF TIME SERIES**

SCS Soil Type	SCS Hydrologic Soil Group	KCRTS Soil Group	Notes
* Alderwood (AgB, AgC, AgD)	C	Till	
Arents, Alderwood Material (AmB, AmC)	C	Till	
Arents, Everett Material (An)	B	Outwash	1
Beausite (BeC, BeD, BeF)	C	Till	2
Bellingham (Bh)	D	Till	3
Briscot (Br)	D	Till	3
Buckley (Bu)	D	Till	4
Earlmont (Ea)	D	Till	3
Edgewick (Ed)	C	Till	3
Everett (EvB, EvC, EvD, EwC)	A/B	Outwash	1
Indianola (InC, InA, InD)	A	Outwash	1
Kitsap (KpB, KpC, KpD)	C	Till	
Klaus (KsC)	C	Outwash	1
Neilton (NeC)	A	Outwash	1
Newberg (Ng)	B	Till	3
Nooksack (Nk)	C	Till	3
Norma (No)	D	Till	3
Orcas (Or)	D	Wetland	
Oridia (Os)	D	Till	3
Ovall (OvC, OvD, OvF)	C	Till	2
Pilchuck (Pc)	C	Till	3
Puget (Pu)	D	Till	3
Puyallup (Py)	B	Till	3
Ragnar (RaC, RaD, RaE)	B	Outwash	1
Renton (Re)	D	Till	3
Salal (Sa)	C	Till	3
Sammamish (Sh)	D	Till	3
Seattle (Sk)	D	Wetland	
Shalcar (Sm)	D	Till	3
Si (Sn)	C	Till	3
Snohomish (So, Sr)	D	Till	3
Sultan (Su)	C	Till	3
Tukwila (Tu)	D	Till	3
Woodinville (Wo)	D	Till	3

Key to Notes:

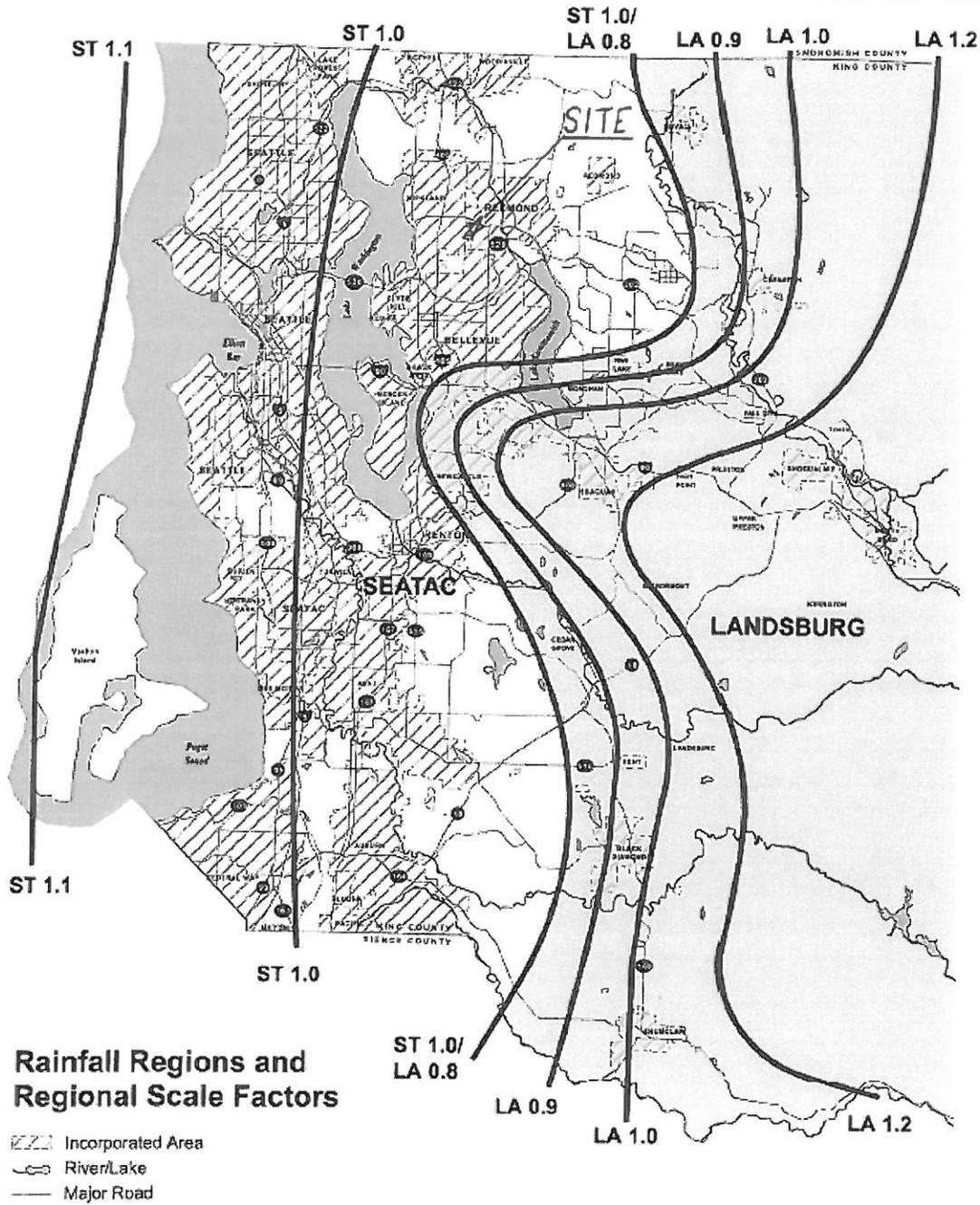
- Where outwash soils are saturated or underlain at shallow depth (<5 feet) by glacial till, they should be treated as till soils.
- These are bedrock soils, but calibration of HSPF (Hydrological Simulation Program-Fortran) by King County Surface Water Management shows bedrock soils to have similar hydrologic response to till soils.
- These are alluvial soils, some of which are underlain by glacial till or have a seasonally high water table. In the absence of detailed study, these soils should be treated as till soils.
- Buckley soils are formed on the low permeability Osceola mudflow. Hydrologic response is assumed to be similar to that for till soils.



B

SECTION 3.2 RUNOFF COMPUTATION AND ANALYSIS METHODS

FIGURE 3.2.2.A RAINFALL REGIONS AND REGIONAL SCALE FACTORS



EXISTING CONDITIONS

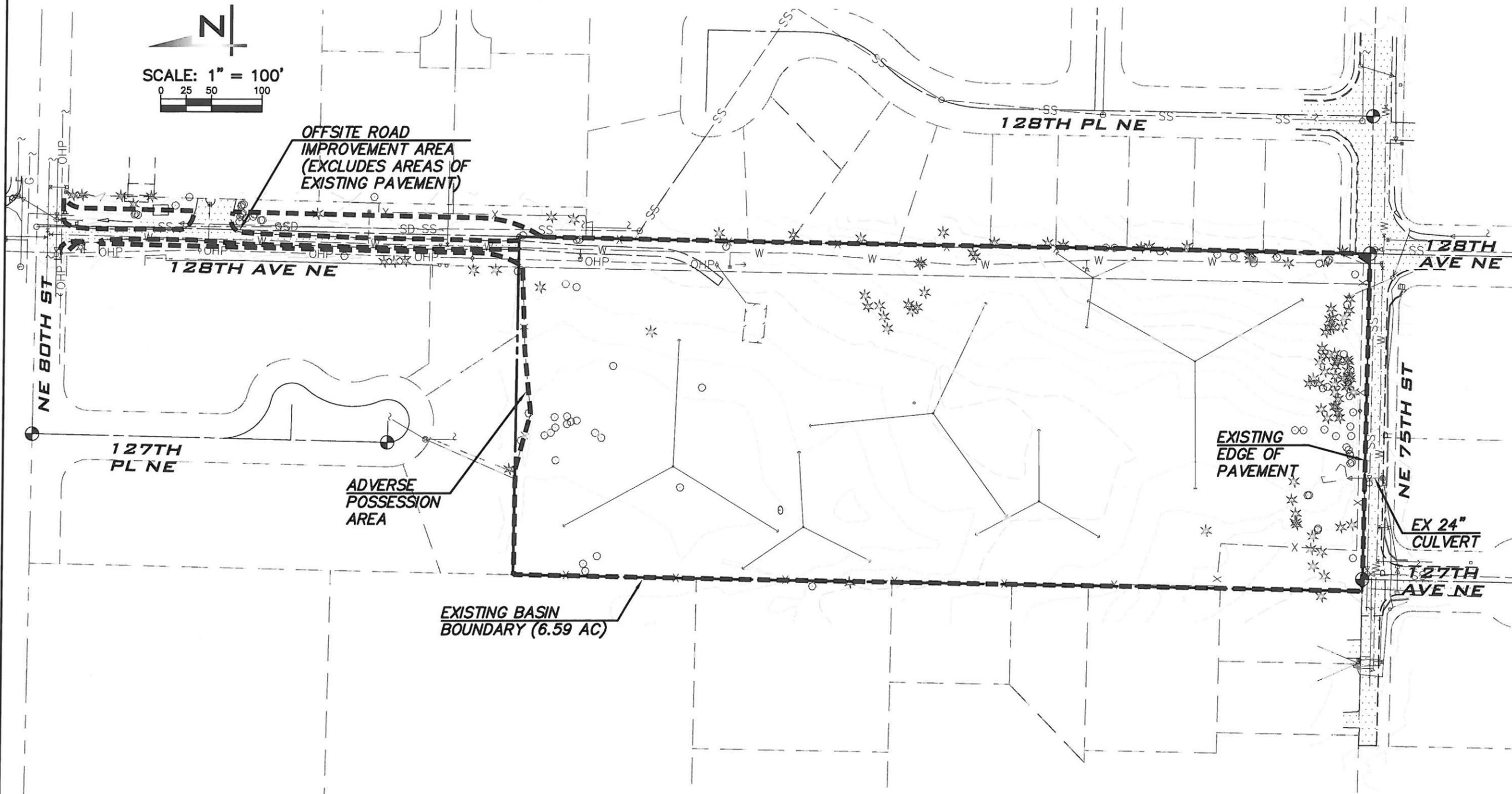
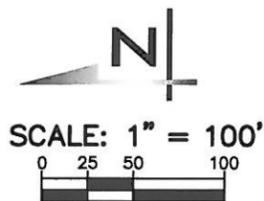
The existing basin boundary area, 6.59 acres, is defined as that area that will be improved through development of the subject property. The existing basin boundary will include the property area with the exception of the adverse possession area at the north end of the site defined by the existing fence, plus the NE 75th Street frontage improvement area between the property boundary and the existing edge of pavement which is generally located at the centerline of right-of-way, plus the offsite road improvement area along 128th Avenue NE excluding the areas of existing pavement. See attached Existing Conditions Exhibit on the following page. The following information was used for generating time series and flow frequencies.

EXISTING CONDITIONS (11070ex.tsf)	Total Area = 6.59 acres
GROUND COVER	AREA(acre)
Till-Forest	6.59

Flow Frequency Analysis
Time Series File:11070ex.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---				-----Flow Frequency Analysis-----			
Flow Rate (CFS)	Rank	Time of Peak		Peaks (CFS)	Rank	Return Period	Prob
0.416	2	2/09/01	18:00	0.532	1	100.00	0.990
0.113	7	1/06/02	3:00	0.416	2	25.00	0.960
0.308	4	2/28/03	3:00	0.319	3	10.00	0.900
0.011	8	3/24/04	20:00	0.308	4	5.00	0.800
0.183	6	1/05/05	8:00	0.269	5	3.00	0.667
0.319	3	1/18/06	21:00	0.183	6	2.00	0.500
0.269	5	11/24/06	4:00	0.113	7	1.30	0.231
0.532	1	1/09/08	9:00	0.011	8	1.10	0.091
Computed Peaks				0.493		50.00	0.980

SEC 9, TWN 25 N, RGE 5 E, W.M.



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SCALE	1" = 100'
PROJECT MANAGER	TODD A. OBERG, PE
DESIGNED BY	GINA R. BROOKS, PE
DRAWN BY	DOMINIQUE GABALDON
DATE	January 10, 2013

JOB NUMBER:
11-070

FIGURE:
EC-01

Jan 10, 2013 - 12:24pm - User: dgabaldon
E:\Projects\11070\Dwg\Exhibits\11070.EC.Exhibit.dwg

DEVELOPED CONDITIONS

The developed basin boundary area is equal to the existing basin boundary area, 6.59 acres, though the boundary will be shifted along the NE 75th Street frontage and along 128th Avenue NE. The shifted boundary will include existing improvements east of the NE 75th Street frontage that will be tributary to the site. These existing improvements collected will offset those offsite road improvements not collected at the north end of the 128th Avenue NE. See attached Developed Conditions Exhibit on the following page.

The developed basin will include:

NE 75 th Street/Interior ROW:	0.94 acre
Offsite 128 th Avenue NE ROW:	0.18 acre
Access Tracts:	0.21 acre
Recreation/Open Space Tracts:	0.90 acre
<u>Lots:</u>	<u>4.36 acres (189,821 square feet)</u>
Total:	6.59 acres

The impervious coverage for the developed site is delineated below.

Impervious Coverage for the NE 75th Street/Interior ROW

The impervious coverage within the NE 75th Street/Interior ROW is 0.82 acre.

Impervious Coverage for the Offsite 128th Avenue NE ROW

The impervious coverage within the Offsite 128th Avenue NE ROW is 0.16 acre.

Impervious Coverage for the Access Tracts

The impervious coverage within the access tracts is 0.19 acre.

Impervious Coverage within the Recreation Tract

The impervious coverage assumed within the Recreation Tract is 0.10 acre.

Impervious Coverage for the Lots

The maximum impervious coverage (lot coverage) per lot is 50% for Zone RSX per Section 17.10 of the Kirkland Zoning Code. With a total lot area of 4.36 acres, the total maximum lot impervious coverage is 2.18 acres.

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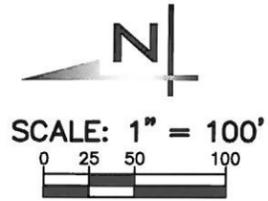
For preliminary design, the sizing for the proposed vault conservatively assumed no Flow Control BMP credits. See Flow Control BMP selection and design on the following pages. The following information was used for generating time series and flow frequencies.

DEVELOPED CONDITIONS (11070d.tsf)	Total Area = 6.59 acres
GROUND COVER	AREA(acre)
Till-Grass	3.14
Impervious	3.45

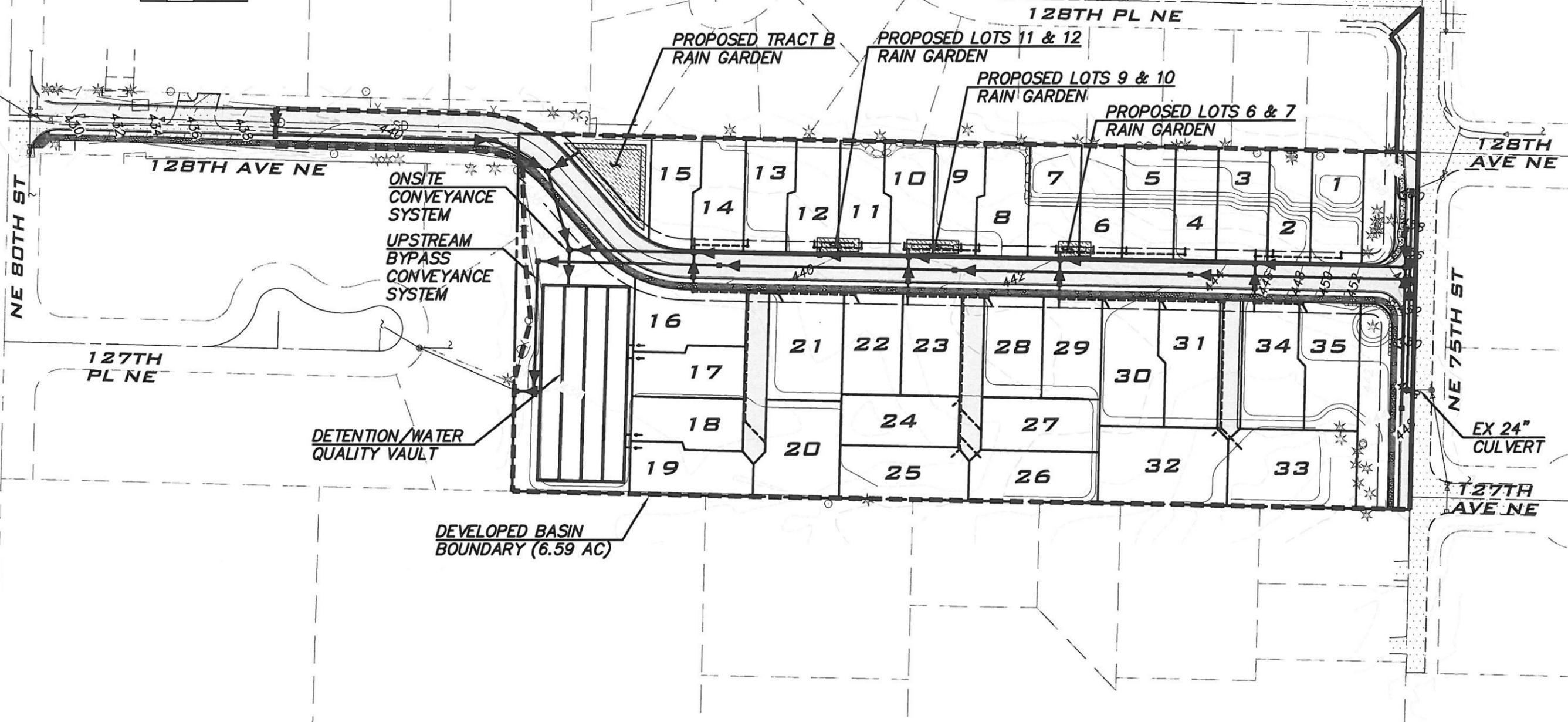
Flow Frequency Analysis
Time Series File:11070d.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---				-----Flow Frequency Analysis-----			
Flow Rate (CFS)	Rank	Time of Peak		- - Peaks - - (CFS)	Rank	Return Period	Prob
1.12	5	2/09/01	2:00	2.29	1	100.00	0.990
0.880	8	1/05/02	16:00	1.35	2	25.00	0.960
1.35	2	2/27/03	7:00	1.33	3	10.00	0.900
0.918	7	8/26/04	2:00	1.18	4	5.00	0.800
1.11	6	10/28/04	16:00	1.12	5	3.00	0.667
1.18	4	1/18/06	16:00	1.11	6	2.00	0.500
1.33	3	10/26/06	0:00	0.918	7	1.30	0.231
2.29	1	1/09/08	6:00	0.880	8	1.10	0.091
Computed Peaks				1.98		50.00	0.980

SEC 9, TWN 25 N, RGE 5 E, W.M.



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DEVELOPED CONDITIONS
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SCALE	1" = 100'
PROJECT MANAGER	TODD A. OBERG, PE
DESIGNED BY	GINA R. BROOKS, PE
DRAWN BY	DOMINIQUE GABALDON
DATE	JANUARY 10, 2013

JOB NUMBER:
11-070

FIGURE:
DC-01

Jan 10, 2013 - 12:24pm - User: dgabalidon
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FLOW CONTROL BMPs

Per City Policy L-2 or Section 1.2.3.3 in the 2009 KCSWDM, projects subject to Core Requirement #3 must apply flow control BMPs to impervious surfaces as directed by Section 1.2.3.3 to either supplement the flow mitigation provided by required flow control facilities or provide flow mitigation where flow control facilities are not required. Flow control BMPs must be selected and applied according to the basic requirements, procedures, and provisions detailed in Section 5.2 and the design specifications for each BMP in Appendix C, Section C.2. Since approval will be required for the subdivision as well as the building permits for the newly created lots, both kinds of flow control BMP implementation are required as described in Section 5.2.

Per Section 5.2, for individual lots, implementation shall be in accordance with the “Individual Lot BMP Requirements” in Section 5.2.1. The individual lots on the subject project are smaller than 22,000 square feet and therefore, fall under the Section 5.2.1.1 “Small Lot BMP Requirements”. Since full dispersion and full infiltration are not feasible, one or more of the following BMPs listed under Section 5.2.1.1 (3.) must be applied to an impervious area equal to at least 10% of the lot for lot areas up to 11,000 square feet. Since the proposed recreation space tract, Tract C, is not required for the subject development and could have been incorporated within the lot areas, the total lot area for assessing required BMP requirements will include Tract C. The total area requiring BMPs is therefore, equal to $10\% \times 217,301$ square feet = 21,730 square feet.

Maximum Allowed Impervious Coverage for the Lots and Tract C

The maximum lot impervious coverage is also, adjusted to include Tract C. As stated previously, the maximum impervious coverage (lot coverage) per lot is 50% for Zone RSX per Section 17.10 of the Kirkland Zoning Code. With a total lot area of 217,301 square feet, the total maximum lot impervious coverage is 108,651 square feet.

Proposed BMPs

A combination of the “Native Growth Retention Credit” per Appendix C, Section C.2.10 will be applied to the sidewalk along NE 75th Street, “Rain Garden” per Appendix C, Section C.2.5 will be applied to the interior right-of-way impervious surfaces, and “Reduced Impervious Surface Credit” per Appendix C, Section C.2.9 will be applied to the lots. The sum of these BMPs treats the required 21,730 square feet. The project therefore, meets the requirements for flow control BMPs.

For the “Native Growth Retention Credit”, an impervious area of 1,288 square feet is treated. The proposed sidewalk along NE 75th Street will be tilted towards the adjacent open space. The area of open space provided exceeds the required 3.5 times the area of impervious area tributary to it.

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For the "Rain Garden", an impervious area of 12,032 square feet is treated. A total of 12,032 square feet * 0.25 feet = 3,008 cubic feet of raingarden storage is provided. The raingardens will be 1.5-feet deep with 1-foot of water and 0.5-foot of freeboard. The raingardens will have 3:1 side slopes. The Tract B raingarden will store 2,347 cubic feet of water storage. The Lot 11 & 12 raingarden will store 214 cubic feet of water storage. The Lot 9 & 10 raingarden will store 262 cubic feet of water storage. The Lot 6 & 7 raingarden will store 185 cubic feet of water storage.

For the "Reduced Impervious Surface Credit", an impervious area of 8,410 square feet is eliminated from the lots/Tract C. The adjusted maximum impervious area allowed on the Lots and Tract C is therefore, 108,651 square feet - 8,410 square feet = 100,241 square feet. The total impervious coverage allowed for construction of the lots/Tract C will be delineated on the final plat documents.

B. Flow Control Analysis and Design

Flow control will be accommodated for in a combined detention/water quality vault. Live storage within the vault will be designed according to Level 2 Flow Control. See KCRTS printout below. The required storage at the 100-year water surface elevation of 435.22 is 74,303 cubic feet. The proposed vault will have a surface area of 76 feet by 180 feet = 13,680 square feet which exceeds the required 13,456 square feet. The provided depth will match the required depth of 5.52 feet. The vault meets the requirements for Level 2 Flow Control.

Required Flow Control Volume = 74,303 cubic feet
Provided Flow Control Volume = 75,514 cubic feet

Retention/Detention Facility

Type of Facility: Detention Vault
 Facility Length: 116.00 ft
 Facility Width: 116.00 ft
 Facility Area: 13456. sq. ft
 Effective Storage Depth: 5.30 ft
 Stage 0 Elevation: 429.70 ft
 Storage Volume: 71317. cu. ft
 Riser Head: 5.30 ft
 Riser Diameter: 12.00 inches
 Number of orifices: 3

Orifice #	Height (ft)	Diameter (in)	Full Head Discharge (CFS)	Pipe Diameter (in)
1	0.00	1.34	0.113	
2	3.45	2.30	0.195	6.0
3	4.30	1.75	0.083	4.0

Top Notch Weir: None
 Outflow Rating Curve: None

Stage (ft)	Elevation (ft)	Storage (cu. ft)	Discharge (cfs)	Percolation (cfs)
0.00	429.70	0.	0.000	0.00
0.01	429.71	135.	0.003	0.006
0.03	429.73	404.	0.009	0.008
0.04	429.74	538.	0.012	0.010
0.06	429.76	807.	0.019	0.012
0.07	429.77	942.	0.022	0.013
0.08	429.78	1077.	0.025	0.014
0.10	429.80	1346.	0.031	0.015
0.11	429.81	1480.	0.034	0.016
0.22	429.92	2960.	0.068	0.023

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0.32	430.02	4306.	0.099	0.028	0.00
0.42	430.12	5652.	0.130	0.032	0.00
0.53	430.23	7132.	0.164	0.036	0.00
0.63	430.33	8477.	0.195	0.039	0.00
0.74	430.44	9957.	0.229	0.042	0.00
0.84	430.54	11303.	0.259	0.045	0.00
0.94	430.64	12649.	0.290	0.048	0.00
1.05	430.75	14129.	0.324	0.050	0.00
1.15	430.85	15474.	0.355	0.053	0.00
1.26	430.96	16955.	0.389	0.055	0.00
1.36	431.06	18300.	0.420	0.057	0.00
1.46	431.16	19646.	0.451	0.059	0.00
1.57	431.27	21126.	0.485	0.061	0.00
1.67	431.37	22472.	0.516	0.063	0.00
1.77	431.47	23817.	0.547	0.065	0.00
1.88	431.58	25297.	0.581	0.067	0.00
1.98	431.68	26643.	0.612	0.069	0.00
2.09	431.79	28123.	0.646	0.071	0.00
2.19	431.89	29469.	0.677	0.072	0.00
2.29	431.99	30814.	0.707	0.074	0.00
2.40	432.10	32294.	0.741	0.076	0.00
2.50	432.20	33640.	0.772	0.077	0.00
2.61	432.31	35120.	0.806	0.079	0.00
2.71	432.41	36466.	0.837	0.081	0.00
2.81	432.51	37811.	0.868	0.082	0.00
2.92	432.62	39292.	0.902	0.084	0.00
3.02	432.72	40637.	0.933	0.085	0.00
3.13	432.83	42117.	0.967	0.087	0.00
3.23	432.93	43463.	0.998	0.088	0.00
3.33	433.03	44808.	1.029	0.089	0.00
3.44	433.14	46289.	1.063	0.091	0.00
3.45	433.15	46423.	1.066	0.091	0.00
3.47	433.17	46692.	1.072	0.093	0.00
3.50	433.20	47096.	1.081	0.097	0.00
3.52	433.22	47365.	1.087	0.104	0.00
3.55	433.25	47769.	1.097	0.114	0.00
3.57	433.27	48038.	1.103	0.126	0.00
3.59	433.29	48307.	1.109	0.140	0.00
3.62	433.32	48711.	1.118	0.152	0.00
3.64	433.34	48980.	1.124	0.156	0.00
3.75	433.45	50460.	1.158	0.173	0.00
3.85	433.55	51806.	1.189	0.187	0.00
3.95	433.65	53151.	1.220	0.199	0.00
4.06	433.76	54631.	1.254	0.210	0.00
4.16	433.86	55977.	1.285	0.221	0.00
4.27	433.97	57457.	1.319	0.231	0.00
4.30	434.00	57861.	1.328	0.234	0.00
4.32	434.02	58130.	1.334	0.236	0.00
4.34	434.04	58399.	1.341	0.240	0.00
4.35	434.05	58534.	1.344	0.244	0.00
4.37	434.07	58803.	1.350	0.250	0.00
4.39	434.09	59072.	1.356	0.257	0.00
4.41	434.11	59341.	1.362	0.266	0.00
4.43	434.13	59610.	1.368	0.275	0.00

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4.45	434.15	59879.	1.375	0.278	0.00
4.46	434.16	60014.	1.378	0.282	0.00
4.57	434.27	61494.	1.412	0.299	0.00
4.67	434.37	62840.	1.443	0.315	0.00
4.78	434.48	64320.	1.477	0.330	0.00
4.88	434.58	65665.	1.507	0.343	0.00
4.98	434.68	67011.	1.538	0.356	0.00
5.09	434.79	68491.	1.572	0.368	0.00
5.19	434.89	69837.	1.603	0.379	0.00
5.30	435.00	71317.	1.637	0.391	0.00
5.40	435.10	72662.	1.668	0.709	0.00
5.50	435.20	74008.	1.699	1.280	0.00
5.60	435.30	75354.	1.730	2.020	0.00
5.70	435.40	76699.	1.761	2.820	0.00
5.80	435.50	78045.	1.792	3.110	0.00
5.90	435.60	79390.	1.823	3.380	0.00
6.00	435.70	80736.	1.853	3.620	0.00
6.10	435.80	82082.	1.884	3.850	0.00
6.20	435.90	83427.	1.915	4.060	0.00
6.30	436.00	84773.	1.946	4.260	0.00
6.40	436.10	86118.	1.977	4.460	0.00
6.50	436.20	87464.	2.008	4.640	0.00
6.60	436.30	88810.	2.039	4.820	0.00
6.70	436.40	90155.	2.070	4.990	0.00
6.80	436.50	91501.	2.101	5.150	0.00
6.90	436.60	92846.	2.131	5.310	0.00
7.00	436.70	94192.	2.162	5.470	0.00
7.10	436.80	95538.	2.193	5.620	0.00
7.20	436.90	96883.	2.224	5.760	0.00
7.30	437.00	98229.	2.255	5.910	0.00

Hyd	Inflow	Outflow		Peak		Storage	
		Target	Calc	Stage	Elev	(Cu-Ft)	(Ac-Ft)
1	2.29	*****	1.44	5.52	435.22	74303.	1.706
2	1.12	0.42	0.44	5.32	435.02	71519.	1.642
3	1.35	*****	0.31	4.66	434.36	62762.	1.441
4	1.33	*****	0.30	4.56	434.26	61344.	1.408
5	1.18	*****	0.18	3.80	433.50	51122.	1.174
6	1.11	*****	0.09	3.47	433.17	46674.	1.071
7	0.88	*****	0.09	3.03	432.73	40762.	0.936
8	0.92	*****	0.07	1.86	431.56	25043.	0.575

Route Time Series through Facility
Inflow Time Series File:11070d.tsf
Outflow Time Series File:vltout

Inflow/Outflow Analysis

Peak Inflow Discharge: 2.29 CFS at 6:00 on Jan 9 in Year 8
Peak Outflow Discharge: 1.44 CFS at 10:00 on Jan 9 in Year 8
Peak Reservoir Stage: 5.52 Ft
Peak Reservoir Elev: 435.22 Ft
Peak Reservoir Storage: 74303. Cu-Ft
: 1.706 Ac-Ft

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Flow Duration from Time Series File:vltout.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence %	Probability
0.006	31266	50.988	50.988	49.012	0.490E+00
0.019	8534	13.917	64.905	35.095	0.351E+00
0.031	6248	10.189	75.095	24.905	0.249E+00
0.043	5696	9.289	84.384	15.616	0.156E+00
0.056	4336	7.071	91.455	8.545	0.855E-01
0.068	2124	3.464	94.918	5.082	0.508E-01
0.080	1563	2.549	97.467	2.533	0.253E-01
0.093	1157	1.887	99.354	0.646	0.646E-02
0.105	57	0.093	99.447	0.553	0.553E-02
0.117	25	0.041	99.488	0.512	0.512E-02
0.130	17	0.028	99.516	0.484	0.484E-02
0.142	14	0.023	99.538	0.462	0.462E-02
0.154	27	0.044	99.583	0.417	0.417E-02
0.167	37	0.060	99.643	0.357	0.357E-02
0.179	45	0.073	99.716	0.284	0.284E-02
0.191	28	0.046	99.762	0.238	0.238E-02
0.203	24	0.039	99.801	0.199	0.199E-02
0.216	21	0.034	99.835	0.165	0.165E-02
0.228	21	0.034	99.870	0.130	0.130E-02
0.240	14	0.023	99.892	0.108	0.108E-02
0.253	4	0.007	99.899	0.101	0.101E-02
0.265	2	0.003	99.902	0.098	0.978E-03
0.277	3	0.005	99.907	0.093	0.930E-03
0.290	10	0.016	99.923	0.077	0.766E-03
0.302	10	0.016	99.940	0.060	0.603E-03
0.314	11	0.018	99.958	0.042	0.424E-03
0.327	7	0.011	99.969	0.031	0.310E-03
0.339	2	0.003	99.972	0.028	0.277E-03
0.351	3	0.005	99.977	0.023	0.228E-03
0.364	3	0.005	99.982	0.018	0.179E-03
0.376	4	0.007	99.989	0.011	0.114E-03
0.388	4	0.007	99.995	0.005	0.489E-04
0.401	2	0.003	99.998	0.002	0.163E-04
0.413	0	0.000	99.998	0.002	0.163E-04
0.425	0	0.000	99.998	0.002	0.163E-04
0.438	0	0.000	99.998	0.002	0.163E-04

Duration Comparison Analysis

Base File: 11070ex.tsf

New File: vltout.tsf

Cutoff Units: Discharge in CFS

Cutoff	-----Fraction of Time-----			-----Check of Tolerance-----			
	Base	New	%Change	Probability	Base	New	%Change
0.091	0.95E-02	0.67E-02	-29.3	0.95E-02	0.091	0.089	-2.9
0.116	0.63E-02	0.52E-02	-18.1	0.63E-02	0.116	0.093	-19.8
0.141	0.49E-02	0.47E-02	-5.6	0.49E-02	0.141	0.126	-10.5
0.166	0.37E-02	0.36E-02	-3.1	0.37E-02	0.166	0.163	-1.6
0.191	0.29E-02	0.24E-02	-16.6	0.29E-02	0.191	0.179	-6.3

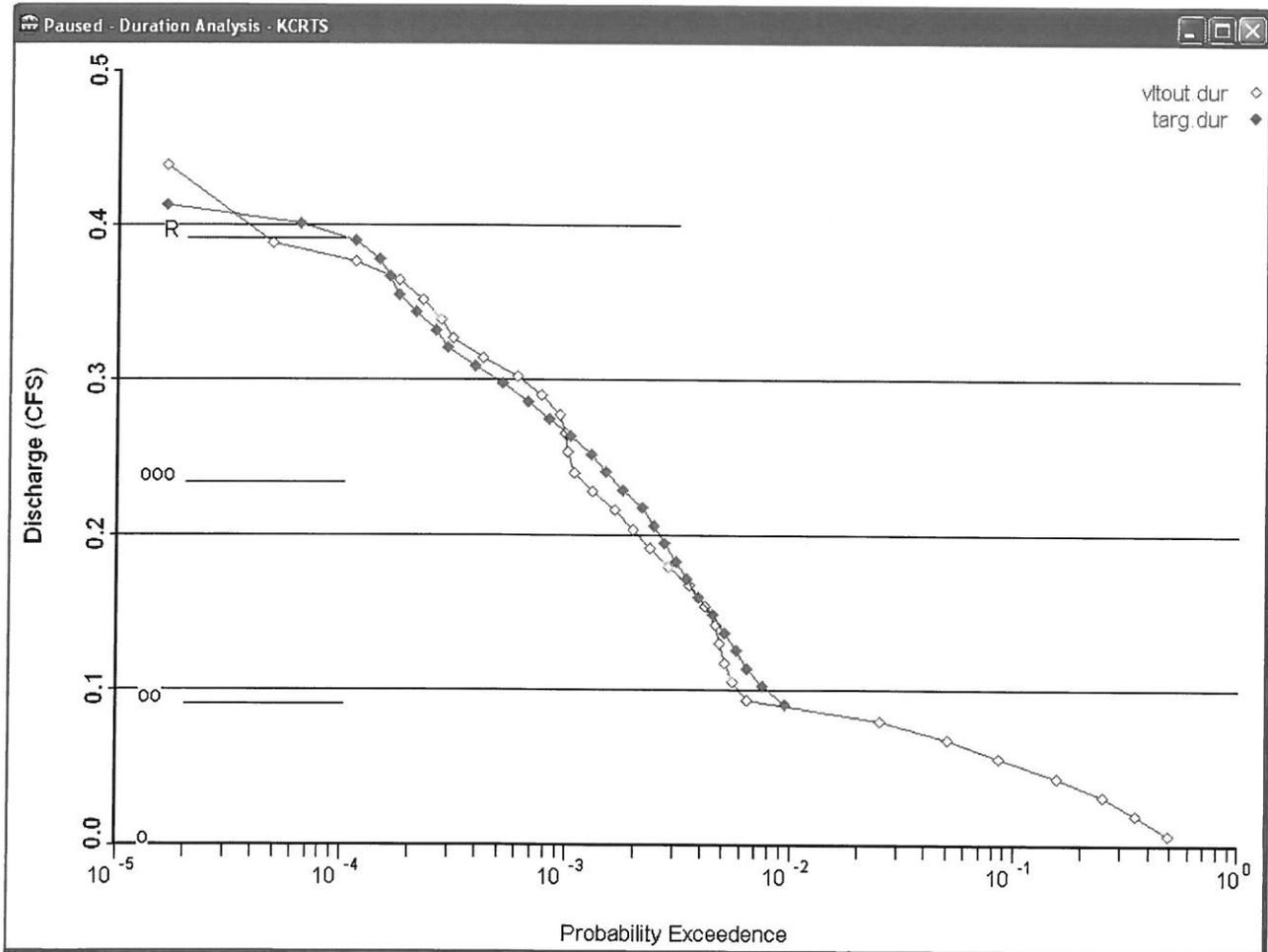


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0.216	0.22E-02	0.16E-02	-25.7	0.22E-02	0.216	0.198	-8.5
0.241	0.15E-02	0.11E-02	-26.7	0.15E-02	0.241	0.222	-7.6
0.266	0.10E-02	0.98E-03	-4.8	0.10E-02	0.266	0.251	-5.6
0.291	0.62E-03	0.77E-03	23.7	0.62E-03	0.291	0.301	3.5
0.316	0.34E-03	0.42E-03	23.8	0.34E-03	0.316	0.323	2.3
0.341	0.21E-03	0.28E-03	30.8	0.21E-03	0.341	0.360	5.7
0.365	0.16E-03	0.16E-03	0.0	0.16E-03	0.365	0.368	0.6
0.390	0.11E-03	0.33E-04	-71.4	0.11E-03	0.390	0.377	-3.4
0.415	0.16E-04	0.16E-04	0.0	0.16E-04	0.415	0.438	5.4

Maximum positive excursion = 0.027 cfs (6.6%)
occurring at 0.411 cfs on the Base Data:11070ex.tsf
and at 0.438 cfs on the New Data:vltout.tsf

Maximum negative excursion = 0.026 cfs (-20.8%)
occurring at 0.125 cfs on the Base Data:11070ex.tsf
and at 0.099 cfs on the New Data:vltout.tsf



C. WATER QUALITY ANALYSIS AND DESIGN

Water quality treatment will be accommodated for in a combined detention/water quality vault. Dead storage within the vault will be designed according to the Basic Water Quality Treatment Menu.

WETVAULT (DEAD STORAGE)

The required dead storage within the vault was determined using procedures provided in Section 6.4.1.1 of the 2009 KCSWDM. Areas tabulated below are the subject site's developed areas tributary to the each pond.

$$V_B = f V_r$$

where: f = volume correction factor = 3 (Basic)

V_r = volume of runoff from mean annual storm, ft³

$$V_r = (0.9A_i + 0.25A_{tg} + 0.10A_{tf} + 0.01A_o) \times R$$

where: A_i = area of impervious surface, ft²

A_{tg} = area of till grass and pasture, ft²

A_{tf} = area of till forest, ft²

A_o = area of outwash soils, ft²

R = rainfall from mean annual storm = 0.039 feet

$$V_B = 3[(0.9(3.45) + 0.25(3.14)] \times 43,560 \times 0.039 = 19,825 \text{ cubic feet}$$

Dead storage within the vault will either be located within the entire vault or a portion of the vault. Details of how the required dead storage will be accommodated for within the vault will be completed at final design.

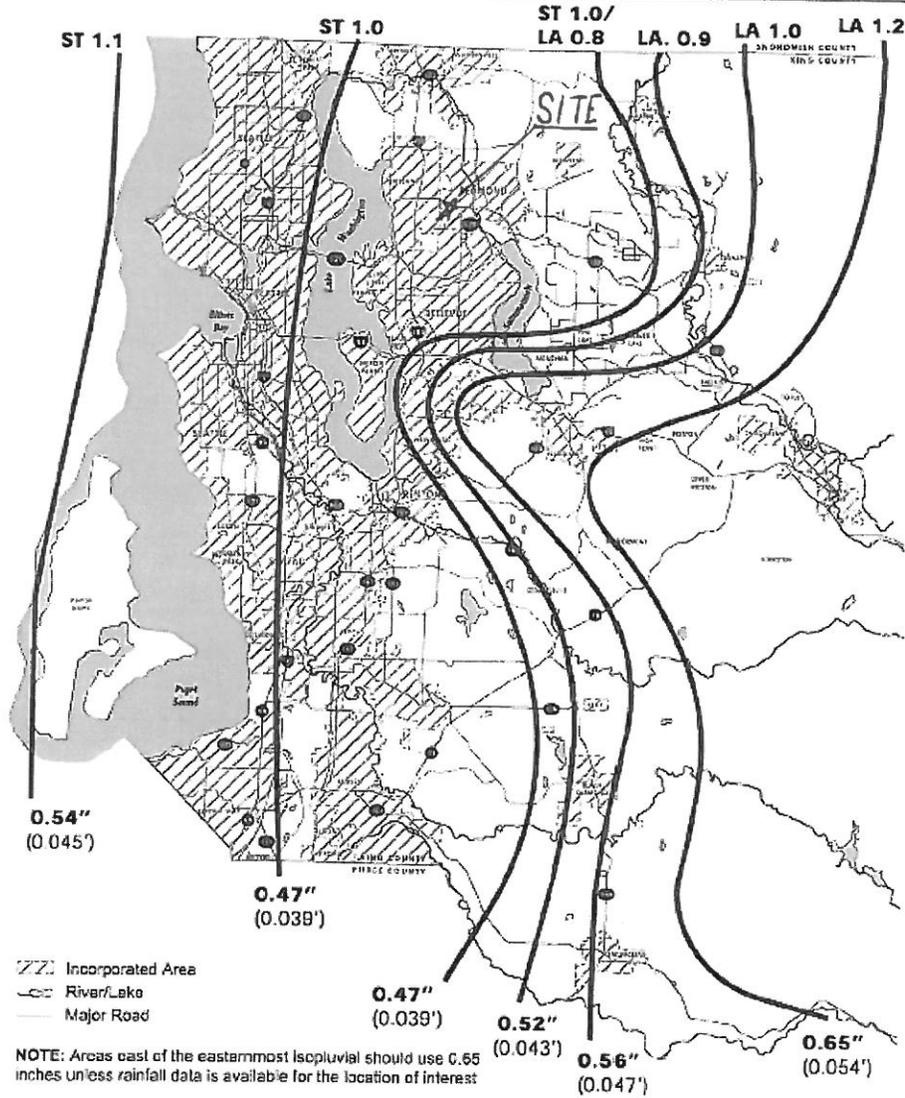
Required Water Quality Volume = 19,825 cubic feet

Provided Water Quality Volume \geq 19,825 cubic feet

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6.4.1 WETPONDS — BASIC AND LARGE — METHODS OF ANALYSIS

FIGURE 6.4.1.A PRECIPITATION FOR MEAN ANNUAL STORM IN INCHES (FEET)



result, generates large amounts of runoff. For this application, till soil types include Buckley and bedrock soils, and alluvial and outwash soils that have a seasonally high water table or are underlain at a shallow depth (less than 5 feet) by glacial till. U.S. Soil Conservation Service (SCS) hydrologic soil groups that are classified as till soils include a few B, most C, and all D soils. See Chapter 3 for classification of specific SCS soil types.