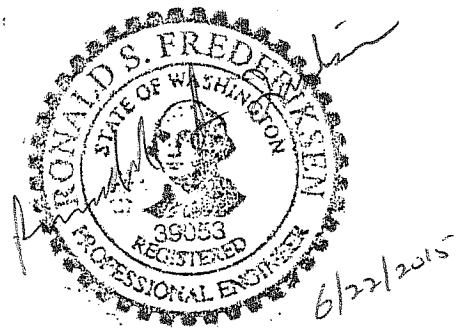
TECHNICAL INFORMATION REPORT

FOR

Artoush Short Plat

City of Kirkland File No.
Eastside Consultants, Inc. File No. 13050

June 22, 2015



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Prepared for:
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T.I.R. Section I: Project Overview

Existing Conditions:

The site is located at 11622 80th Avenue NE in Kirkland, WA. The existing site conditions consists of an existing 894.54 sf house, a 160.35 sf shed, and a 9 ft wide, 3,372.16 sf gravel driveway that borders the lot to the west and to the north. The remaining area is made up of approximately grass and scattered trees.

Generally, the site slopes southwesterly at 5 -16% with underlying Vashon Lodgement Till in most areas with one test pit showing Vashon Recessional Outwash at a depth of 8 feet. See the Soils Report in Section VI.

Proposed Conditions:

The proposed project consists of constructing five new single family residents with a 28 foot access road and a 20 foot paved private road to handle five lots.

The proposed storm system will consist of collecting runoff from all roads and driveways along with the five new residences. Since the soils are not conducive for infiltration or dispersion, the site will be tight lined to a detention facility. It is proposed to construct a combined Wet/Detention Vault for Enhanced Basic Water Quality and Level 2 Flow Control. The facilities will be designed per the 2009 KCSWDM.

Since the Preliminary Short Plat to the south is not proceeding in a timely manor, we are having to improve the existing 30 foot easement to a 20 foot wide drivable surface with curb, gutter, sidewalk on the west side And then transition it onto the existing NE 80th Avenue. This will also require removing some existing sidewalks and asphalt and then replacing it with new asphalt and sidewalks, etc. This will also involve an 8' x 50 foot detention pipe to facilitate the bypass area from the plat along with the neighboring 30 foot easement, and NE 80th ROW Improvements.

King County Department of Development and Environmental Services

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner

Artoush Fanaiyan

Address

9517 132nd Ave NE, Kirkland, Wa 98033

Phone

425-922-7845

Project Engineer

Ronald Frederiksen, PE

Company Eastside Consultants, Inc.

Address/Phone (425) 392-5351

Part 2 PROJECT LOCATION AND DESCRIPTION

Project Name

Artoush Short Plat

Location

Township 26 N

Range 4E

Section 25

Part 3 TYPE OF PERMIT APPLICATION

- ☐ Subdivision
- ☑ Short Subdivision
- ☐ Grading
- ☐ Commercial
- ☐ Other CUP and SDSP _Bldg. Permit

Part 4 OTHER REVIEWS AND PERMITS

- ☐ DFW HPA
- ☐ Shoreline Management
- ☐ COE 404
- ☐ Rockery
- ☐ DOE Dam Safety
- ☐ Structural Vaults
- ☐ FEMA Floodplain
- ☐ Other
- ☐ COE Wetlands

Part 5 SITE COMMUNITY AND DRAINAGE BASIN

Community

kirkland, WA

Drainage Basin

Lake Washington

Part 6 SITE CHARACTERISTICS

- ☐ River
- ☐ Stream /Critical Stream Reach
- ☐ Depressions/Swales
- ☐ Lake
- ☐ Steep Slopes
- ☐ Floodplain
- ☐ Wetlands Class 2 wetland
- ☐ Seeps/Springs
- ☐ High Groundwater Table
- ☐ Groundwater Recharge
- ☐ Other

Part 7 SOILS

Soil Type	Slopes	Erosion Potential	Erosive Velcoties
Alderwood and Kitsap Soils (AkF)	6-15%	severe	

☐ Additional Sheets Attached

Part 8 DEVELOPMENT LIMITATIONS

	REFERENCE	LIMITATION/SITE CONSTRAINT
•	Ch. 4 – Downstream Analysis	
☐		
☐		
☐		
☐		
☐		

☐ Additional Sheets Attached

Part 9 ESC REQUIREMENTS

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION

- ✓Sedimentation Facilities
- ✓Stabilized Construction Entrance
- • Perimeter Runoff Control
- ☐ Clearing and Grading Restrictions
- ☐ Cover Practices
- ☐ Construction Sequence
- ☐ Other

MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION

- • Stabilize Exposed Surface
- • Remove and Restore Temporary ESC Facilities
- • Clean and Remove All Silt and Debris
- • Ensure Operation of Permanent Facilities
- ☐ Flag Limits of SAO and open space preservation areas
- ☐ Other

Part 10 SURFACE WATER SYSTEM

- ☐ Grass Lined Channel
- ☐ Pipe System
- ☐ Open Channel
- ☐ Dry Pond
- ☐ Wet Pond
- ✓ Tank
- ✓ Vault
- ☐ Energy Dissapator
- ☐ Wetland
- ☐ Stream
- ☐ Infiltration
- ☐ Depression
- ✓ Flow Dispersal
- ☐ Waiver
- ☐ Regional Detention

Method of Analysis

___KCRTS_____

_____

Compensation/Mitigation of Eliminated Site Storage

_____

Brief Description of System Operation The site will contain a combined wet/detention vault and an offsite detention tank followed by a Contech Stormfilter Vault

Facility Related Site Limitations

Reference	Facility	Limitation

Part 11 STRUCTURAL ANALYSIS

- ✓ Cast in Place Vault
- ✓ Retaining Wall
- ☐ Rockery > 4' High
- ☐ Structural on Steep Slope
- ☐ Other

Part 12 EASEMENTS/TRACTS

- ☐ Drainage Easement
- ☐ Access Easement
- ☐ Native Growth Protection Easement
- ☐ Tract
- ☐ Other

Part 13 SIGNATURE OF PROFESSIONAL ENGINEER

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

Signed/Date 6/23/2015

T.I.R. Section II: Preliminary Conditions Summary

DEVELOPMENT STANDARDS

SUB14-00283

BUILDING DEPARTMENT

BUILDING General Conditions
Contact: Tom Jensen tjensen@kirklandwa.gov

1. Prior to issuance of Building, Demolition or Landsurface Modification permit applicant must submit a proposed rat baiting program for review and approval. Kirkland Municipal Ordinance 9.04.040
2. A Demolition permit is required for removal of existing structures prior to recording the short plat.
3. Plumbing meter and service line shall be sized in accordance with the current UPC. We are currently using the 2012 edition.
4. Any vault or retaining wall will require a separate permit.
5. Building permits must comply with the International Building, Residential and Mechanical Codes and the Uniform Plumbing Code as adopted and amended by the State of Washington and the City of Kirkland. Kirkland currently has adopted the 2012 editions.
6. Structures must comply with International Energy Conservation Code as adopted and amended by the State of Washington. We are currently using the 2012 edition.
7. Kirkland reviews, issues and inspects all electrical permits in the city. Kirkland currently uses the 2009 Washington Cities Electrical Code chapters 1 and 3 as published by WABO.
8. Structures must be designed for seismic design category D, wind speed of 85 miles per hour and exposure B.

FIRE DEPARTMENT

FIRE DEPARTMENT COMMENTS

Contact: Grace Steuart at 425-587-3660; or gsteuart@kirklandwa.gov

HYDRANTS and FIRE FLOW

One new hydrant is required to be installed in front of the property, as shown on the plans submitted. It shall be equipped with a 5" Storz fitting.

Fire flow requirement for this project is 1,000 gpm. The project is in Northshore Utility District. A certificate of water availability shall be provided from NUD.

PUBLIC WORKS DEPARTMENT

Permit #: SUB14-00283
Project Name: Artoush 5 lot Short Plat
Project Address: 11622 80th Ave. NE
Date: March 12, 2015

General Conditions:

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.kirklandwa.gov.

2. This project will be subject to Public Works Permit and Connection Fees. 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.kirklandwa.gov The applicant should anticipate the following fees:

o Surface Water Connection Fees (paid with the issuance of a Building Permit)
o Right-of-way Fee
o Review and Inspection Fee (for utilities and street improvements).
o 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). Any existing buildings within this project which are demolished will receive a Traffic Impact Fee credit, Park Impact Fee Credit and School Impact Fee Credit. This credit will be applied to the first Building Permits that are applied for within the project. The credit amount for each demolished building will be equal to the most currently adopted Fee schedule.

3. All street and utility improvements shall be permitted by obtaining a Land Surface Modification (LSM) Permit.

4. Submittal of Building Permits within a subdivision prior to recording:

• Submittal of a Building Permit with an existing parcel number prior to subdivision recording: A Building Permit can be submitted prior to recording of the subdivision for each existing parcel number in the subject property, however in order for it to be deemed a complete application, all of the utility and street improvements for the new home must be submitted with the Building Permit application. If the utility and street improvements are to be reviewed and constructed through a Land Surface Modification permit process, then Building Permit cannot be applied for because it will be deemed incomplete until the Land Surface Modification Permit is applied for.

• Submittal of Building Permits within an Integrated Development Plan (IDP): If this subdivision is using the IDP process, the Building Permits for the new homes can only be applied for after the Land Surface Modification Permit has been submitted, reviewed, and approved.

• Submittal of a Building Permit within a standard subdivision (non IDP): If this subdivision is not using the IDP process, the Building Permits for the new houses can be applied for after the subdivision is recorded and the Land Surface Modification permit has been applied for.

• Review of Expedited or Green Building Permits: A new single family home Building Permit within a subdivision can only be review on an expedited or green building fast track if the associated Land Surface Modification Permit has been reviewed and approved by the Public Works Department.

5. The subdivision can be recorded in advance of installing all the required street and utility improvements by posting a performance security equal to 130% of the value of work. Contact the Development Engineer assigned to this project to assist with this process.

6. This project is exempt from concurrency review.

7. 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.

8. 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.

9. 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).

10. A completeness check meeting is required prior to submittal of any Building Permit applications.

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

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

Utility Maintenance: Each property owner shall be responsible for maintenance of the sanitary sewer, storm water stub,

rain garden, permeable pavement, or any infiltration facilities (known as Low Impact Development) 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, surface water stub, rain garden, permeable pavement, or any infiltration facilities, 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 and Water Conditions:

1. Northshore Utility District approval required for water and sewer service. A letter of sewer/water availability is required; call N.U.D at 425-398-4400.

Surface Water Conditions:

1. Provide temporary and permanent storm water control per the 2009 King County Surface Water Design Manual and the Kirkland Addendum (Policy D-10). 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.

- Full Drainage Review

A full drainage review is required for any proposed project, new or redevelopment, that will:

☐ Adds 5,000ft2 or more of new impervious surface area or 10,000ft2 or more of new plus replaced 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. A preliminary drainage report (Technical Information Report) has been submitted with the subdivision application.

3. The project has been submitted with the assumption that an approved subdivision directly to the south will be constructed prior to this project being started. If the other subdivision does not move forward and this subdivision is approved and the developer decides to proceed with construction, this project will be responsible to extending the drainage south to the public storm system in 80th Ave. NE. Any off-site drainage improvements shall include collection, conveyance, detention, and water quality treatment per the 2009 King County Surface Water Design Manual.

4. 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 or L-2 (depending on drainage review) for more information on this requirement.

5. 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.

6. This project is creating or replacing more than 5000 square feet of new impervious area that will be used by vehicles (PGIS - pollution generating impervious surface). Provide storm water quality treatment per the 2009 King County Surface Water Design Manual. The enhanced treatment level is encouraged when feasible for multi-family residential, commercial, and industrial projects less than 1 acre in size.

7. It doesn't appear that any work within an existing ditch will be required, however 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 a separate storm drainage connection for each lot. All roof and driveway drainage must be tight-lined to the storm drainage system or utilize low impact development techniques. The tight line connections shall be installed with the individual new houses.

11. Extend a 12" storm line to the north end of the new 80th Ave. NE extension and terminate the extension with a catch basin.

Street and Pedestrian Improvement Conditions:

1. The subject property abuts a new access street that is an extension of 80th Avenue NE This street is a Neighborhood Access type street. 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:

A. Dedicate 40 ft. of right-of-way along the west property line.
B. Install 28 ft. of asphalt, storm drainage, and vertical curb and gutter on both sides of the new asphalt.
C. Install a 4.5 ft. wide planter strip with street trees 30 ft. on-center, and a 5 ft. wide sidewalk to the east of the new curb (back of new sidewalk should be along east edge of right-of-way dedication).
D. The project has been submitted with the assumption that an approved subdivision directly to the south will be

constructed prior to this project being started. If the other subdivision does not move forward and this subdivision is approved and the developer decides to proceed with construction, this project will be responsible to extending a paved road to the project. The paved road shall be at least 20 ft. wide (constructed to public street standards) and shall include the drainage collection and conveyance (see above conditions regarding drainage).
E. At the north end of the street improvements, relocate the power pole if it is within in the 28 ft. of paved street and safety accommodations cannot be made to allow the pole to temporarily remain in place.

2. When three or more utility trench crossings occur within 150 lineal ft. of street length or where utility trenches parallel the street centerline, the street shall be overlaid with new asphalt or the existing asphalt shall be removed and replaced.
- Existing streets with 4-inches or more of existing asphalt shall receive a 2-inch (minimum thickness) asphalt overlay. Grinding of the existing asphalt to blend in the overlay will be required along all match lines.
- Existing streets with 3-inches or less of existing asphalt shall have the existing asphalt removed and replaced with an asphalt thickness equal or greater than the existing asphalt provided however that no asphalt shall be less than 2-inches thick and the subgrade shall be compacted to 95% density.

3. Design and construct the private access easement road to serve as a temporary Fire Department turn-around tee. At least 25 ft. of the access easement will serve as a temporary emergency fire truck turn around and shall be recorded as such.

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. 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.

6. Underground all new and existing on-site utility lines and overhead transmission lines (including those along the new public street)

7. New street lights will 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.

8. Public Pedestrian Pathway:
A) Grant a 5 ft. wide public pedestrian easement and install a 5 ft. wide concrete sidewalk along the north edge of the access easement serving lots 1, 2, and 3.
B) At the east end of the said sidewalk, grant a 10 ft. wide public pedestrian easement between lots 3 and 4 and along the east property line of lot 4. Within the said easement install an 8 ft. wide paved pedestrian pathway.
C) Fences installed by this short plant along any portion of the pedestrian easement are limited to 42" in height.
D) The pathway is for future extension to the east. They City will need to negotiate the connection of the path to the easement on the Chatham Ridge Plat to the east.

9. Zoning Code Section 110.60.9 establishes the requirement that existing utility and transmission (power, telephone, etc.) lines on-site and in rights-of-way adjacent to the site must be underground. The Public Works Director may determine if undergrounding transmission lines in the adjacent right-of-way is not feasible and defer the undergrounding by signing an agreement to participate in an undergrounding project, if one is ever proposed. In this case, the Public Works Director has determined that undergrounding of existing overhead utility on80th Ave. NE is not feasible at this time and the undergrounding of off-site/frontage transmission lines should be deferred with a Local Improvement District (LID) No Protest Agreement. The final recorded subdivision mylar shall include the following note:

Local Improvement District (LID) Waiver Agreement. Chapter 110.60.7.b of the Kirkland Zoning Code requires all overhead utility lines along the frontage of the subject property to be converted to underground unless the Public Works Director determines that it is infeasible to do so at the time of the subdivision recording. If it is determined to be infeasible, then the property owner shall consent to the formation of a Local Improvement District, hereafter formed by the City or other property owners. During review of this subdivision it was determined that it was infeasible to convert the overhead utility lines to underground along the frontage of this subdivision on 80th Ave. NE. Therefore, in consideration of deferring the

requirement to underground the overhead utility lines at the time of the subdivision recording, the property owner and all future property owners of lots within this subdivision hereby consent to the formation of a Local Improvement District hereafter formed by the City or other property owners

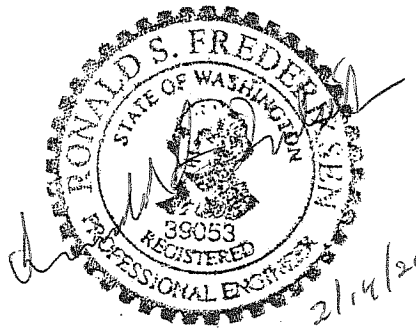
T.I.R. Section III: Off-Site Analysis

LEVEL 1 DRAINAGE ANALYSIS

FOR

Artoush Short Plat

February 14, 2015



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Task 1 – Define Map and Study Area

The downstream drainage path consists of 1 flowpath. The site drains south and westerly underneath 80th Ave NE. See the Downstream Drainage Map Section for a map defining the area. The site is located within the Lake Washington drainage basin.

Task 2 – Resource Review

A review of the IMAP Sensitive Area Map Folio's revealed that there no Sensitive Areas onsite.

A review of the IMAP Drainage Complaint Reports showed four Drainage Complaints near the site or drainage flow path. They were all more than 10 years old, except one. The drainage complaint number is 2008-0394. King County reviewed the drainage complaint and determined that it was a non-issue. Refer to the attached evaluation.

Task 3 – Field Inspection

Upstream basin

Stormwater run-on flows from the northeast across the site. See the Upstream Drainage Map Section for a map defining the area.

Downstream Basin

The stormwater runoff drains to the southwest corner of the lot and travels south along 80th Ave NE in the stormwater system. A more detailed description of the flowpath and basin is provided in the following section. During the field inspection, no problems seemed to exist in the basin. See the Downstream Drainage Map Section for a map defining the area.

Task 4 – Drainage System Description

Downstream Basin

The stormwater leaves the site (Point A) and sheet flows south to a catchbasin (Point B) at the north end of 80th Ave NE and enters a 12-inch concrete pipe and passes through three catchbasins to a catachbasin (Point C) with a FROP-T to control the movement of oil in the stormwater system. Stormwater passes through the FROP-T into a 12-inch corrugated aluminum pipe (CAP) and enters a 12-inch concrete pipe (Point D) before entering a 12-inch Solid Walled Polyethylene (SWPE) pipe (Point E) and passes through three catchbasins before entering a 12-inch CAP (Point F) and passes through two catchbasins before entering another 12-inch CAP and turns northwest (Point G). This is the end of the ¼ mile downstream analysis.

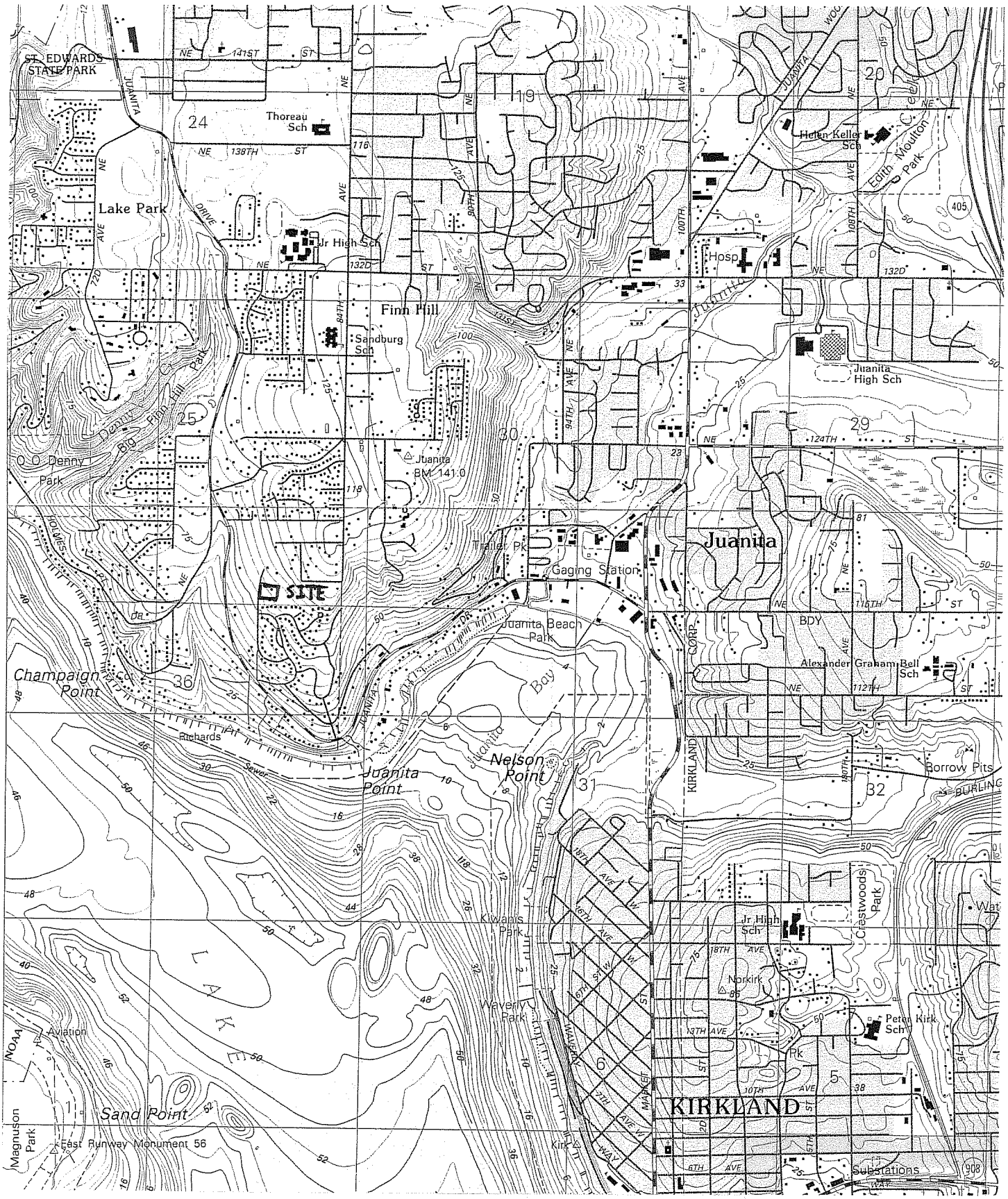
Task 5 – Mitigation of Existing or Potential Problems

The project does not seem to have any existing or potential problems. This project will not create a significant impact to the downstream conveyance system.

QUAD, SOILS, AND VICINITY MAPS

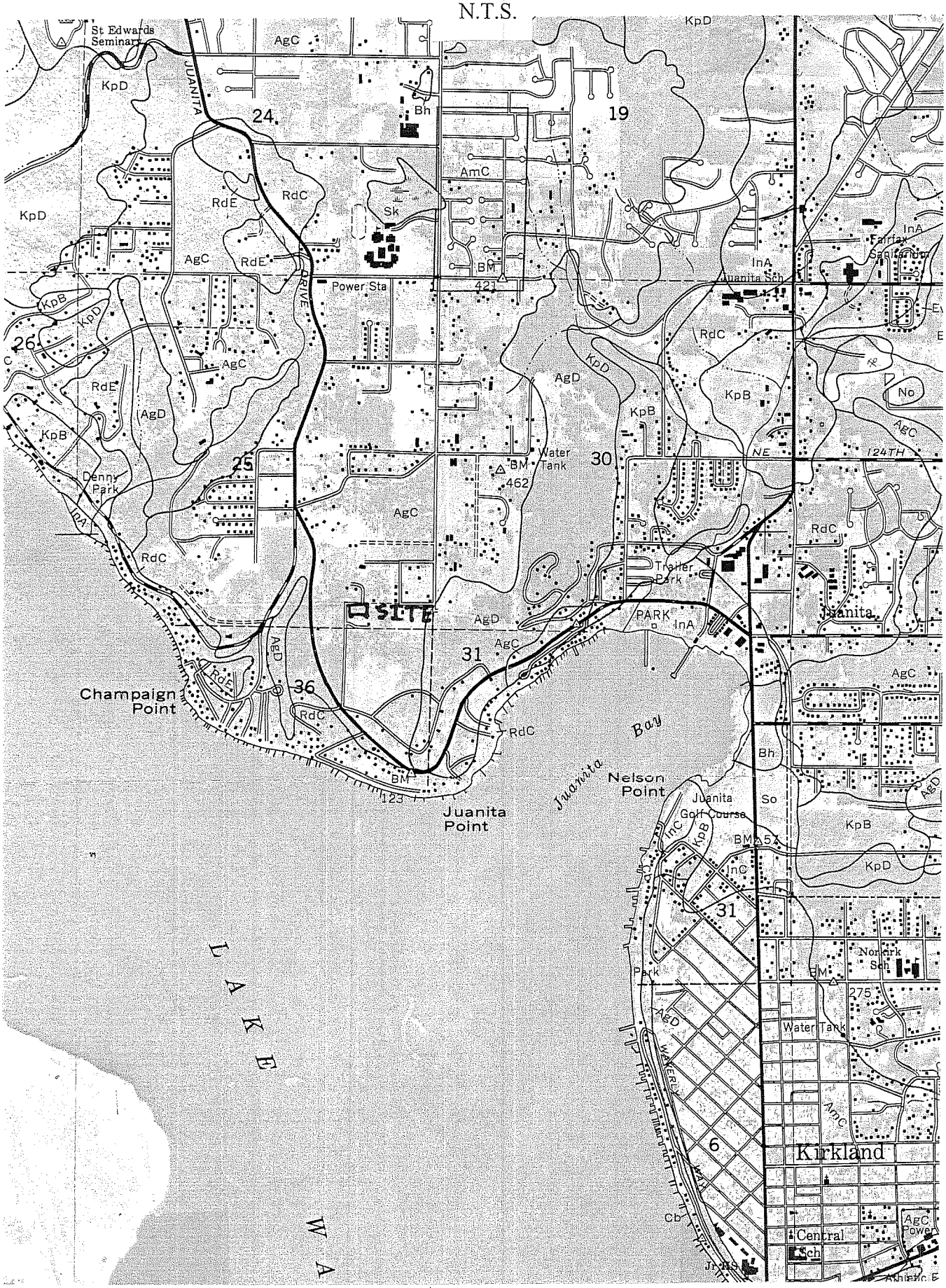
QUAD MAP

N.T.S.


ST. EDWARDS STATE PARK
Thoreau Sch
Lake Park
Jr High Sch
Finn Hill
Sandburg Sch
Big Finn Hill Park
Denny Park
Juanita BM 141.0
Trailer Pk
Gaging Station
SITE
Juanita Beach Park
Champaign Point
Juanita Bay
Juanita Point
Nelson Point
Richards
Sewer
Helen Keller Sch
Edith Moulton Park
Hosp
Juanita High Sch
Juanita
BDY
Alexander Graham Bell Sch
Borrow Pits
Jr High Sch
Crestwoods Park
Norkirk
Peter Kirk Sch
Kiwanis Park
Waverly Park
Aviation
Sand Point
East Runway Monument 56
Magnuson Park
KIRKLAND
Substations
LAKE

SOILS MAP

N.T.S.



VICINITY MAP

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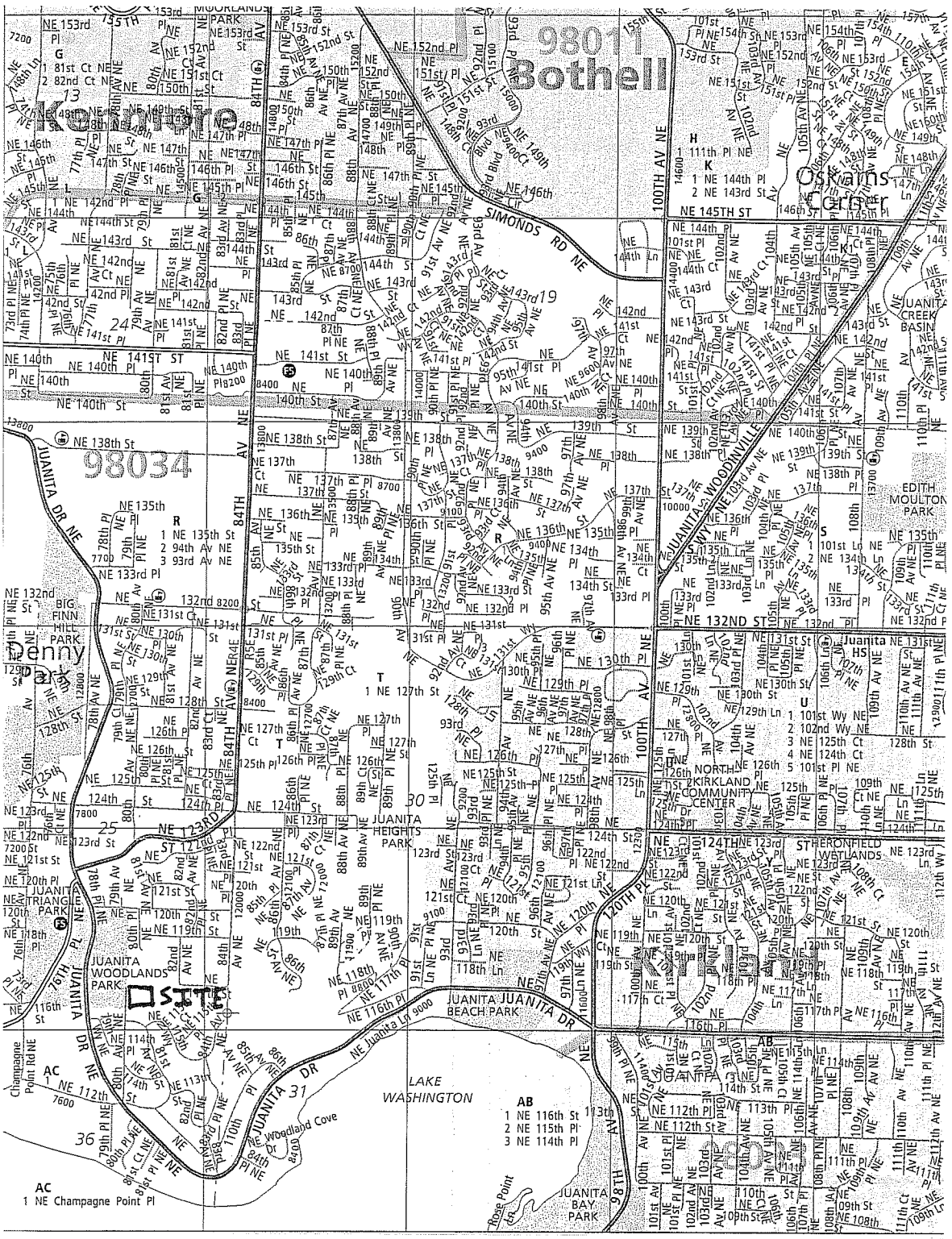
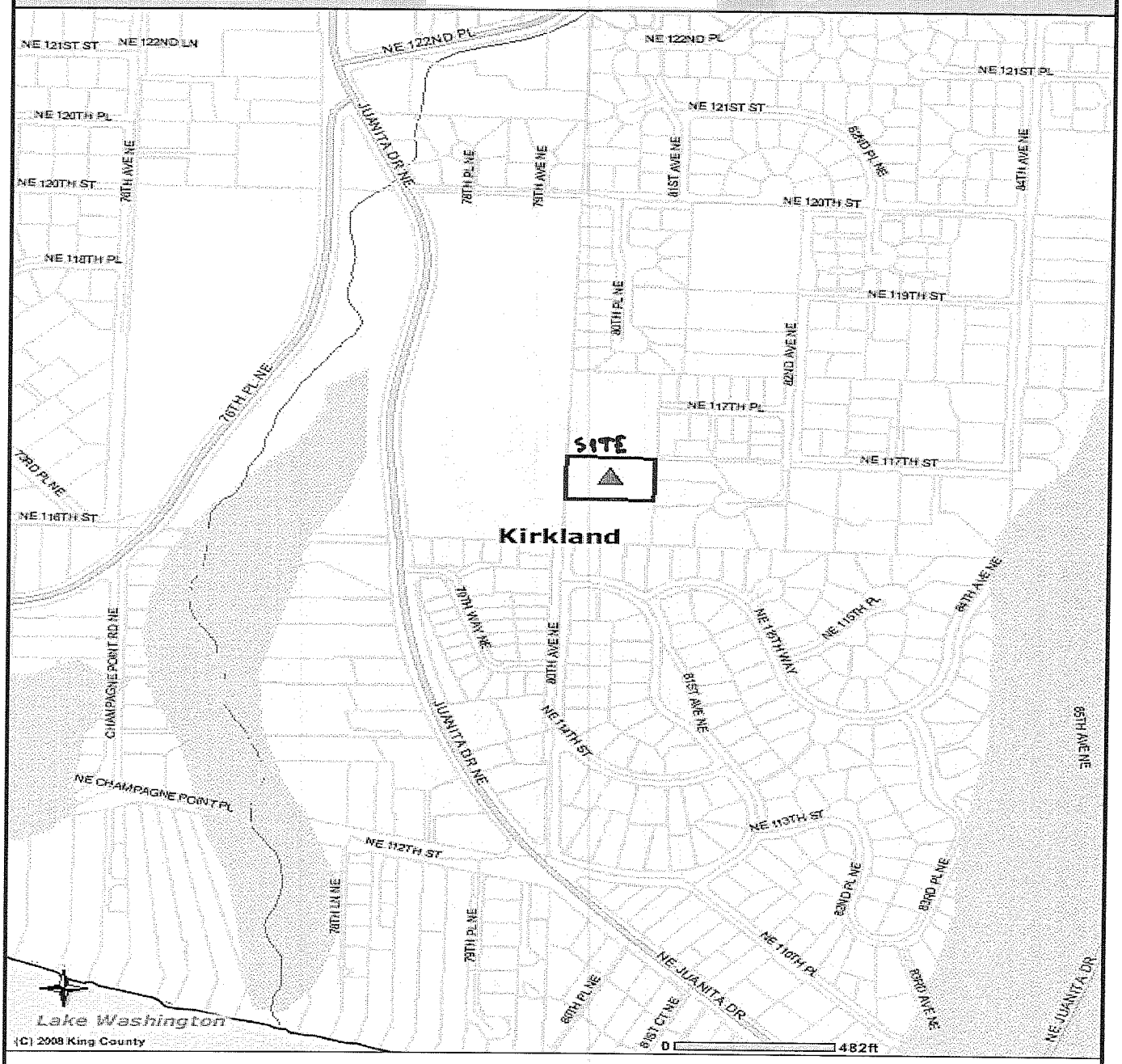


1990 SENSITIVE AREA FOLIO MAPS

SAO EROSION



Legend

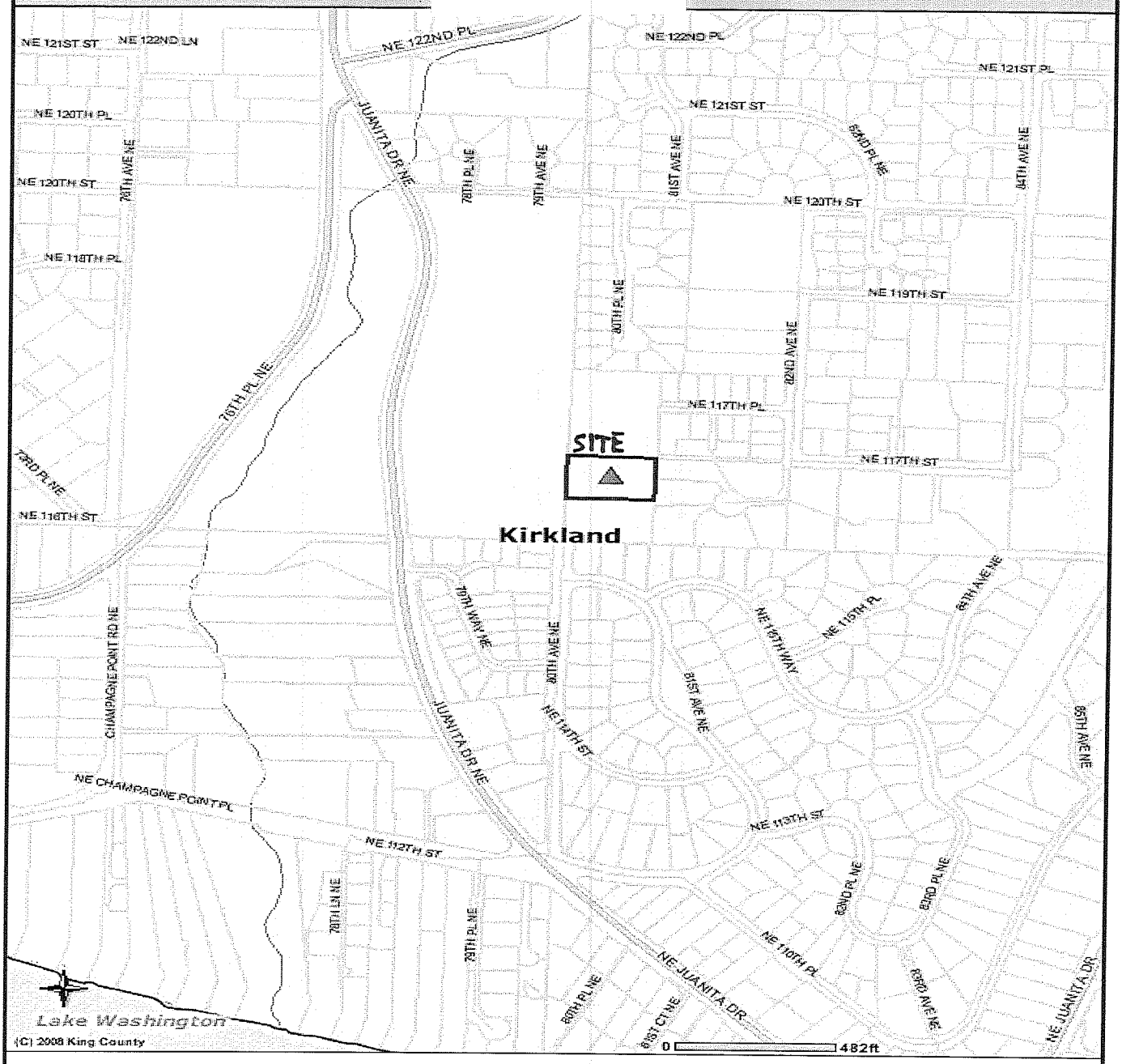
- Highlighted Feature
- County Boundary
- Mountain Peaks
- Highways
- Incorporated Area
- Streets
- (cont)
- Highway
- Arterials
- Local
- Parcels
- Lakes and Large Rivers
- Streams
- SAO Erosion

The information included on this map has been compiled by King County staff from a variety of sources and is subject to change without notice. King County makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a survey product. King County shall not be liable for any general, special, indirect, incidental, or consequential damages including, but not limited to, lost revenues or lost profits resulting from the use or misuse of the information contained on this map. Any sale of this map or information on this map is prohibited except by written permission of King County.

Date: 2/10/2014 Source: King County iMAP - Sensitive Areas (http://www.metrokc.gov/GIS/iMAP)

King County

SAO SEISMIC



Legend

- Highlighted Feature
- County Boundary
- Mountain Peaks
- Highways
- Incorporated Area
- Streets
- (cont)
- Highway
- Arterials
- Local
- Parcels
- Lakes and Large Rivers
- Streams
- SAO Seismic

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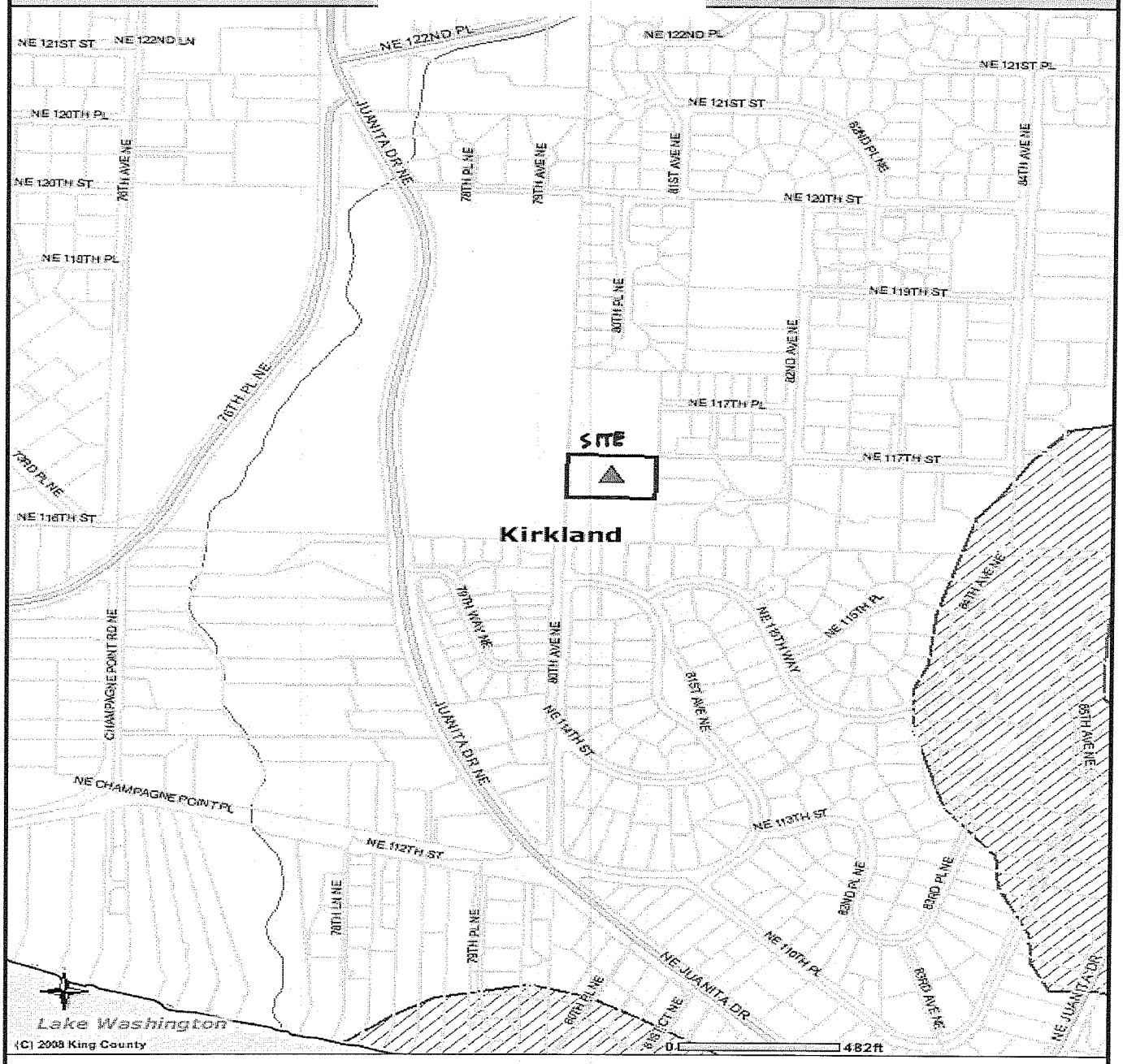
Date: 2/10/2014 Source: King County iMAP - Sensitive Areas (http://www.metrokc.gov/GIS/iMAP)

King County

SAO LANDSLIDE



Legend

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- SAO Landslide

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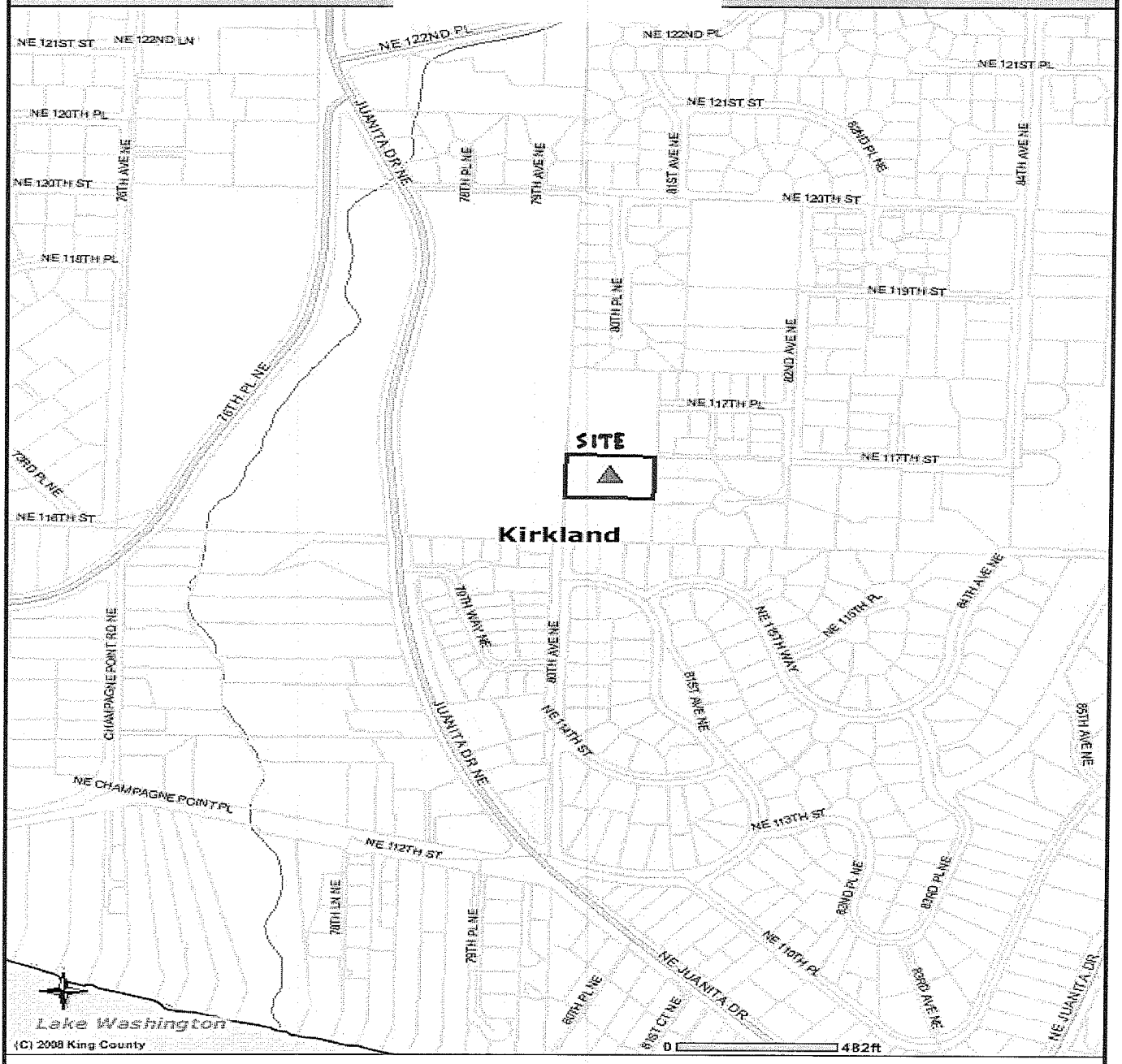
King County

SAO COAL MINE



Legend

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- SAO Coal Mine

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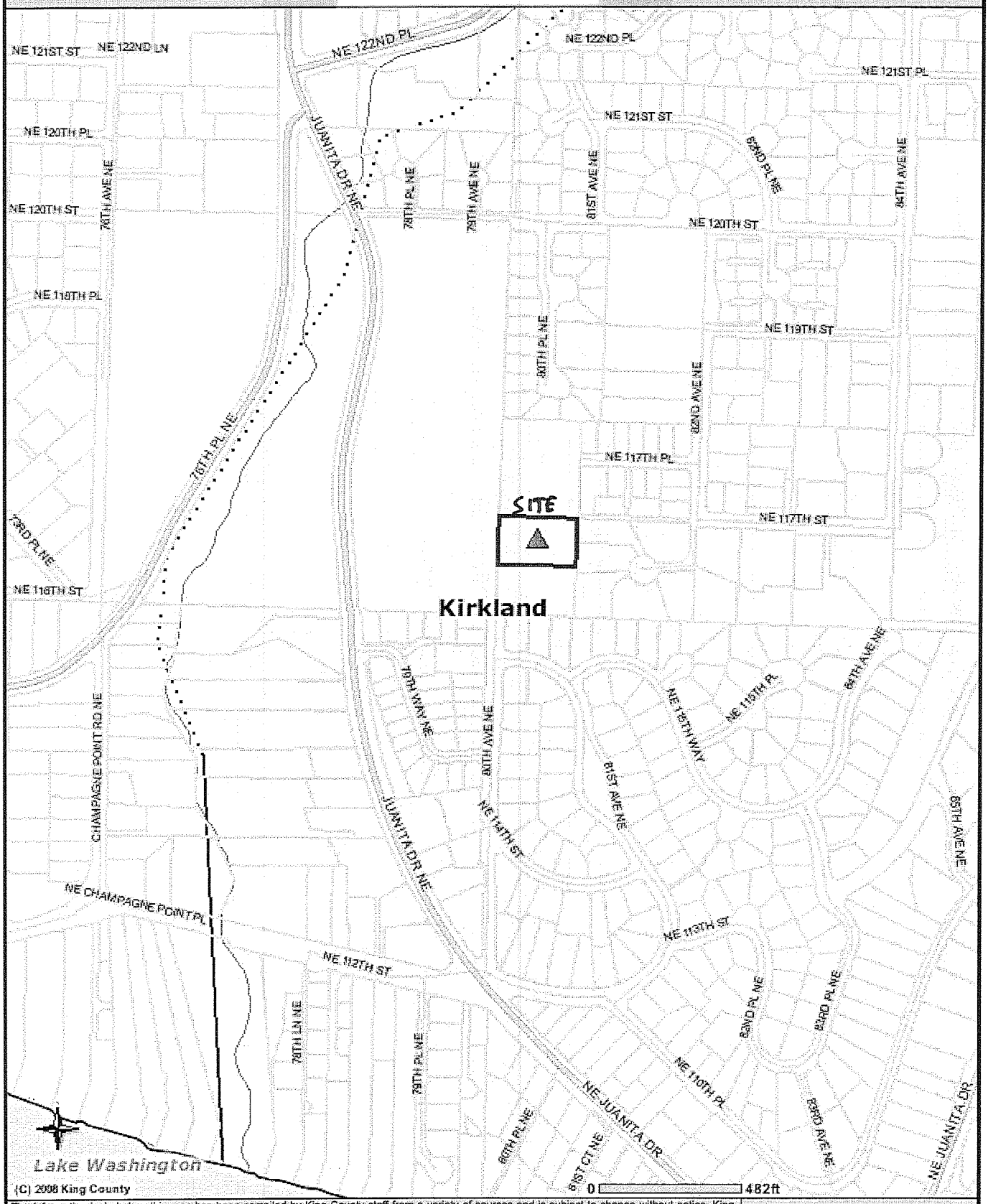
Date: 2/10/2014 Source: King County iMAP - Sensitive Areas (http://www.metrokc.gov/GIS/iMAP)

King County

SAO STREAMS



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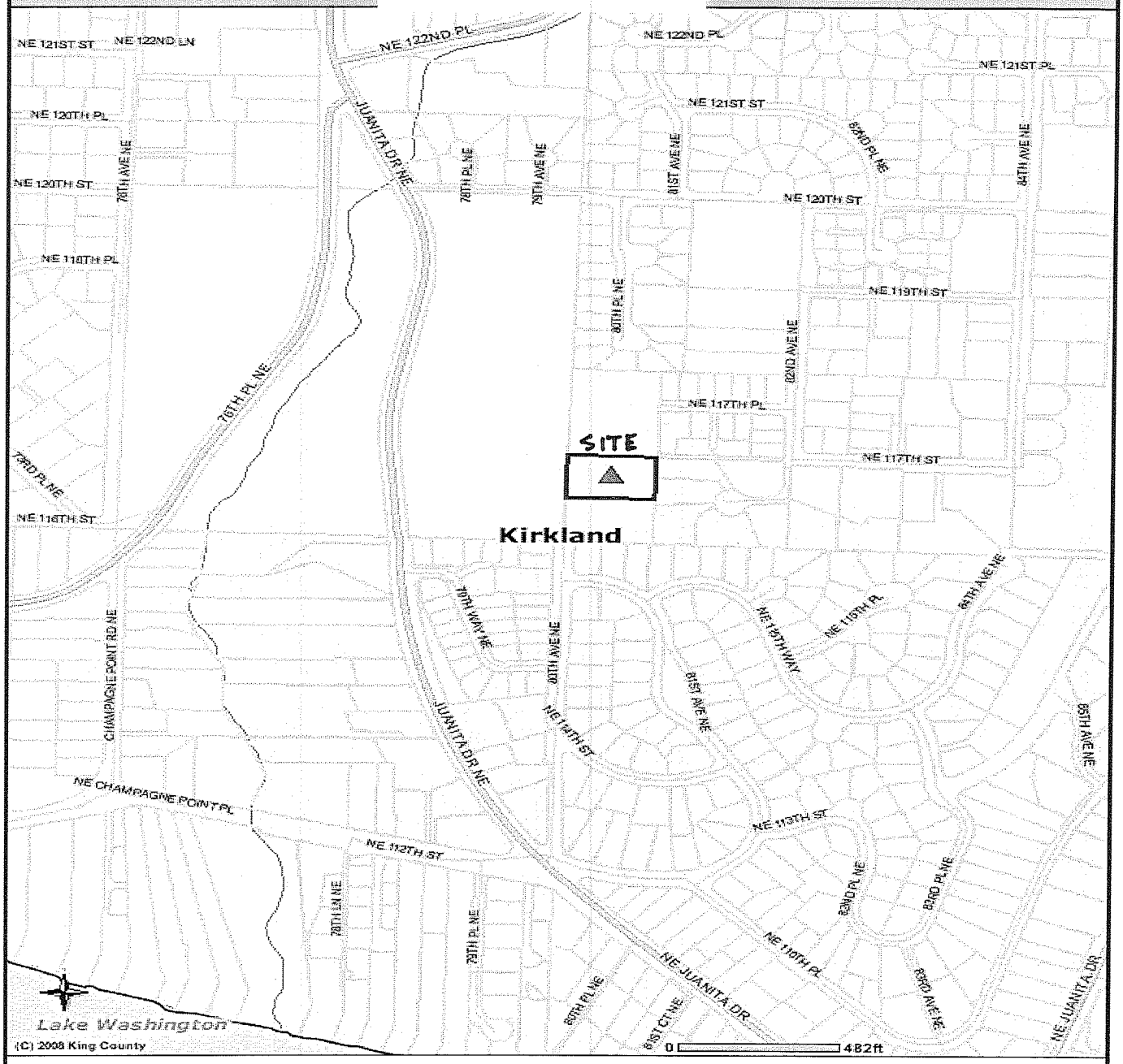
Date: 2/10/2014 Source: King County iMAP - Sensitive Areas (http://www.metrokc.gov/GIS/iMAP)

King County

SAO WETLAND



Legend

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- Highways
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- Streets
- (cont)
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- Local
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- Streams
- SAO Wetland

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Date: 2/10/2014 Source: King County iMAP - Sensitive Areas (http://www.metrokc.gov/GIS/iMAP)

King County

OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE

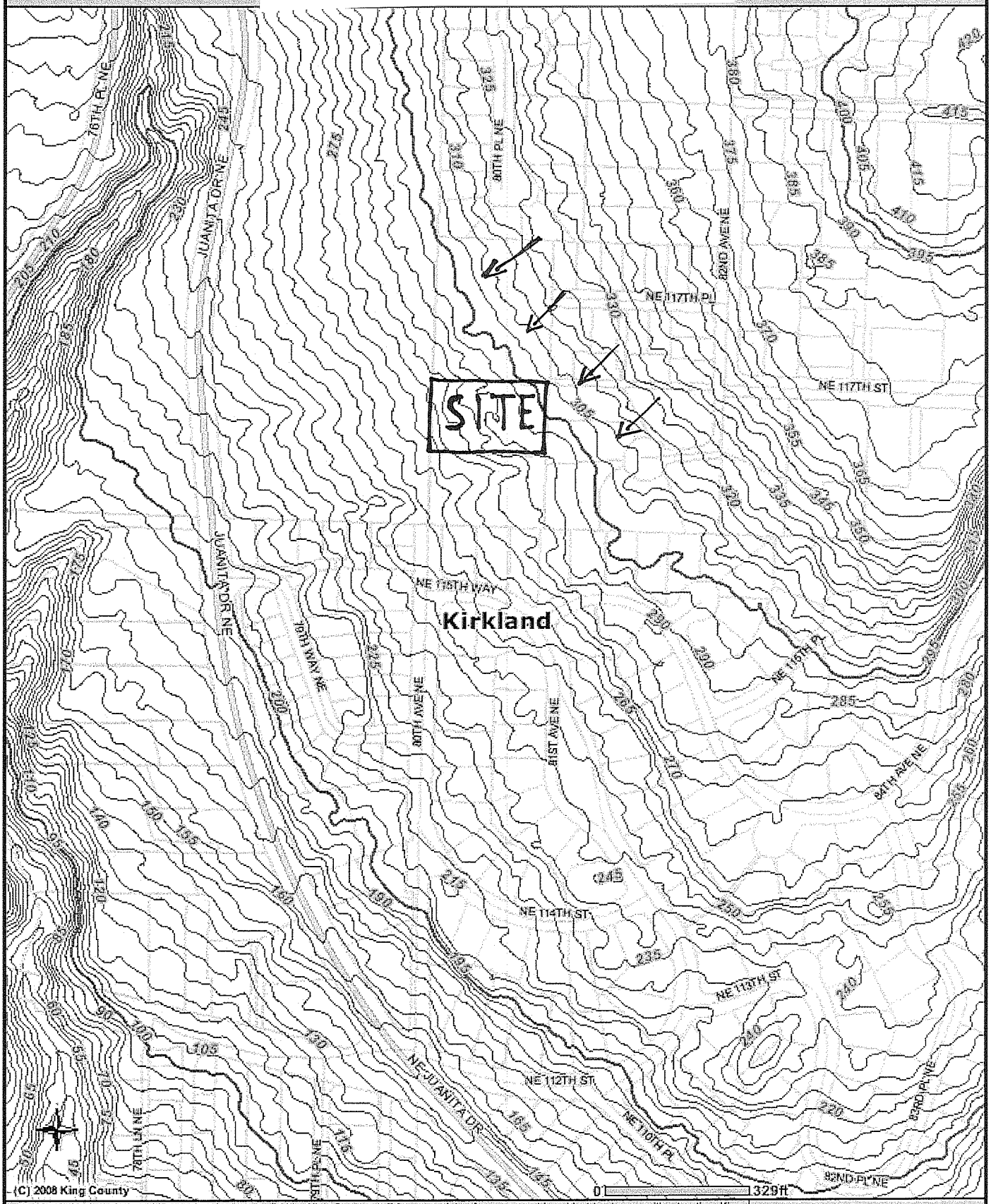
OFF-SITE ANALYSIS DRAINAGE SYSTEM TABLE
SURFACE WATER DESIGN MANUAL, CORE REQUIREMENT #2

Basin: Lake Washington **Subbasin Name:** Unknown Creek **Subbasin Number:**

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	%	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
A	Site Discharge			0	None observed	None	Looked in good condition
A-B	Sheet Flow	Along South Side of 80th Ave NE	1%	0-238'	None observed	None	No Impacts
B-C	12" Concrete Pipe	Under 80th Ave NE Through Three Catchbasins	7%	238'-765'	None observed	None	No Impacts
C-D	36" CAP with FROP-T	Under 80th Ave NE	5.5%	765'-899'	None observed	None	No Impacts
D-E	12" Concrete Pipe	Under 80th Ave NE	5%	899'-947'	None observed	None	No Impacts
E-F	12" SWPE Pipe	Under 80th Ave NE Through Three Catchbasins	12%-14.5	709'-1200'	None observed	None	No Impacts
F-G	12" CAP Pipe	Under 80th Ave NE Through Two Catchbasins	13%	1200'-1355'	None observed	None	No Impacts
G	Roughly ¼ mile downstream			1355'	None observed	None	No Impacts

UPSTREAM DRAINAGE MAPS

UPSTREAM DRAINAGE MAP



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Date: 2/10/2014 Source: King County iMAP - Hydrographic Information (http://www.metrokc.gov/GIS/iMAP)

King County

DOWNSTREAM DRAINAGE MAPS

DOWNSTREAM DRAINAGE MAP

FLOWPATH #1

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Date: 2/14/2014 Source: King County iMAP - Property Information (http://www.metrokc.gov/GIS/iMAP)

King County

Catch Basin Storm Filter - 1
Catch Basin Storm Filter - 2
Catch Basin Storm Filter - 3
Catch Basin Storm Filter - 4
Catch Basin Storm Filter - 5
Blind Tee
Cleanout
Dead End
Inlet
Material Change
Other
Outfall
Riser
Sewer Connections
Water Nodes (Detention)
Catch Basin (Type I/Inlet)
Catch Basin (Type II)
Catch Basin (Other)
Catch Basin Storm Filter - 1
Catch Basin Storm Filter - 2
Catch Basin Storm Filter - 3
Blind Tee
Cleanout
Dead End
Inlet
Material Change
Other
Outfall
Riser
Water Nodes (Control)
Catch Basin (Type I Control)
Catch Basin (Type II Control/Water)
Catch Basin (Type II Control)
Other (Control/Water)
Other (Control)
Culvert
Pipe
French Drain
Tank
Ditch
Stream
Swale
Culvert (Private)
Pipe (Private)
French Drain (Private)
Tank (Private)
Ditch (Private)
Stream (Private)
Swale (Private)
Vault
Swale
Pond
Sensitive Areas
Sub Tag Number
Rx Parcel
Park/Open Space
Borough
Point of Origin
A-1-4 Section Grid
City Limit Boundary
Future Improvements (shown as gray pipes and ponds)

3215--- ID #
(3.2) --- Depth
If no measure down depth shown, feature has a "0" value in the database

K5-14
Red Features w/ ID # Indicate Detention System

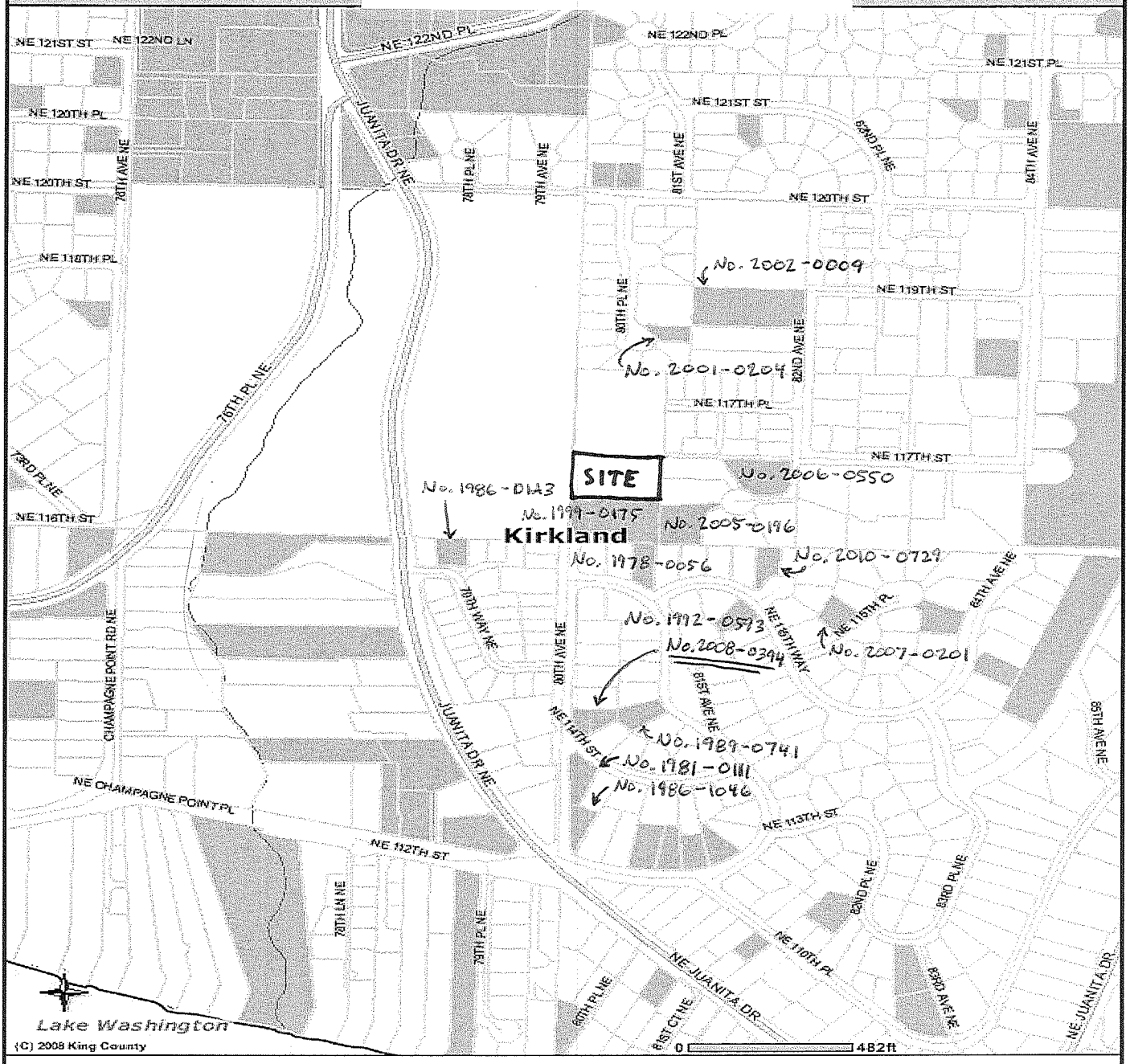
J7 J6
SE SW
NE NW
I7 I6
SE SW

50 100 150
Feet
0.01 0.02 0.03
Miles

80th Ave NE
NE 114th Pl
NE 114th St
NE 112th St
I7-7
I7-2
2972
2961
2961
2961

DRAINAGE COMPLAINTS

DRAINAGE COMPLAINTS



Legend

- County Boundary
- Mountain Peaks
- Highways
- Incorporated Area
- Streets
- Highway (cont)
- Arterials
- Local
- Parcels
- Lakes and Large Rivers
- Streams
- SAO Wetland
- Drainage Complaints

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Date: 2/10/2014 Source: King County iMAP - Sensitive Areas (http://www.metrokc.gov/GIS/IMAP)

King County

April 4, 2008

TO: File

FM: Eric T. Bosserman

RE: 2008-0392 Hermosa Vista B

BACKGROUND

This is an Orphan facility that should consist of a standing tee section and tight lined conveyance.

INVESTIGATION

I reviewed the available files and plans Hermosa Vista B.

The plan has no flow control facility for this location only a simple flow-restrictor-oil-prevention-tee (FROP-T) for spill containment. The system is tight lined to Lake Washington directly from this FROP-T.

On the site visit of August 14, 2008 I confirmed that there is only a FROP-T at this site and that it is tightlined to Lake Washington. This facility is mostly in the right-of-way or on lands dedicated to King County.

DISCUSSION

I do not believe a simple FROP-T in the right-of-way constitutes a facility; therefore there is no facility at this Orphan site. I talked to Dave Hancock, Stormwater Service Section Engineer III, who manages the Drainage Investigation and Inspection Services Group. He said that at one time FROP-T's where considered water quality facilities by themselves, but no longer are.

Photos are available in electronic form in complaint file.

RECOMMENDATION

I recommend the Orphan be slated for abandonment

T.I.R. Section IV: Retention/Detention System Analysis & Design

The proposed project consists of constructing five new single family residents on a with a 20 foot paved road on dedicated Tract B to handle five lots and the road improvements on 80th Ave NE and the drainage facility on Tract C.

The proposed storm system will consist of collecting runoff from all roads and driveways along with the five new residences. Since the soils are not conducive for infiltration or dispersion, the site will be tight lined to a detention facility. It is proposed to construct a combined Wet/Detention Vault for Enhanced Basic Water Quality and Level 2 Flow Control. The facilities will be designed per the 2009 KCSWDM.

Since the Preliminary Short Plat to the south is not proceeding in a timely manor, we are having to improve the existing 30 foot easement to a 20 foot wide drivable surface with curb, gutter, sidewalk on the west side And then transition it onto the existing NE 80th Avenue. This will also require removing some existing sidewalks and asphalt and then replacing it with new asphalt and sidewalks, etc. This will also involve an 8' x 50 foot detention pipe to facilitate the bypass area from the plat along with the neighboring 30 foot easement, and NE 80th ROW Improvements.

LID Bmps are deemed inadequate based on the limited space for dispersion and no infiltration capability per the attached Geotech Report in Section VI of this report.

EXISTING CONDITIONS
SCALE: 1" = 20'

FND 2 1/2"IRON PIPE
N70°E 3.5'.
NOT ACCEPTED.
VISITED JUNE 2013

15' SEWER EASEMENT
PER AFN 20030314001318

40.00' ROADWAY
TRACT A

30' ROADWAY EASEMENT
PER AFN 3322220

15.00' ROADWAY
EASEMENT PER
AFN 3322220

TRACT B
CHATHAM RIDGE

FND 1/2" REBAR W/LS
CAP No. 35145,
ACCEPTED AS TRUE
CORNER.
VISITED JUNE 2013

GRAVEL DRIVE

8.00' PEDESTRIAN
EASEMENT

LOT 1
6181 SF

LOT 2
6096 SF

LOT 3
6503 SF

AREA COUNTED AS
FOREST TO DETENTION VAULT

11.50' PEDESTRIAN
AND ACCESS
EASEMENT
WIDTH VARIES

LOT 1
KCSP L9850023
REC. No. 200003279000016

5.00' PEDESTRIAN
EASEMENT

DRIVEWAY CUT
PER WSDOT STD PLN
NO. F-80.10-03
TYPE 1

TO BE
REMOVED

21.00' ACCESS
TRACT B

TO BE
REMOVED

FND 1/2" REBAR W/LS
CAP No. 28409.
0.1' WEST OF LINE.
VISITED JUNE 2013

JUANITA
WOODLANDS
PARK

TRACT A
2628 SF

20.00'

TRACT B
6623 SF
TOTAL

DRIVEWAY FOR
LOTS 3 AND 4

4.00' PEDESTRIAN AND
ACCESS EASEMENT

6' WIDE CONCRETE
PATH WITHIN A 8' WIDE
PEDESTRIAN EASEMENT

LOT 5
6071 SF

LOT 4
6575 SF

TRACT C
3694 SF

KCSP L9850023
REC. No. 200003279000016

10' WATER LINE
EASEMENT PER AFN
2003034001317

FND 1" IRON PIPE, NO
HISTORY, FITS
CALCULATED POSITION,
ACCEPTED AS TRUE
CORNER.
VISITED JUNE 2013

10' SEWER EASEMENT
PER AFN 9004160642
10' WATER LINE EASEMENT
PER AFN 20020410002974

FND 1/2" REBAR W/LS
CAP No. 15025,
ACCEPTED AS TRUE
CORNER. SEE NOTES.
VISITED JUNE 2013

AREA COUNTED AS FOREST
TO DETENTION TANK

LOT 2
KCSP L0250025

164.89'

NOTE: EXISTING AND ADJACENT ZONING IS RS 7.2

30' ROADWAY EASEMENT
PER AFN 3322220

PENDING 6 LOT SHORT PLAT
SUB14-00072

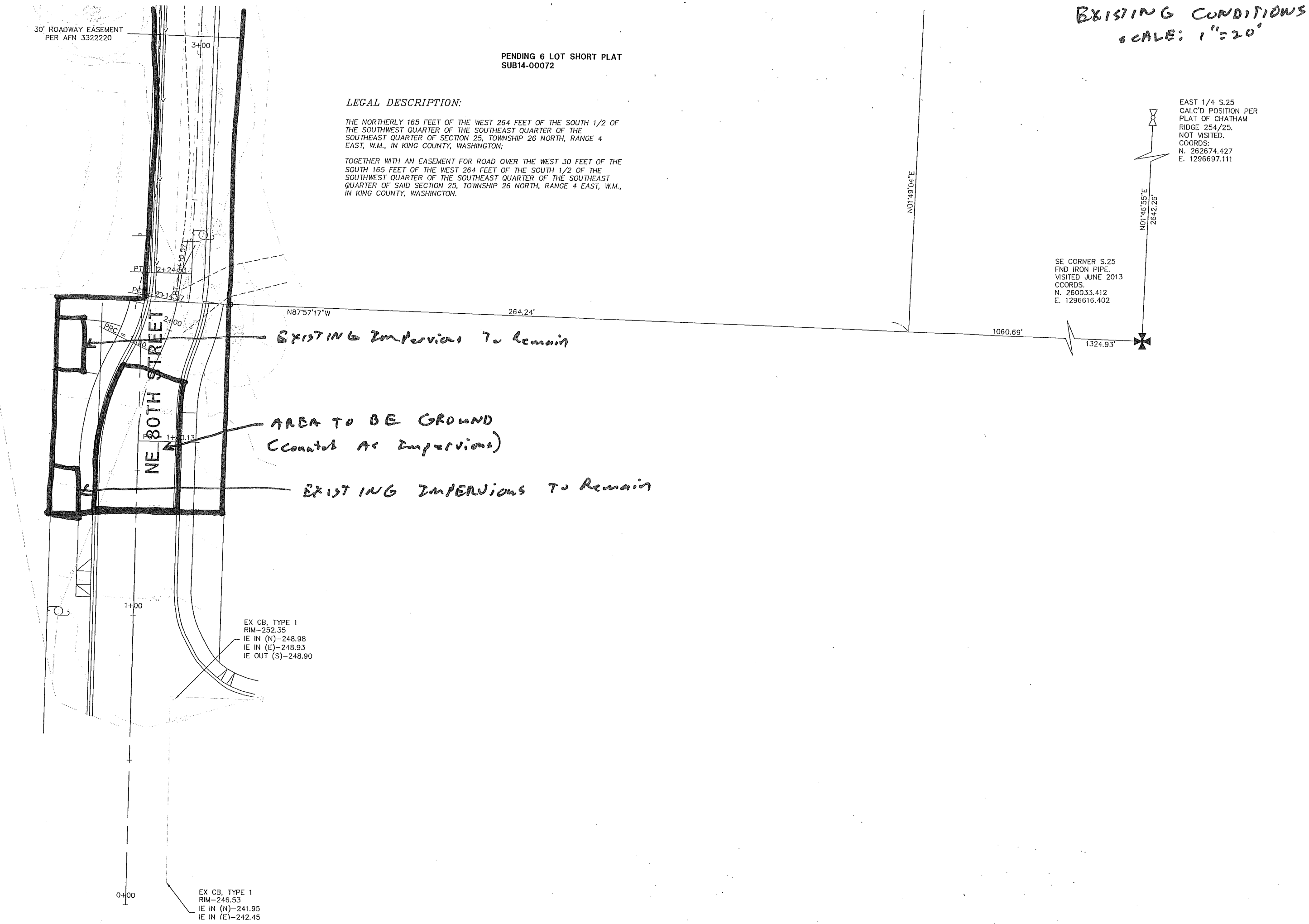
EXISTING CONDITIONS
SCALE: 1"=20'

PENDING 6 LOT SHORT PLAT
SUB14-00072

LEGAL DESCRIPTION:

THE NORTHERLY 165 FEET OF THE WEST 264 FEET OF THE SOUTH 1/2 OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 25, TOWNSHIP 26 NORTH, RANGE 4 EAST, W.M., IN KING COUNTY, WASHINGTON;

TOGETHER WITH AN EASEMENT FOR ROAD OVER THE WEST 30 FEET OF THE SOUTH 165 FEET OF THE WEST 264 FEET OF THE SOUTH 1/2 OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SAID SECTION 25, TOWNSHIP 26 NORTH, RANGE 4 EAST, W.M., IN KING COUNTY, WASHINGTON.



DEVELOPED CONDITIONS
SCALE: 1" = 20'

FND 2 1/2"IRON PIPE
N70°E 3.5'.
NOT ACCEPTED.
VISITED JUNE 2013

5+60.10

IE=274.00

15' SEWER EASEMENT
PER AFN 20030314001318

30' ROADWAY EASEMENT
PER AFN 3322220

15.00' ROADWAY
EASEMENT PER
AFN 3322220

TRACT B
CHATHAM RIDGE

FND 1/2" REBAR W/LS
CAP No. 35145,
ACCEPTED AS TRUE
CORNER.
VISITED JUNE 2013

GRAVEL DRIVE

8.00' PEDESTRIAN
EASEMENT

CB#13, TYPE 1
PER COK STD NO. D.07
STA 4+85, 13.1' RT
RIM=274.52
IE OUT=271.52

LOT 1
6181 SF

LOT 2
6096 SF

LOT 3
6503 SF

11.50' PEDESTRIAN
AND ACCESS
EASEMENT
WIDTH VARIES

5+00

40.00'

45 LF 12" PVC @4.49%

CB#14, TYPE 1
PER COK STD NO. D.07
STA 0+50.77, 9.1' RT
RIM=272.50
IE IN=269.50
IE OUT=269.50

5.00' PEDESTRIAN
EASEMENT

LOT 1
KCSP L9950023
REC. No. 200003279000016

TO BE
REMOVED

TO BE
REMOVED

FND 1/2" REBAR W/LS
CAP No. 28409.
0.1' WEST OF LINE.
VISITED JUNE 2013

0+00

1+00

TRACT A
2628 SF

2+00

2+64.08

JUANITA
WOODLANDS
PARK

CB#9, TYPE 1
PER COK STD NO. D.07
STA 4+24.50, 13.1' LT
RIM=269.68
IE OUT=267.18

TRACT B
6623 SF
TOTAL

10 LF 12" PVC @2.0%

CB#12, TYPE 2 48"
STA 0+79, 15.54' RT
PER COK STD NO. D.09
RIM=272.50
IE IN (W)=265.42
IE OUT (S)=258.25

26 LF 12" PVC @2.0%
IE IN=258.00

29 LF 12" PVC @2.0%

4.00' PEDESTRIAN AND
ACCESS EASEMENT

28 LF 8" PVC @2.0%

CB#10, TYPE 1
PER COK STD NO. D.07
STA 4+24.50, 13.1' RT
RIM=269.68
IE IN=266.62
IE OUT=266.62

4+00

26 LF 12" PVC @2.0%

TRACT C
3694 SF

CB#11, TYPE 1 48"
STA 0+50, 15.54' RT
PER COK STD NO. D.09
RIM=272.50
IE IN (SW)=266.10
IE IN (NE)=269.24
IE OUT=266.00

LOT 5
6071 SF

CB#15, TYPE 1
PER COK STD NO. D.07
STA 1+94.07, 9.1' RT
RIM=291.88
IE OUT=288.88

LOT 4
6575 SF

KCSP L9950023
REC. No. 200003279000016

10' WATER LINE
EASEMENT PER AFN
2003034001317

IE OUT=259.00

FND 1" IRON PIPE, NO
HISTORY, FITS
CALCULATED POSITION,
ACCEPTED AS TRUE
CORNER.
VISITED JUNE 2013

22 LF 12" PVC @2.0%

CB#7, TYPE 2 48"
PER COK STD D.09
STA 3+80.57, 13.1' LT
RIM=266.43
12" IE IN (NE)=258.00
12" IE OUT (S)=258.00

CB# TYPE 2 48"
PER K STD NO. D.09
STA 90.27, 13.1' RT
R 7.10
I 58.56
I -258.56

28 12" PVC @2.0%

10' SEWER EASEMENT
PER AFN 9004160642
10' WATER LINE EASEMENT
PER AFN 20020410002974

FND 1/2" REBAR W/LS
CAP No. 15025,
ACCEPTED AS TRUE
CORNER. SEE NOTES.
VISITED JUNE 2013

164.89'

LOT 2
KCSP L8250025

NOTE: EXISTING AND ADJACENT ZONING IS RS 7.2

30' ROADWAY EASEMENT
PER AFN 3322220

3+00

165 LF 12" PVC @1.09%

PENDING 6 LOT SHORT PLAT
SUB14-00072

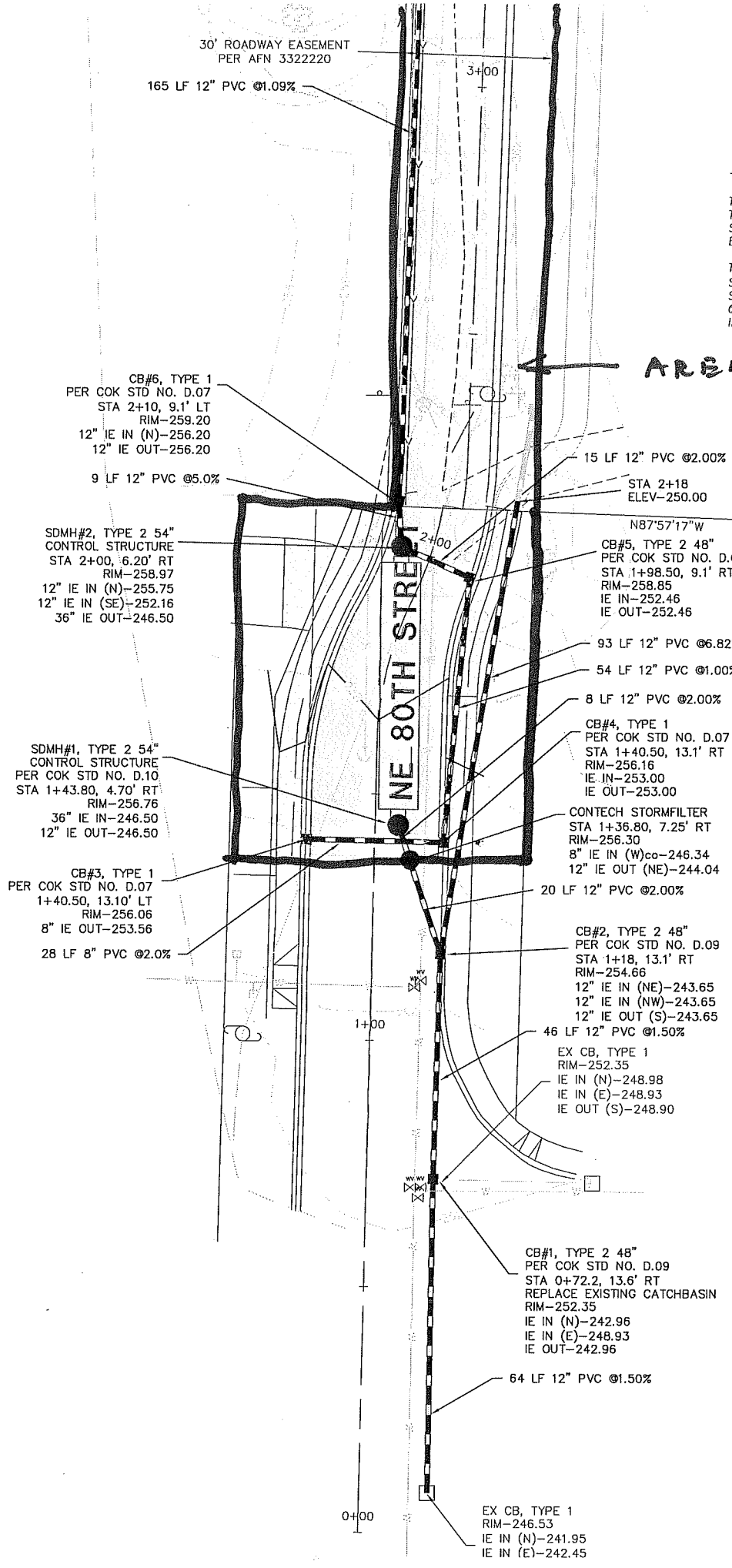
DEVELOPED CONDITIONS
SCALE: 1" = 20'

PENDING 6 LOT SHORT PLAT
SUB14-00072

LEGAL DESCRIPTION:

THE NORTHERLY 165 FEET OF THE WEST 264 FEET OF THE SOUTH 1/2 OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SECTION 25, TOWNSHIP 26 NORTH, RANGE 4 EAST, W.M., IN KING COUNTY, WASHINGTON;

TOGETHER WITH AN EASEMENT FOR ROAD OVER THE WEST 30 FEET OF THE SOUTH 165 FEET OF THE WEST 264 FEET OF THE SOUTH 1/2 OF THE SOUTHWEST QUARTER OF THE SOUTHEAST QUARTER OF THE SOUTHEAST QUARTER OF SAID SECTION 25, TOWNSHIP 26 NORTH, RANGE 4 EAST, W.M., IN KING COUNTY, WASHINGTON.



DETENTION SYSTEM AND WATER QUALITY ANALYSIS AND DESIGN

1. Overview

The existing and developed flows are analyzed for the road right-of-way area draining to the site and the site area.
On-Site Area = 43,723.42 sf
Offsite Area = 8273.20 sf (This includes 30-foot easement on property to the south and the northerly 55.50 feet of the NE 80th Street Right of Way)

Total Area Being Analyzed = (43,723 + 8273) = 51,996 sf or 1.194 acres

Soils: Alderwood Soils (AgC, Group C)
TILL SOILS
Seatac 1.00

Design Standards:

1. 2009 King County Surface Water Design Manual
   KCRTS Conservation Flow Control – Basic Water Quality
2. Used KCRTS/runoff files implementing HSPF

ONSITE DETENTION VAULT SIZING

2. Existing Site Hydrology

Onsite to Vault = (43,723 – 1,795) = 41,928 sf or 0.962 acres

Use historic site conditions
A = 0.963 acres (forested)

Using K.C.R.T.S. (See Printout)
Q-100 = 0.078 cfs
Q-10 = 0.046 cfs
Q-2 = 0.027 cfs

3. Developed Site Hydrology

Total Area = 0.962 acres

Impervious Area:
A = 3,838 sf (80th Ave NE)
A = 2,602 sf (Private Drive)
A = 648 sf (Vault Access)
A = 463 sf (sidewalks)
Total = 7,551 sf

The 5-foot pedestrian walk, etc. are included in the 50% Lot coverage calculations

Lot 1 = 6181 sf x .50% imp = 3090.50 sf
Lot 2 = 6096 sf x .50% imp = 3048 sf
Lot 3 = 6503 sf x .50% imp = 3251.50 sf
Lot 4 = 6574 sf x .50% imp = 3287 sf
Lot 5 = 6077 sf x .50% imp = 3038.50 sf

Lot Impervious Area Total = 15,715.50 sf

Total Impervious Area = (7,551 + 15,715.50) = 23,267 sf or 0.534 acres

Pervious Area:
A = 41,928 – 23,267 sf = 18,661 sf or 0.428 acres (lawn)

Using K.C.R.T.S. (See Printout)
Q-100 = 0.343 cfs
Q-10 = 0.203 cfs
Q-2 = 0.168 cfs

4. Detention

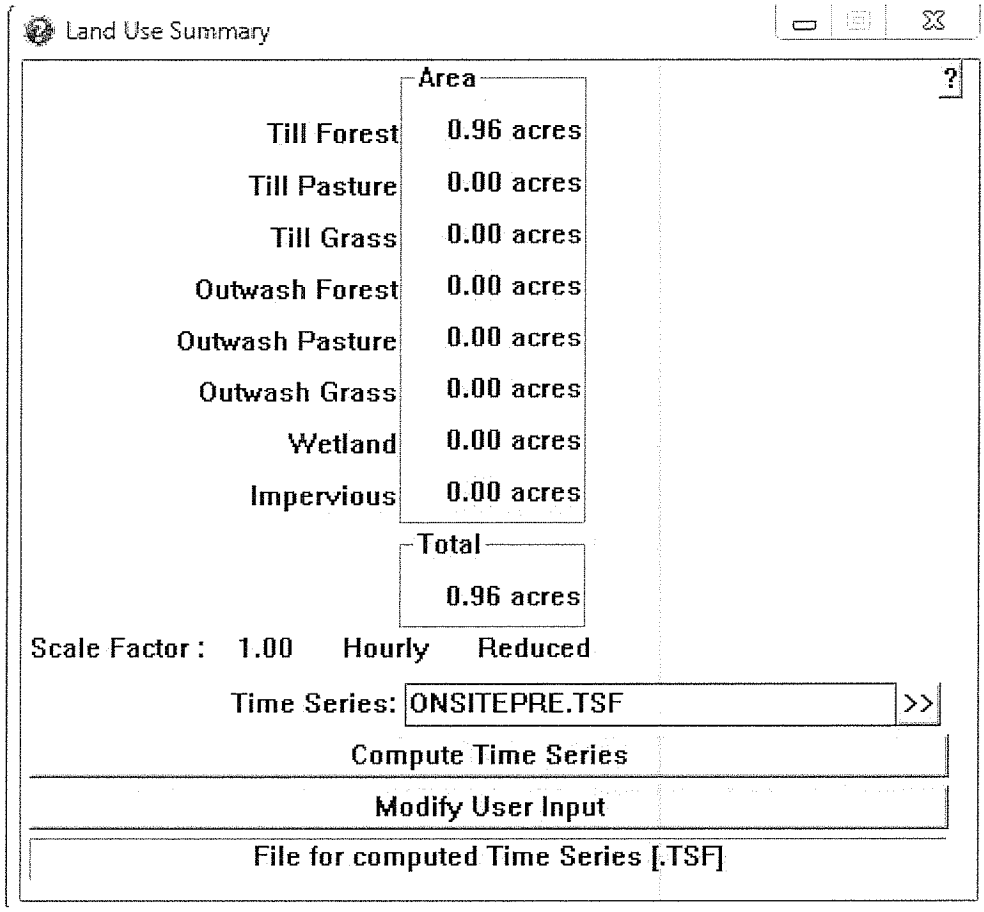
Detention Design Volume:

Conservation Flow Control: Match developed discharge durations to pre-developed durations for the range of discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The proposed facility is a combined detention/water quality vault.

Using K.C.R.T.S. (see printout)
Storage Volume = 10,560 cf
Depth = 8 ft
Bottom Orifice = 0.48 in
Second Orifice = 0.80 in @ 4.70 ft

Required Volume = 10,560 cf

Provided Volume = 44' X 30'X 8'= 10,560 cf


Land Use Summary
?
Area
Till Forest 0.96 acres
Till Pasture 0.00 acres
Till Grass 0.00 acres
Outwash Forest 0.00 acres
Outwash Pasture 0.00 acres
Outwash Grass 0.00 acres
Wetland 0.00 acres
Impervious 0.00 acres
Total
0.96 acres
Scale Factor : 1.00 Hourly Reduced
Time Series: ONSITEPRE.TSF
>>
Compute Time Series
Modify User Input
File for computed Time Series [.TSF]

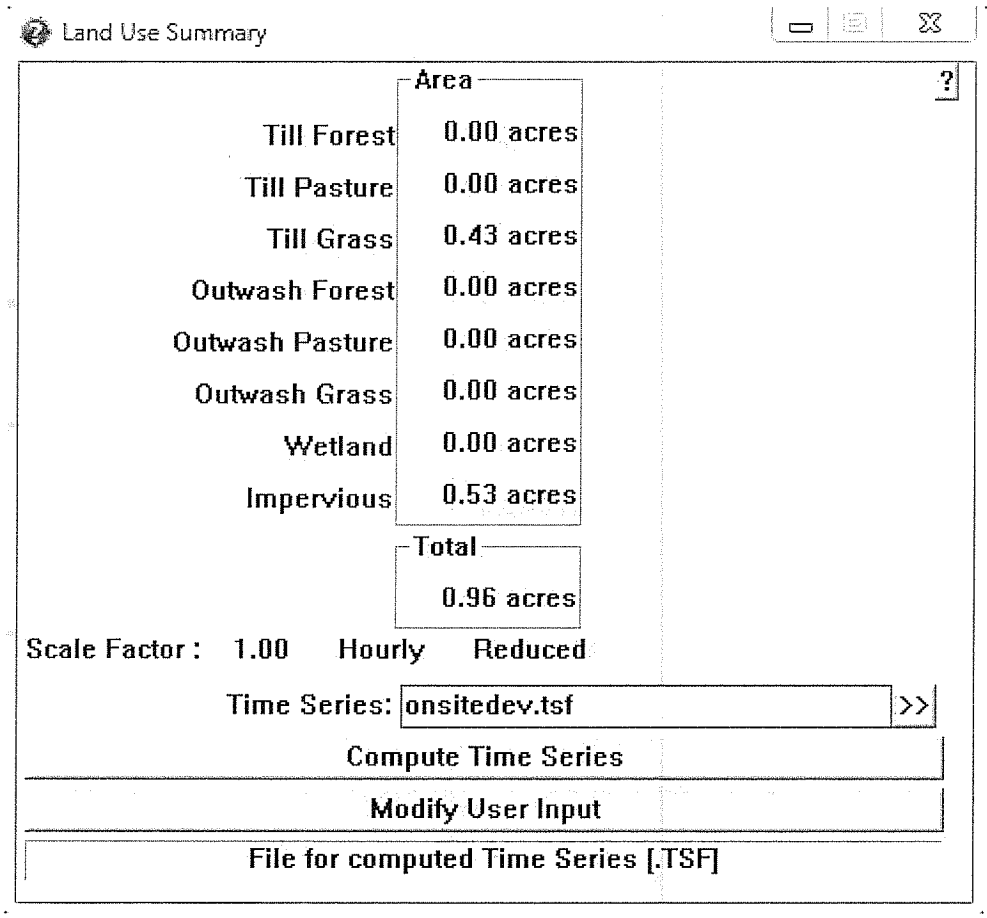
Flow Frequency Analysis
Time Series File:onsitepre.tsf
Project Location:Sea-Tac

---Annual Peak Flow Rates---

Flow Rate (CFS)	Rank	Time of Peak
0.060	2	2/09/01 18:00
0.017	7	1/06/02 3:00
0.045	4	2/28/03 3:00
0.002	8	3/24/04 19:00
0.027	6	1/05/05 8:00
0.046	3	1/18/06 20:00
0.039	5	11/24/06 4:00
0.078	1	1/09/08 9:00
Computed Peaks		

-----Flow Frequency Analysis-------

- - Peaks - - (CFS)	Rank	Return Period	Prob
0.078	1	100.00	0.990
0.060	2	25.00	0.960
0.046	3	10.00	0.900
0.045	4	5.00	0.800
0.039	5	3.00	0.667
0.027	6	2.00	0.500
0.017	7	1.30	0.231
0.002	8	1.10	0.091
0.072		50.00	0.980


Land Use Summary
Area
?
Till Forest
0.00 acres
Till Pasture
0.00 acres
Till Grass
0.43 acres
Outwash Forest
0.00 acres
Outwash Pasture
0.00 acres
Outwash Grass
0.00 acres
Wetland
0.00 acres
Impervious
0.53 acres
Total
0.96 acres
Scale Factor : 1.00
Hourly
Reduced
Time Series:
onsitedev.tsf
>>
Compute Time Series
Modify User Input
File for computed Time Series [.TSF]

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

---Annual Peak Flow Rates---

Flow Rate (CFS)	Rank	Time of Peak
0.168	6	2/09/01 2:00
0.133	8	1/05/02 16:00
0.203	3	2/27/03 7:00
0.141	7	8/26/04 2:00
0.171	5	10/28/04 16:00
0.178	4	1/18/06 16:00
0.205	2	10/26/06 0:00
0.343	1	1/09/08 6:00

Computed Peaks

-----Flow Frequency Analysis-------

- - Peaks - - (CFS)	Rank	Return Period	Prob
0.343	1	100.00	0.990
0.205	2	25.00	0.960
0.203	3	10.00	0.900
0.178	4	5.00	0.800
0.171	5	3.00	0.667
0.168	6	2.00	0.500
0.141	7	1.30	0.231
0.133	8	1.10	0.091
0.297		50.00	0.980

Retention/Detention Facility

Type of Facility:	Detention Vault	
Facility Length:	44.00	ft
Facility Width:	30.00	ft
Facility Area:	1320.	sq. ft
Effective Storage Depth:	8.00	ft
Stage 0 Elevation:	0.00	ft
Storage Volume:	10560.	cu. ft
Riser Head:	8.00	ft
Riser Diameter:	18.00	inches
Number of orifices:	2	

Orifice #	Height (ft)	Diameter (in)	Full Head Discharge (CFS)	Pipe Diameter (in)
1	0.00	0.48	0.018	
2	4.70	0.80	0.032	4.0

Top Notch Weir: None
Outflow Rating Curve: None

Stage (ft)	Elevation (ft)	Storage (cu. ft)	Storage (ac-ft)	Discharge (cfs)	Percolation (cfs)
0.00	0.00	0.	0.000	0.000	0.00
0.01	0.01	13.	0.000	0.001	0.00
0.02	0.02	26.	0.001	0.001	0.00
0.03	0.03	40.	0.001	0.001	0.00
0.04	0.04	53.	0.001	0.001	0.00
0.18	0.18	238.	0.005	0.003	0.00
0.32	0.32	422.	0.010	0.004	0.00
0.45	0.45	594.	0.014	0.004	0.00
0.59	0.59	779.	0.018	0.005	0.00
0.72	0.72	950.	0.022	0.005	0.00
0.86	0.86	1135.	0.026	0.006	0.00
0.99	0.99	1307.	0.030	0.006	0.00
1.13	1.13	1492.	0.034	0.007	0.00
1.27	1.27	1676.	0.038	0.007	0.00
1.40	1.40	1848.	0.042	0.007	0.00
1.54	1.54	2033.	0.047	0.008	0.00
1.67	1.67	2204.	0.051	0.008	0.00
1.81	1.81	2389.	0.055	0.008	0.00
1.94	1.94	2561.	0.059	0.009	0.00
2.08	2.08	2746.	0.063	0.009	0.00
2.21	2.21	2917.	0.067	0.009	0.00
2.35	2.35	3102.	0.071	0.010	0.00
2.49	2.49	3287.	0.075	0.010	0.00
2.62	2.62	3458.	0.079	0.010	0.00
2.76	2.76	3643.	0.084	0.010	0.00
2.89	2.89	3815.	0.088	0.011	0.00
3.03	3.03	4000.	0.092	0.011	0.00
3.16	3.16	4171.	0.096	0.011	0.00
3.30	3.30	4356.	0.100	0.011	0.00

3.43	3.43	4528.	0.104	0.012	0.00
3.57	3.57	4712.	0.108	0.012	0.00
3.71	3.71	4897.	0.112	0.012	0.00
3.84	3.84	5069.	0.116	0.012	0.00
3.98	3.98	5254.	0.121	0.012	0.00
4.11	4.11	5425.	0.125	0.013	0.00
4.25	4.25	5610.	0.129	0.013	0.00
4.38	4.38	5782.	0.133	0.013	0.00
4.52	4.52	5966.	0.137	0.013	0.00
4.66	4.66	6151.	0.141	0.013	0.00
4.70	4.70	6204.	0.142	0.014	0.00
4.71	4.71	6217.	0.143	0.014	0.00
4.72	4.72	6230.	0.143	0.015	0.00
4.73	4.73	6244.	0.143	0.016	0.00
4.74	4.74	6257.	0.144	0.017	0.00
4.75	4.75	6270.	0.144	0.018	0.00
4.76	4.76	6283.	0.144	0.018	0.00
4.77	4.77	6296.	0.145	0.018	0.00
4.91	4.91	6481.	0.149	0.022	0.00
5.05	5.05	6666.	0.153	0.024	0.00
5.18	5.18	6838.	0.157	0.026	0.00
5.32	5.32	7022.	0.161	0.028	0.00
5.45	5.45	7194.	0.165	0.030	0.00
5.59	5.59	7379.	0.169	0.031	0.00
5.72	5.72	7550.	0.173	0.033	0.00
5.86	5.86	7735.	0.178	0.034	0.00
6.00	6.00	7920.	0.182	0.035	0.00
6.13	6.13	8092.	0.186	0.036	0.00
6.27	6.27	8276.	0.190	0.037	0.00
6.40	6.40	8448.	0.194	0.038	0.00
6.54	6.54	8633.	0.198	0.040	0.00
6.67	6.67	8804.	0.202	0.041	0.00
6.81	6.81	8989.	0.206	0.042	0.00
6.94	6.94	9161.	0.210	0.042	0.00
7.08	7.08	9346.	0.215	0.043	0.00
7.22	7.22	9530.	0.219	0.044	0.00
7.35	7.35	9702.	0.223	0.045	0.00
7.49	7.49	9887.	0.227	0.046	0.00
7.62	7.62	10058.	0.231	0.047	0.00
7.76	7.76	10243.	0.235	0.048	0.00
7.89	7.89	10415.	0.239	0.049	0.00
8.00	8.00	10560.	0.242	0.049	0.00
8.10	8.10	10692.	0.245	0.512	0.00
8.20	8.20	10824.	0.248	1.360	0.00
8.30	8.30	10956.	0.252	2.450	0.00
8.40	8.40	11088.	0.255	3.750	0.00
8.50	8.50	11220.	0.258	5.220	0.00
8.60	8.60	11352.	0.261	6.640	0.00
8.70	8.70	11484.	0.264	7.170	0.00
8.80	8.80	11616.	0.267	7.660	0.00
8.90	8.90	11748.	0.270	8.130	0.00
9.00	9.00	11880.	0.273	8.560	0.00
9.10	9.10	12012.	0.276	8.980	0.00
9.20	9.20	12144.	0.279	9.380	0.00

9.30	9.30	12276.	0.282	9.760	0.00
9.40	9.40	12408.	0.285	10.130	0.00
9.50	9.50	12540.	0.288	10.480	0.00
9.60	9.60	12672.	0.291	10.820	0.00
9.70	9.70	12804.	0.294	11.150	0.00

Hyd	Inflow	Outflow		Peak		Storage	
		Target	Calc	Stage	Elev	(Cu-Ft)	(Ac-Ft)
1	0.34	*******	0.20	8.03	8.03	10604.	0.243
2	0.17	0.06	0.06	8.00	8.00	10562.	0.242
3	0.21	*******	0.04	6.83	6.83	9013.	0.207
4	0.20	*******	0.04	6.61	6.61	8719.	0.200
5	0.18	*******	0.03	5.64	5.64	7449.	0.171
6	0.17	*******	0.02	4.84	4.84	6392.	0.147
7	0.13	*******	0.01	4.32	4.32	5698.	0.131
8	0.14	*******	0.01	2.88	2.88	3799.	0.087

Route Time Series through Facility
Inflow Time Series File:onsitedev.tsf
Outflow Time Series File:rdout

Inflow/Outflow Analysis
Peak Inflow Discharge: 0.343 CFS at 6:00 on Jan 9 in Year 8
Peak Outflow Discharge: 0.201 CFS at 9:00 on Jan 9 in Year 8
Peak Reservoir Stage: 8.03 Ft
Peak Reservoir Elev: 8.03 Ft
Peak Reservoir Storage: 10604. Cu-Ft
: 0.243 Ac-Ft

Flow Duration from Time Series File:rdout.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence_Probability %	
0.001	30969	50.504	50.504	49.496	0.495E+00
0.003	7875	12.842	63.346	36.654	0.367E+00
0.004	6380	10.404	73.751	26.249	0.262E+00
0.006	4290	6.996	80.747	19.253	0.193E+00
0.007	4968	8.102	88.849	11.151	0.112E+00
0.009	2052	3.346	92.195	7.805	0.780E-01
0.011	1948	3.177	95.372	4.628	0.463E-01
0.012	1607	2.621	97.993	2.008	0.201E-01
0.014	778	1.269	99.261	0.739	0.739E-02
0.015	32	0.052	99.313	0.687	0.687E-02
0.017	18	0.029	99.343	0.657	0.657E-02
0.019	39	0.064	99.406	0.594	0.594E-02
0.020	31	0.051	99.457	0.543	0.543E-02
0.022	22	0.036	99.493	0.507	0.507E-02
0.023	36	0.059	99.552	0.448	0.448E-02
0.025	37	0.060	99.612	0.388	0.388E-02
0.027	27	0.044	99.656	0.344	0.344E-02
0.028	17	0.028	99.684	0.316	0.316E-02
0.030	18	0.029	99.713	0.287	0.287E-02
0.032	32	0.052	99.765	0.235	0.235E-02

0.033	22	0.036	99.801	0.199	0.199E-02
0.035	22	0.036	99.837	0.163	0.163E-02
0.036	16	0.026	99.863	0.137	0.137E-02
0.038	15	0.024	99.887	0.113	0.113E-02
0.040	10	0.016	99.904	0.096	0.962E-03
0.041	12	0.020	99.923	0.077	0.766E-03
0.043	15	0.024	99.948	0.052	0.522E-03
0.044	10	0.016	99.964	0.036	0.359E-03
0.046	8	0.013	99.977	0.023	0.228E-03
0.048	4	0.007	99.984	0.016	0.163E-03
0.049	9	0.015	99.998	0.002	0.163E-04
0.051	0	0.000	99.998	0.002	0.163E-04
0.052	0	0.000	99.998	0.002	0.163E-04
0.054	0	0.000	99.998	0.002	0.163E-04
0.056	0	0.000	99.998	0.002	0.163E-04
0.057	0	0.000	99.998	0.002	0.163E-04

Duration Comparison Anaylsis
Base File: onsitepre.tsf
New File: rdout.tsf
Cutoff Units: Discharge in CFS

	-----Fraction of Time-----			---------Check of Tolerance-------			
Cutoff	Base	New	%Change	Probability	Base	New	%Change
0.013	0.91E-02	0.77E-02	-15.3	0.91E-02	0.013	0.013	-3.3
0.015	0.75E-02	0.69E-02	-8.7	0.75E-02	0.015	0.014	-10.5
0.017	0.62E-02	0.66E-02	6.1	0.62E-02	0.017	0.018	6.2
0.019	0.56E-02	0.59E-02	5.9	0.56E-02	0.019	0.020	6.7
0.020	0.50E-02	0.53E-02	6.8	0.50E-02	0.020	0.022	7.8
0.022	0.43E-02	0.49E-02	15.2	0.43E-02	0.022	0.024	8.0
0.024	0.38E-02	0.43E-02	12.3	0.38E-02	0.024	0.025	5.3
0.026	0.33E-02	0.37E-02	12.9	0.33E-02	0.026	0.028	8.1
0.027	0.30E-02	0.33E-02	12.7	0.30E-02	0.027	0.029	7.1
0.029	0.26E-02	0.30E-02	17.2	0.26E-02	0.029	0.031	5.8
0.031	0.23E-02	0.25E-02	9.2	0.23E-02	0.031	0.032	2.2
0.033	0.20E-02	0.21E-02	3.2	0.20E-02	0.033	0.033	1.3
0.034	0.16E-02	0.17E-02	2.0	0.16E-02	0.034	0.035	0.6
0.036	0.14E-02	0.14E-02	3.6	0.14E-02	0.036	0.036	0.9
0.038	0.11E-02	0.12E-02	1.4	0.11E-02	0.038	0.038	0.1
0.040	0.88E-03	0.96E-03	9.3	0.88E-03	0.040	0.040	1.6
0.041	0.70E-03	0.72E-03	2.3	0.70E-03	0.041	0.042	0.8
0.043	0.55E-03	0.51E-03	-8.8	0.55E-03	0.043	0.042	-1.8
0.045	0.39E-03	0.29E-03	-25.0	0.39E-03	0.045	0.044	-1.6
0.047	0.29E-03	0.21E-03	-27.8	0.29E-03	0.047	0.045	-3.5
0.048	0.26E-03	0.11E-03	-56.3	0.26E-03	0.048	0.046	-5.2
0.050	0.21E-03	0.16E-04	-92.3	0.21E-03	0.050	0.047	-6.5
0.052	0.18E-03	0.16E-04	-90.9	0.18E-03	0.052	0.047	-8.6
0.054	0.16E-03	0.16E-04	-90.0	0.16E-03	0.054	0.048	-10.8
0.055	0.15E-03	0.16E-04	-88.9	0.15E-03	0.055	0.048	-13.4
0.057	0.11E-03	0.16E-04	-85.7	0.11E-03	0.057	0.049	-14.7
0.059	0.49E-04	0.00E+00	-100.0	0.49E-04	0.059	0.049	-16.6
0.060	0.16E-04	0.00E+00	-100.0	0.16E-04	0.060	0.058	-3.8

Maximum positive excursion = 0.002 cfs (9.7%)
occurring at 0.020 cfs on the Base Data:onsitepre.tsf
and at 0.022 cfs on the New Data:rdout.tsf

Maximum negative excursion = 0.011 cfs (-18.5%)
occurring at 0.060 cfs on the Base Data:onsitepre.tsf
and at 0.049 cfs on the New Data:rdout.tsf

4a. Water Quality

Basic Water Quality
Basic Wetpond

Wetpool Volume Calculations: (Dead Storage)

V_r	$= (0.9A_i+0.25A_{tg}+0.10A_{tf}+0.01A_o) \times (R/12)$	
V_r	= volume of runoff from mean annual storm (cf)	
A_i	= area of impervious surface (sf)	23,267 SF
A_{tg}	= area of till soil covered with grass (sf)	18,661 SF
A_{tf}	= area of till soil covered with forest (sf)	0 SF
A_o	= area of outwash soil covered with grass (sf)	0 SF
R	= rainfall from mean annual storm (inches)	0.470 IN.
f	= wetpool volume factor	3

V_r = [(0.9 x 23,267)+(0.25 x 18,661)+(0.10x0)+(0.01x0] x (0.470/12)
V_r = 1003 cf

V_b = *f* x Vr
V_b = wetpool volume (cf)

V_b = 3 x 1003 cf = 3009 cf Volume of Wetpool in Wetvault

Provided Volume

30' X 3.5' X 44' = 4,620 cf > 3,009 cf **OK**

A Baffle will need to be placed in the entrance cell to hold 25-35% of the volume.

15' x 3.5' x 16' = 840 cf

840/3,009 = 27.92% OK

OFFSITE DETENTION VAULT SIZING

3. Existing Site Hydrology

Offsite to Vault = (1,795 + 9211) = 11,006 sf or 0.253 acres

Area of existing impervious to remain untouched or field grinding =

A = 1,566 sf (asphalt to be ground and overlaid)
A = 170 sf (existing driveway to remain)
Total = 1,736 sf or 0.040 acres

Remaining area to be considered forested

A = (11006 – 1736) = 9,270 sf or 0.213 acres (forested)

Using K.C.R.T.S. (See Printout)
Q-100 = 0.034 cfs
Q-10 = 0.020 cfs
Q-2 = 0.012 cfs

3. Developed Site Hydrology

Total Area = 0.231 acres

Impervious Area:

A = 7,606 sf (80th Ave NE)
A = 175 sf (sidewalks from onsite)
Total = 7781 sf or 0.179 acres

Pervious Area:

A = 11,006 – 7781 sf = 3,225 sf or 0.074 acres (lawn)

Using K.C.R.T.S. (See Printout)
Q-100 = 0.100 cfs
Q-10 = 0.060 cfs
Q-2 = 0.050 cfs

4. Detention

Detention Design Volume:

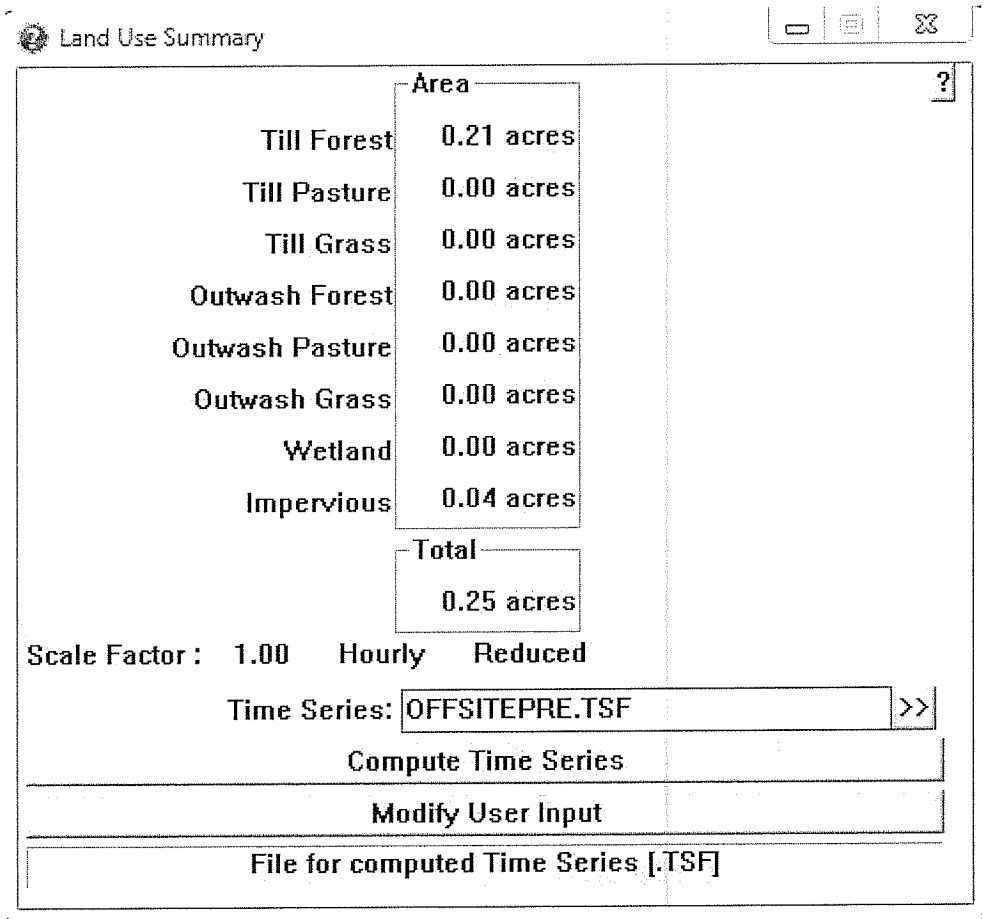
Conservation Flow Control: Match developed discharge durations to pre-developed durations for the range of discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The proposed facility is a detention tank followed by a 48" stormfillter manhole.

Using K.C.R.T.S. (see printout)

Storage Volume = 2,448 cf
Depth = 8 ft
Bottom Orifice = 0.33 in
Second Orifice = 0.54 in @ 4.85 ft

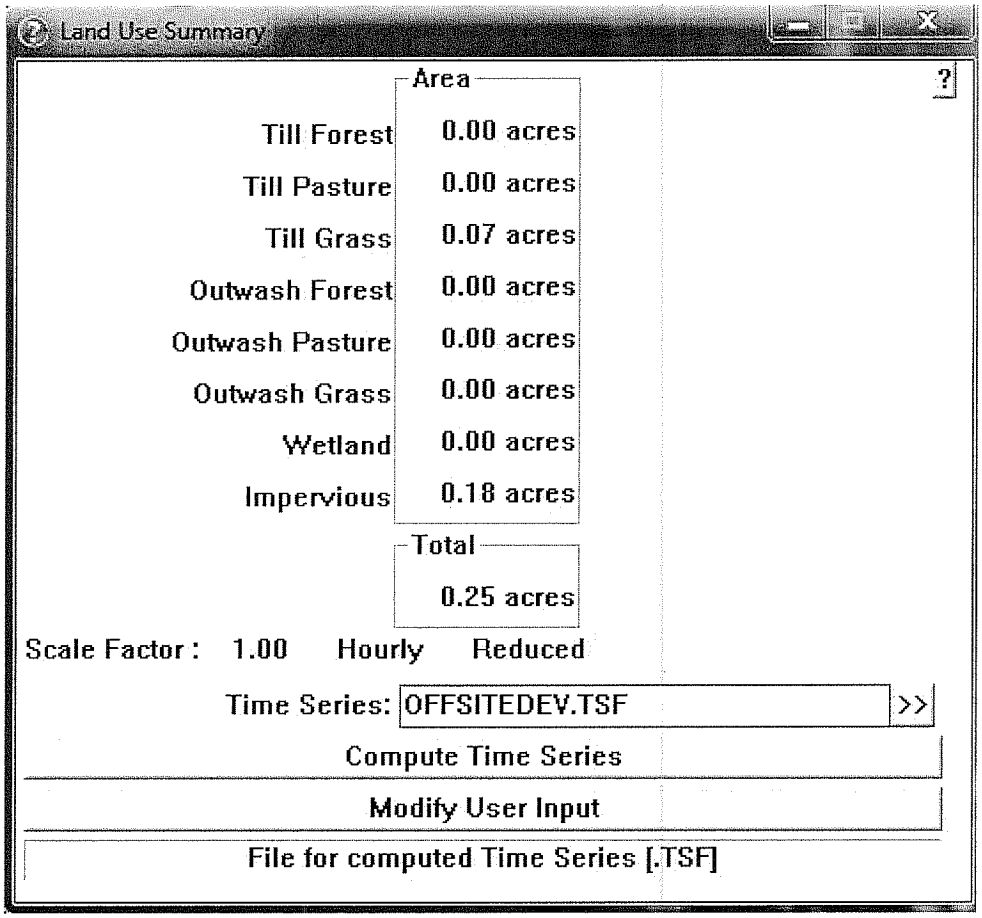
Required Volume = 2,448 cf

Provided Volume = 8' diameter tank and 7.5 feet deep plus 2 - 54" manholes at 7.5 deep = 2,686 cf


Land Use Summary
?
Area
Till Forest
0.21 acres
Till Pasture
0.00 acres
Till Grass
0.00 acres
Outwash Forest
0.00 acres
Outwash Pasture
0.00 acres
Outwash Grass
0.00 acres
Wetland
0.00 acres
Impervious
0.04 acres
Total
0.25 acres
Scale Factor : 1.00 Hourly Reduced
Time Series: OFFSITEPRE.TSF
>>
Compute Time Series
Modify User Input
File for computed Time Series [.TSF]

Flow Frequency Analysis
Time Series File:offsitepre.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
0.020	2	2/09/01 15:00	0.034	1	100.00	0.990
0.012	7	1/05/02 16:00	0.020	2	25.00	0.960
0.020	3	2/27/03 7:00	0.020	3	10.00	0.900
0.010	8	8/26/04 2:00	0.020	4	5.00	0.800
0.012	6	1/05/05 8:00	0.018	5	3.00	0.667
0.020	4	1/18/06 16:00	0.012	6	2.00	0.500
0.018	5	11/24/06 4:00	0.012	7	1.30	0.231
0.034	1	1/09/08 6:00	0.010	8	1.10	0.091
Computed Peaks			0.029		50.00	0.980


Land Use Summary
?
Area
Till Forest 0.00 acres
Till Pasture 0.00 acres
Till Grass 0.07 acres
Outwash Forest 0.00 acres
Outwash Pasture 0.00 acres
Outwash Grass 0.00 acres
Wetland 0.00 acres
Impervious 0.18 acres
Total
0.25 acres
Scale Factor : 1.00 Hourly Reduced
Time Series: OFFSITEDEV.TSF >>
Compute Time Series
Modify User Input
File for computed Time Series [.TSF]

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

---Annual Peak Flow Rates---

Flow Rate (CFS)	Rank	Time of Peak
0.050	6	2/09/01 2:00
0.042	8	1/05/02 16:00
0.060	3	2/27/03 7:00
0.046	7	8/26/04 2:00
0.055	4	10/28/04 16:00
0.053	5	1/18/06 16:00
0.067	2	10/26/06 0:00
0.100	1	1/09/08 6:00
Computed Peaks		

-----Flow Frequency Analysis-------

- - Peaks - - (CFS)	Rank	Return Period	Prob
0.100	1	100.00	0.990
0.067	2	25.00	0.960
0.060	3	10.00	0.900
0.055	4	5.00	0.800
0.053	5	3.00	0.667
0.050	6	2.00	0.500
0.046	7	1.30	0.231
0.042	8	1.10	0.091
0.089		50.00	0.980

Retention/Detention Facility

Type of Facility:	Detention Tank	
Tank Diameter:	8.00	ft
Tank Length:	50.00	ft
Effective Storage Depth:	7.50	ft
Stage 0 Elevation:	243.50	ft
Storage Volume:	2448.	cu. ft
Riser Head:	7.50	ft
Riser Diameter:	18.00	inches
Number of orifices:	2	

Orifice #	Height (ft)	Diameter (in)	Full Head Discharge (CFS)	Pipe Diameter (in)
1	0.00	0.33	0.008	
2	4.85	0.54	0.013	4.0

Top Notch Weir: None
Outflow Rating Curve: None

Stage (ft)	Elevation (ft)	Storage (cu. ft)	Storage (ac-ft)	Discharge (cfs)	Percolation (cfs)
0.00	243.50	0.	0.000	0.000	0.00
0.01	243.51	2.	0.000	0.000	0.00
0.02	243.52	4.	0.000	0.000	0.00
0.03	243.53	6.	0.000	0.000	0.00
0.15	243.65	31.	0.001	0.001	0.00
0.28	243.78	61.	0.001	0.002	0.00
0.41	243.91	93.	0.002	0.002	0.00
0.54	244.04	127.	0.003	0.002	0.00
0.66	244.16	160.	0.004	0.002	0.00
0.79	244.29	197.	0.005	0.003	0.00
0.92	244.42	236.	0.005	0.003	0.00
1.04	244.54	273.	0.006	0.003	0.00
1.17	244.67	315.	0.007	0.003	0.00
1.30	244.80	358.	0.008	0.003	0.00
1.43	244.93	402.	0.009	0.004	0.00
1.55	245.05	443.	0.010	0.004	0.00
1.68	245.18	489.	0.011	0.004	0.00
1.81	245.31	536.	0.012	0.004	0.00
1.93	245.43	580.	0.013	0.004	0.00
2.06	245.56	628.	0.014	0.004	0.00
2.19	245.69	677.	0.016	0.004	0.00
2.32	245.82	726.	0.017	0.004	0.00
2.44	245.94	772.	0.018	0.005	0.00
2.57	246.07	823.	0.019	0.005	0.00
2.70	246.20	873.	0.020	0.005	0.00
2.82	246.32	921.	0.021	0.005	0.00
2.95	246.45	972.	0.022	0.005	0.00
3.08	246.58	1024.	0.023	0.005	0.00
3.21	246.71	1075.	0.025	0.005	0.00
3.33	246.83	1123.	0.026	0.005	0.00

3.46	246.96	1175.	0.027	0.005	0.00
3.59	247.09	1227.	0.028	0.006	0.00
3.71	247.21	1275.	0.029	0.006	0.00
3.84	247.34	1327.	0.030	0.006	0.00
3.97	247.47	1379.	0.032	0.006	0.00
4.10	247.60	1430.	0.033	0.006	0.00
4.22	247.72	1478.	0.034	0.006	0.00
4.35	247.85	1529.	0.035	0.006	0.00
4.48	247.98	1579.	0.036	0.006	0.00
4.60	248.10	1626.	0.037	0.006	0.00
4.73	248.23	1675.	0.038	0.006	0.00
4.85	248.35	1721.	0.040	0.007	0.00
4.86	248.36	1725.	0.040	0.007	0.00
4.87	248.37	1728.	0.040	0.007	0.00
4.88	248.38	1732.	0.040	0.008	0.00
4.89	248.39	1736.	0.040	0.008	0.00
4.90	248.40	1740.	0.040	0.008	0.00
5.03	248.53	1788.	0.041	0.010	0.00
5.15	248.65	1832.	0.042	0.011	0.00
5.28	248.78	1879.	0.043	0.012	0.00
5.41	248.91	1925.	0.044	0.013	0.00
5.54	249.04	1970.	0.045	0.013	0.00
5.66	249.16	2011.	0.046	0.014	0.00
5.79	249.29	2054.	0.047	0.015	0.00
5.92	249.42	2096.	0.048	0.015	0.00
6.04	249.54	2134.	0.049	0.016	0.00
6.17	249.67	2174.	0.050	0.016	0.00
6.30	249.80	2212.	0.051	0.017	0.00
6.43	249.93	2248.	0.052	0.017	0.00
6.55	250.05	2280.	0.052	0.018	0.00
6.68	250.18	2312.	0.053	0.018	0.00
6.81	250.31	2343.	0.054	0.019	0.00
6.93	250.43	2369.	0.054	0.019	0.00
7.06	250.56	2394.	0.055	0.019	0.00
7.19	250.69	2416.	0.055	0.020	0.00
7.32	250.82	2434.	0.056	0.020	0.00
7.44	250.94	2445.	0.056	0.021	0.00
7.50	251.00	2448.	0.056	0.021	0.00
7.60	251.10	2448.	0.056	0.483	0.00
7.70	251.20	2448.	0.056	1.330	0.00
7.80	251.30	2448.	0.056	2.420	0.00
7.90	251.40	2448.	0.056	3.720	0.00
8.00	251.50	2448.	0.056	5.190	0.00
8.10	251.60	2448.	0.056	6.610	0.00
8.20	251.70	2448.	0.056	7.140	0.00
8.30	251.80	2448.	0.056	7.630	0.00
8.40	251.90	2448.	0.056	8.100	0.00
8.50	252.00	2448.	0.056	8.530	0.00
8.60	252.10	2448.	0.056	8.950	0.00
8.70	252.20	2448.	0.056	9.350	0.00
8.80	252.30	2448.	0.056	9.730	0.00
8.90	252.40	2448.	0.056	10.090	0.00
9.00	252.50	2448.	0.056	10.450	0.00
9.10	252.60	2448.	0.056	10.790	0.00

9.20	252.70	2448.	0.056	11.120	0.00
9.30	252.80	2448.	0.056	11.440	0.00

Hyd	Inflow	Outflow		Peak		Storage	
		Target	Calc	Stage	Elev	(Cu-Ft)	(Ac-Ft)
1	0.03	*******	0.00	1.36	244.86	378.	0.009
2	0.06	0.02	0.00	3.16	246.66	1054.	0.024
3	0.07	*******	0.02	6.21	249.71	2186.	0.050
4	0.05	*******	0.00	2.98	246.48	985.	0.023
5	0.03	*******	0.00	3.21	246.71	1077.	0.025
6	0.06	*******	0.00	2.77	246.27	903.	0.021
7	0.04	*******	0.00	2.77	246.27	900.	0.021
8	0.10	*******	0.08	7.51	251.01	2448.	0.056

Route Time Series through Facility
Inflow Time Series File:offsitedev.tsf
Outflow Time Series File:rdout

Inflow/Outflow Analysis
Peak Inflow Discharge: 0.100 CFS at 6:00 on Jan 9 in Year 8
Peak Outflow Discharge: 0.076 CFS at 9:00 on Jan 9 in Year 8
Peak Reservoir Stage: 7.51 Ft
Peak Reservoir Elev: 251.01 Ft
Peak Reservoir Storage: 2448. Cu-Ft
: 0.056 Ac-Ft

Flow Duration from Time Series File:rdout.tsf

Cutoff CFS	Count	Frequency %	CDF %	Exceedence_Probability %	
0.000	35052	57.162	57.162	42.838	0.428E+00
0.001	9391	15.315	72.477	27.523	0.275E+00
0.001	2129	3.472	75.949	24.051	0.241E+00
0.002	1403	2.288	78.237	21.763	0.218E+00
0.002	5669	9.245	87.482	12.518	0.125E+00
0.003	671	1.094	88.576	11.424	0.114E+00
0.003	3258	5.313	93.889	6.111	0.611E-01
0.004	2173	3.544	97.433	2.567	0.257E-01
0.005	95	0.155	97.588	2.412	0.241E-01
0.005	889	1.450	99.038	0.962	0.962E-02
0.006	47	0.077	99.114	0.886	0.886E-02
0.006	405	0.660	99.775	0.225	0.225E-02
0.007	11	0.018	99.793	0.207	0.207E-02
0.007	13	0.021	99.814	0.186	0.186E-02
0.008	0	0.000	99.814	0.186	0.186E-02
0.008	5	0.008	99.822	0.178	0.178E-02
0.009	5	0.008	99.830	0.170	0.170E-02
0.009	6	0.010	99.840	0.160	0.160E-02
0.010	5	0.008	99.848	0.152	0.152E-02
0.010	8	0.013	99.861	0.139	0.139E-02
0.011	10	0.016	99.878	0.122	0.122E-02
0.012	13	0.021	99.899	0.101	0.101E-02
0.012	9	0.015	99.914	0.086	0.864E-03

0.013	6	0.010	99.923	0.077	0.766E-03
0.013	15	0.024	99.948	0.052	0.522E-03
0.014	2	0.003	99.951	0.049	0.489E-03
0.014	2	0.003	99.954	0.046	0.457E-03
0.015	1	0.002	99.956	0.044	0.440E-03
0.015	6	0.010	99.966	0.034	0.342E-03
0.016	3	0.005	99.971	0.029	0.294E-03
0.016	6	0.010	99.980	0.020	0.196E-03
0.017	1	0.002	99.982	0.018	0.179E-03
0.017	2	0.003	99.985	0.015	0.147E-03
0.018	0	0.000	99.985	0.015	0.147E-03
0.019	2	0.003	99.989	0.011	0.114E-03
0.019	4	0.007	99.995	0.005	0.489E-04

Duration Comparison Anaylsis
Base File: offsitepre.tsf
New File: rdout.tsf
Cutoff Units: Discharge in CFS

	Fraction of Time			Check of Tolerance			
Cutoff	Base	New	%Change	Probability	Base	New	%Change
0.006	0.69E-02	0.85E-02	22.5	0.69E-02	0.006	0.006	0.1
0.007	0.56E-02	0.22E-02	-61.8	0.56E-02	0.007	0.006	-7.8
0.007	0.45E-02	0.19E-02	-59.1	0.45E-02	0.007	0.006	-14.6
0.008	0.41E-02	0.19E-02	-54.4	0.41E-02	0.008	0.006	-20.5
0.008	0.34E-02	0.18E-02	-47.6	0.34E-02	0.008	0.006	-25.6
0.009	0.31E-02	0.17E-02	-45.3	0.31E-02	0.009	0.006	-30.1
0.009	0.27E-02	0.17E-02	-37.4	0.27E-02	0.009	0.006	-34.1
0.010	0.20E-02	0.16E-02	-23.2	0.20E-02	0.010	0.007	-28.8
0.010	0.19E-02	0.15E-02	-22.7	0.19E-02	0.010	0.007	-31.5
0.011	0.16E-02	0.13E-02	-16.3	0.16E-02	0.011	0.009	-12.4
0.011	0.14E-02	0.12E-02	-15.5	0.14E-02	0.011	0.011	-5.8
0.012	0.13E-02	0.10E-02	-23.5	0.13E-02	0.012	0.011	-8.4
0.012	0.11E-02	0.83E-03	-23.9	0.11E-02	0.012	0.011	-7.9
0.013	0.98E-03	0.68E-03	-30.0	0.98E-03	0.013	0.012	-7.4
0.013	0.86E-03	0.51E-03	-41.5	0.86E-03	0.013	0.012	-9.3
0.014	0.75E-03	0.49E-03	-34.8	0.75E-03	0.014	0.013	-8.0
0.014	0.72E-03	0.46E-03	-36.4	0.72E-03	0.014	0.013	-11.2
0.015	0.57E-03	0.42E-03	-25.7	0.57E-03	0.015	0.013	-12.5
0.015	0.52E-03	0.34E-03	-34.4	0.52E-03	0.015	0.013	-14.2
0.016	0.49E-03	0.29E-03	-40.0	0.49E-03	0.016	0.014	-12.9
0.016	0.34E-03	0.20E-03	-42.9	0.34E-03	0.016	0.016	-5.0
0.017	0.29E-03	0.16E-03	-44.4	0.29E-03	0.017	0.016	-6.0
0.018	0.24E-03	0.15E-03	-40.0	0.24E-03	0.018	0.016	-8.6
0.018	0.13E-03	0.13E-03	0.0	0.13E-03	0.018	0.018	0.2
0.019	0.98E-04	0.11E-03	16.7	0.98E-04	0.019	0.019	2.1
0.019	0.98E-04	0.49E-04	-50.0	0.98E-04	0.019	0.019	-0.7
0.020	0.82E-04	0.49E-04	-40.0	0.82E-04	0.020	0.019	-3.3
0.020	0.33E-04	0.00E+00	-100.0	0.33E-04	0.020	0.020	-0.8

Maximum positive excursion = 0.001 cfs (3.9%)
occurring at 0.018 cfs on the Base Data:offsitepre.tsf
and at 0.019 cfs on the New Data:rdout.tsf

Maximum negative excursion = 0.004 cfs (-37.0%)
occurring at 0.010 cfs on the Base Data:offsitepre.tsf
and at 0.006 cfs on the New Data:rdout.tsf

4a. Water Quality

A 48-inch Stormfilter manhole with CSF media.

The Stormfilter was Sized using a Water Quality Flow Rate of 0.026 cfs, which is the combined 2-year outflow from the Vault and Tank detention facilities.
The 100 year overflow was sized based on the combined 100 year storm from the developed conditions of 0.443 cfs.
It was determined by Contech that a 48-inch manhole with 3 cartridges would suffice
See Sizing Calculations

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Size and Cost Estimate

Prepared by Stephanie Jacobsen on June 24, 2015

Artoush Short Plat – Stormwater Treatment System

Kirkland, WA

Information provided:

- Total contributing area = 1.22 acre
- Impervious area = 0.71 acre
- Detention release rate, Q_{treat} = 0.03 cfs
- Presiding agency = City of Kirkland

Assumptions:

- Media = CSF cartridges
- Per cartridge flow rate = 7.5 gpm
- Drop required from inlet to outlet = 2.3' minimum

Size and cost estimates:

The StormFilter is a flow-based system, and therefore, is sized by calculating the peak water quality flow rate associated with the design storm. However, when the StormFilter is placed downstream of detention the flow rate generated at the water quality storm is not always representative of the total volume of water that will go through the system or type of pollutant-loading the system may experience in one year.

For this site, Contech Engineered Solutions LLC recommends using a 48" Manhole StormFilter with 3 cartridges (see attached detail). The estimated cost of this system is $16,800, complete and delivered to the job site. This estimate assumes that the vault is 6 feet deep. The final system cost will depend on the actual depth of the unit and whether extras like doors rather than castings are specified. The contractor is responsible for setting the StormFilter and all external plumbing.

Typically, precast StormFilters have internal bypass capacities of 1.8 cfs. If the peak discharge off the site is expected to exceed this rate, we recommend placing a high-flow bypass upstream of the StormFilter system. Contech Engineered Solutions could provide our high-flow bypass, the StormGate, which provides a combination weir-orifice control structure to limit the flow to the StormFilter. The estimated cost of this structure is $4,500. The final cost would depend on the actual depth and size of the unit.

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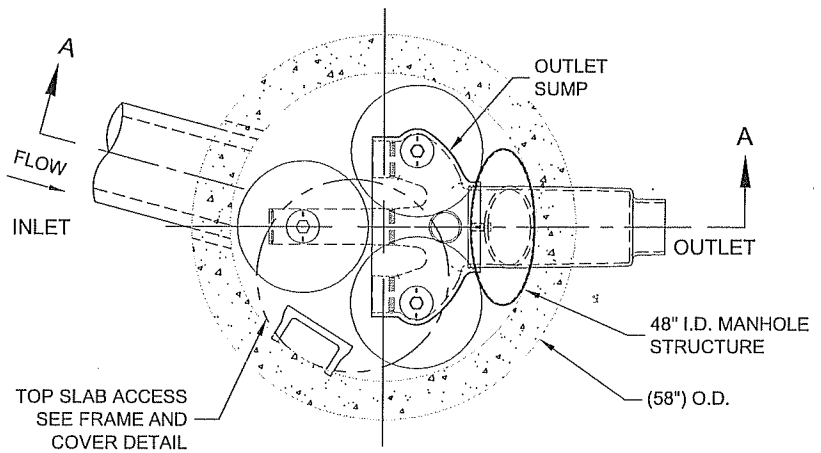
Determining Number of Cartridges for Systems Downstream of Detention

CONTECH Stormwater Solutions Inc. Engineer:	SKJ	
Date	6/24/2015	
Site Information		
Project Name	Artoush Short Plat	
Project State	Washington	
Project Location	Kirkland	
Drainage Area, Ad	1.22	ac
Impervious Area, Ai	0.71	ac
Pervious Area, Ap	0.50	
% Impervious	59%	
Runoff Coefficient, Rc	0.58	
Upstream Detention System		
Peak release rate from detention, $Q_{release\ peak}$	0.44	cfs
Treatment release rate from detention, $Q_{release\ treat}$	0.03	cfs
Detention pretreatment credit (from removal efficiency calcs)	50%	
Mass loading calculations		
Mean Annual Rainfall, P	38	in
Agency required % removal	80%	
Percent Runoff Capture	90%	
Mean Annual Runoff, V_t	87,181	ft^3
Event Mean Concentration of Pollutant, EMC	60	mg/l
Annual Mass Load, M_{total}	326.36	lbs
Filter System		
Filtration brand	StormFilter	
Cartridge height	18	in
Specific Flow Rate	1.00	gpm/ft^2
Number of cartridges - mass loading		
Mass removed by pretreatment system, M_{pre}	163.18	lbs
Mass load to filters after pretreatment, M_{pass1}	163.18	lbs
Estimate the required filter efficiency, E_{filter}	0.60	
Mass to be captured by filters, M_{filter}	97.91	lbs
Allowable Cartridge Flow rate, Q_{cart}	7.50	
Mass load per cartridge, M_{cart} (lbs)	36.00	lbs
Number of Cartridges required, N_{mass}	3	
Treatment Capacity	0.05	cfs
Determine Critical Sizing Value		
Number of Cartridges using $Q_{release\ treat}$, N_{flow}	2	
Method to Use:	MASS-LOADING	

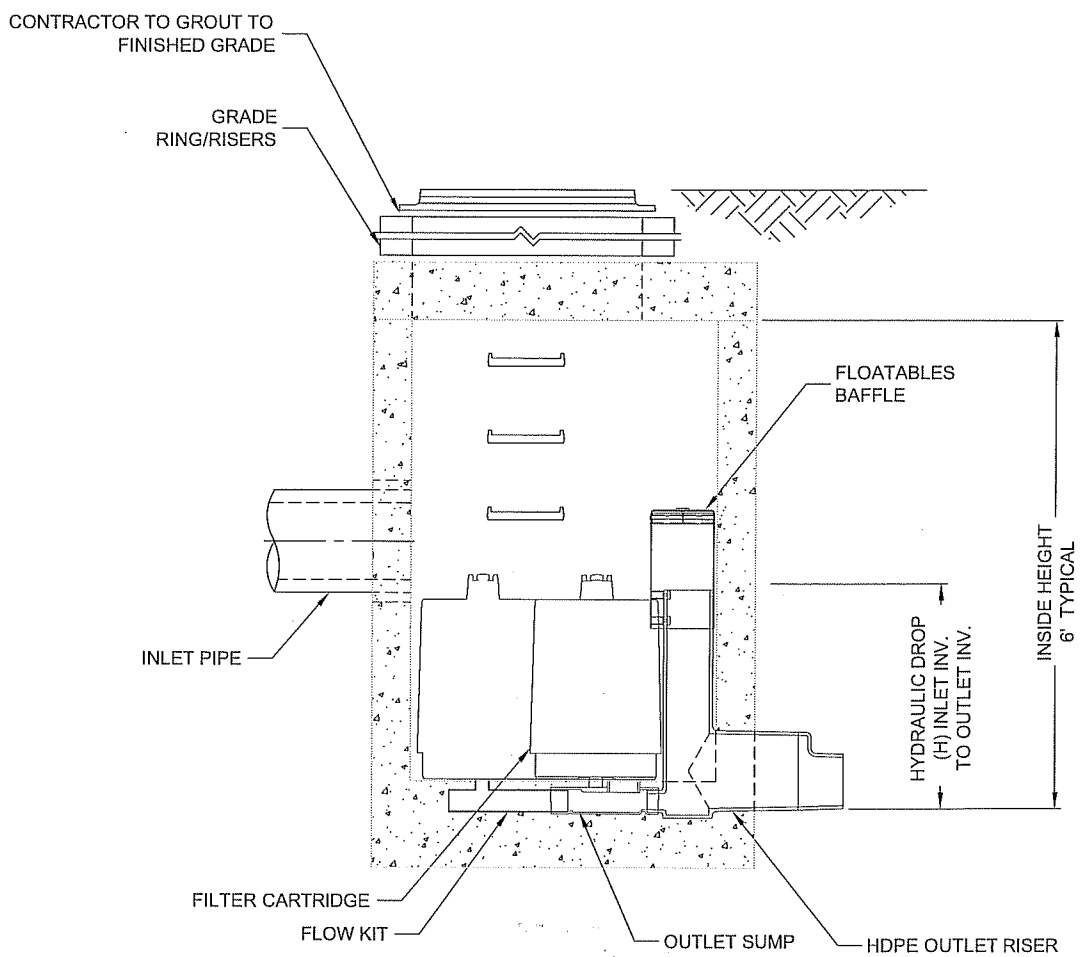
SUMMARY

Treatment Flow Rate, cfs	0.05
Cartridge Flow Rate, gpm	7.5
Number of Cartridges	3



PLAN VIEW

STANDARD OUTLET RISER
FLOWKIT: 40A



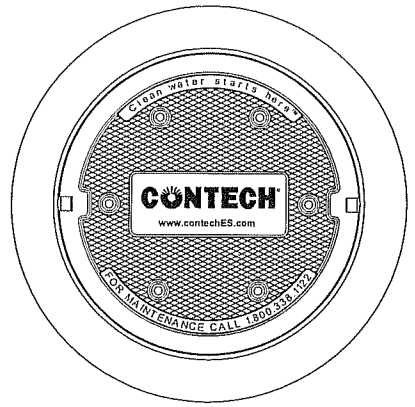
SECTION A-A

STORMFILTER DESIGN NOTES

STORMFILTER TREATMENTCAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (3). VOLUME SYSTEM IS ALSO AVAILABLE WITH MAXIMUM 3 CARTRIDGES. Ø48" MANHOLE STORMFILTER PEAK HYDRAULIC CAPACITY IS 1.0 CFS. IF THE SITE CONDITIONS EXCEED 1.0 CFS AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"		18"		LOW DROP	
RECOMMENDED HYDRAULIC DROP (H)	3.05'		2.3'		1.8'	
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/ft²	1 gpm/ft²	2 gpm/ft²	1 gpm/ft²	2 gpm/ft²	1 gpm/ft²
CARTRIDGE FLOW RATE (gpm)	22.5	11.25	15	7.5	10	5



FRAME AND COVER

(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	SDMH #1
WATER QUALITY FLOW RATE (cfs)	0.03
PEAK FLOW RATE (cfs)	0.44
RETURN PERIOD OF PEAK FLOW (yrs)	100-YEAR
# OF CARTRIDGES REQUIRED	3
CARTRIDGE FLOW RATE	7.5 GPM
MEDIA TYPE (CSF, PERLITE, ZPG, GAC, PHS)	CSF

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE #1	246.34	PVC	12"
INLET PIPE #2	*	*	*
OUTLET PIPE	244.04	PVC	12"

RIM ELEVATION	256.30

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
6. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 39 SECONDS.
7. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

INSTALLATION NOTES

1. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
2. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE (LIFTING CLUTCHES PROVIDED).
3. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
4. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET PIPE(S).
5. CONTRACTOR TO PROVIDE AND INSTALL CONNECTOR TO THE OUTLET RISER STUB. STORMFILTER EQUIPPED WITH A DUAL DIAMETER HDPE OUTLET STUB AND SAND COLLAR. IF OUTLET PIPE IS LARGER THAN 8 INCHES, CONTRACTOR TO REMOVE THE 8 INCH OUTLET STUB AT MOLDED IN CUT LINE. COUPLING BY FERNCO OR EQUAL AND PROVIDED BY CONTRACTOR.
6. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

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STANDARD DETAIL

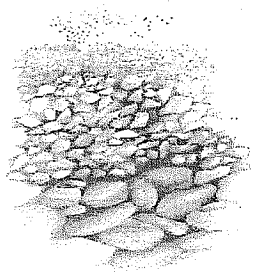
T.I.R. Section V: Conveyance System Analysis & Design

To be done after first engineering review comments.

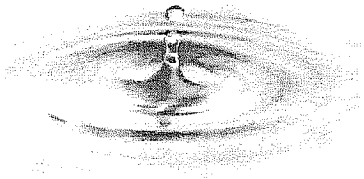
T.I.R. Section VI: Special Studies

Geotech Report by Associated Earth Sciences, Inc. Dated January 9, 2015

Arborist Report by Tree Solutions, Inc. dated January 29, 2014

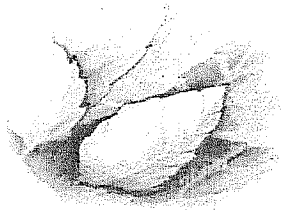


Geotechnical Engineering



Water Resources

Environmental Assessments and Remediation



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Geologic Assessments

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Subsurface Exploration, Geologic Hazard, and Preliminary Geotechnical Engineering Report

ARTOUSH SHORT PLAT

Kirkland, Washington

Prepared for

East West Quality Home, LLC

Project No. KE140645A
January 9, 2015

SUBSURFACE EXPLORATION, GEOLOGIC HAZARD, AND PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

ARTOUSH SHORT PLAT

Kirkland, Washington

Prepared for:
East West Quality Home, LLC
P.O. Box 133
Bellevue, Washington 98009

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January 9, 2015
Project No. KE140645A

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of our subsurface exploration, geologic hazards, and preliminary geotechnical engineering studies for the proposed new short plat. The site location is shown on the "Vicinity Map," Figure 1. The approximate locations of explorations completed for this study are shown on Figure 2, "Site and Exploration Plan." Logs of the subsurface explorations and copies of laboratory test results completed for this study are included in the Appendix.

1.1 Purpose and Scope

The purpose of this study is to provide geotechnical engineering design recommendations to be utilized in the preliminary design of the project. This study included a review of selected available geologic literature, observing the excavation of six exploration pits, and performing geologic studies to assess the type, thickness, distribution, and physical properties of the subsurface sediments and shallow ground water. Geotechnical engineering studies were completed to formulate recommendations for site preparation, structural fill, foundations, rockeries, pavement subgrade preparation, and drainage. This report summarizes our fieldwork and offers preliminary geotechnical engineering recommendations based on our present understanding of the project. We recommend that we be allowed to review the recommendations presented in this report and revise them, if needed, when a detailed project design has been developed.

1.2 Authorization

Authorization to proceed with this study was granted by means of a signed copy of our scope of work and cost proposal dated November 13, 2014. This report has been prepared for the exclusive use of East West Quality Home, LLC and their agents for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made.

2.0 PROJECT AND SITE DESCRIPTION

The subject property is located at 11622 80th Avenue NE in Kirkland, Washington. The parcel (King County Parcel No. 2526049024) is a partially developed residential lot,

rectangular-shaped, approximately 1 acre and measures about 264 feet by 165 feet. The site is bounded to the north, south, and east by residential properties and to the west by an unpaved private access road (80th Avenue NE). An existing single-family residence is present within the eastern third of the property. An unpaved driveway is oriented along the north property boundary. The western portion of the property is primarily covered with blackberry bushes and the eastern portion is generally covered with grass. Site grades slope gradually to the west with a total elevation drop of about 30 feet. The site does not appear to include Geologic Hazard Areas as mapped by the City of Kirkland.

We understand that the planned project will consist of demolishing the existing single-family residence and subdividing the property to accommodate five lots for new single-family residences. Lots No. 1 through No. 3 will be situated on the north side of the property with Lots No. 4 and No. 5 on the south side. The northern and southern lots will be separated by a paved street. Other improvements will include an underground storm water detention vault in the southwest corner of the site, underground utilities, and rockeries (cut) along the western property boundary. We understand that an evaluation of storm water infiltration feasibility is needed.

3.0 SUBSURFACE EXPLORATION

Our subsurface exploration completed for this project included observation of six exploration pits on December 22, 2014. The conclusions and recommendations presented in this report are based on the explorations completed for this study. The locations and depths of the explorations were completed within site and budget constraints.

3.1 Exploration Pits

The exploration pits were excavated using a tracked excavator provided and operated by IO Environmental and Infrastructure Inc., under subcontract to Associated Earth Sciences, Inc. (AESI). The pits permitted direct, visual observation of subsurface conditions. Materials encountered in the exploration pits were studied and classified in the field by a geotechnical engineer from our firm. All exploration pits were backfilled after examination and logging. Selected samples were then transported to our laboratory for further visual classification and testing, as necessary.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study, visual reconnaissance of the site, and review of selected applicable

geologic literature. As shown on the field logs, the exploration pits generally encountered a layer of fill overlying native, glacially consolidated sediments consisting of medium dense to very dense, silty to very silty sand (Vashon till). In one exploration pit we encountered loose to medium dense, silty sand (recessional outwash) overlying the Vashon till. Because of the nature of exploratory work below ground, extrapolation of subsurface conditions between field explorations is necessary. It should be noted that differing subsurface conditions may sometimes be present due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of any variations between the field explorations may not become fully evident until construction.

4.1 Stratigraphy

Surficial Topsoil

Exploration pits encountered surficial topsoil approximately 6 inches to 1 foot thick. Topsoil is not suitable for structural support, and should be stripped from structural areas. Excavated topsoil may be suitable for reuse in landscape areas if allowed by project specifications.

Fill

Existing fill soils (those not naturally placed) were encountered in AESI's explorations (EP-1, EP-3 and EP-4) completed for this study and are typically encountered near residential structures where topography has been altered by grading activities. The fill extended to a maximum explored depth of 4 feet and was comprised of loose to medium dense reddish brown, silty fine to medium sand with varying gravel content. There may also be other areas where uncontrolled fill is present. Fill is typically variable in composition, can be in a loose to medium dense condition, and can have a highly variable sediment type. Fill also typically contains variable amounts of organic material in places and may contain debris in areas. The fines content of fill can be highly variable. Therefore, where relatively high fines content are present, these soils would be considered moisture-sensitive. Fill soils are generally not considered suitable for storm water infiltration. Fill soils may be reused for structural fill if adequate compaction and moisture content can be achieved.

Vashon Recessional Outwash

Below the topsoil/sod, Vashon recessional outwash sediments were encountered in exploration EP-6 to a maximum depth of 8 feet. The outwash sediments were deposited by meltwater streams flowing from the receding Vashon glacier approximately 10,000 years ago. The outwash material consisted primarily of a loose grading to medium dense, damp to moist, brown to brown-gray mottled silty sand with some gravel. This unit is generally suitable for

support of light to moderately loaded foundations and for pavement subbase when properly compacted as discussed in this report.

Vashon Lodgement Till

All of our exploration pits encountered sediments interpreted to be Vashon lodgment till, extending to a maximum explored depth of 15 feet below ground surface in EP-1. The lodgement till observed in our explorations graded from medium dense to very dense, orangish brown in the weathered zone near the surface to grayish brown at depth, and generally consisted of a silty to very silty fine to medium sand with some gravel. Lodgment till was deposited at the base of an active continental glacier during the Vashon Stade of the Fraser Glaciation approximately 12,500 to 15,000 years ago. The till was compacted by the weight of about 3,000 feet of overlying ice. Lodgment till typically has high strength and low-compressibility attributes that are favorable for structural support with proper preparation. Lodgment till is typically silty, moisture-sensitive, and easily disturbed under wet site or weather conditions. Excavated lodgment till is suitable for reuse in structural fill applications under dry site and weather conditions when it can be moisture-conditioned to allow compaction to a firm and unyielding condition at the specified level for the intended purpose. Lodgment till is not suitable for infiltration of storm water because of its low permeability.

Published Geologic Map

We reviewed a published geologic map of the area (J.P. Minard, 1983, Geologic Map of the Kirkland Quadrangle, Washington: U.S. Geological Survey, Miscellaneous Field Studies Map MF-1543, scale 1:24,000). The referenced map indicates that the site is expected to be underlain at shallow depths by lodgement till. Advance outwash is mapped locally in all directions near the site.

4.2 Hydrology

Ground water seepage was observed in exploration pits EP-1 and EP-5, at depths of 3 to 4 feet, during the subsurface explorations completed for this study on December 22, 2014. This was interpreted as perched ground water, or shallow interflow which can occur where water has infiltrated into the subsurface soils and becomes perched on low-permeability soils, such as unweathered till. Fluctuations in the level of the ground water and amount of seepage may occur due to variations in rainfall, time of the year, and changes in site development. It should be noted that our field work was completed in the winter when ground water elevations are typically at the highest.

4.3 Laboratory Testing

We selected samples of the lodgement till for mechanical grain-size analysis testing in accordance with the *American Society for Testing and Materials* (ASTM):D 422-63. Data sheets for all laboratory testing are included in the Appendix.

4.4 Infiltration Potential

Native sediments below the surficial topsoil at this site consist of existing fill over lodgement till with the exception of the southeast corner where recessional outwash over lodgement till was present (EP-6). Lodgement till is silty and dense, and is not suitable for use as a storm water infiltration receptor. The recessional outwash is also not suitable as a storm water infiltration receptor due to the limited areal extent of the unit and its location in the topographically higher portion of the site.

II. GEOLOGIC HAZARDS AND MITIGATIONS

The following discussion of potential geologic hazards is based on the geologic, slope, and ground and surface water conditions, as observed and discussed herein. The discussion will be limited to slope stability, seismic, and erosion issues. The site does not appear to contain any areas that meet City of Kirkland definitions for Erosion, Landslide, or Seismic Hazard Areas. Individual geologic hazard topics are discussed in further detail below.

5.0 SLOPE HAZARDS AND MITIGATIONS

Based on the parcel map that was provided to us and visual reconnaissance of the site, it does not appear that any slopes on-site meet City of Kirkland definitions for treatment as Steep Slope or Landslide Hazard critical areas. No detailed assessment of slope stability was prepared as part of this report and none is warranted in our opinion.

6.0 SEISMIC HAZARDS AND MITIGATIONS

The site is underlain at shallow depths by dense lodgement till. The area is not mapped by the City of Kirkland as a Seismic Hazard area. A detailed assessment of liquefaction risks was not completed, and none is warranted for the currently proposed project in our opinion.

6.1 Surficial Ground Rupture

The nearest known fault traces to the project site are the South Whidbey Island-Lake Alice Fault located approximately 5 miles to the northeast and the Seattle Fault located approximately 10 miles to the south. Recent studies of both the Seattle Fault and the South Whidbey Island-Lake Alice fault indicate that they are active faults capable of generating surface ruptures. The recognition of these faults is relatively new, and data pertaining to them are limited, with the studies still ongoing. According to the U.S. Geological Survey (USGS) studies, the recurrence interval of movements along these faults is unknown, but is speculated to be on the order of 1,100 years. Due to the distance from the site to the known fault zones, the risk for damage to the project due to surface faulting is expected to be low, in our opinion.

6.2 Ground Motion

Structural design of the project should be in accordance with the 2012 *International Building Code* (IBC) using Site Class C.

7.0 EROSION HAZARDS AND MITIGATIONS

The following discussion addresses Washington State Department of Ecology (Ecology) erosion control regulations that will be applicable to the project. We anticipate that if the project complies with Washington State requirements, it will also be acceptable with respect to City of Kirkland requirements.

As of October 1, 2008, Ecology Construction Storm Water General Permit (also known as the National Pollutant Discharge Elimination System [NPDES] permit) requires weekly Temporary Erosion and Sedimentation Control (TESC) inspections, turbidity monitoring, and pH monitoring for all sites 1 or more acres in size that discharge storm water to surface waters of the state. Because the proposed project will not require disturbance of more than 1 acre, we anticipate that these inspection and reporting requirements will not be triggered. The following recommendations are related to general erosion potential and mitigation.

The erosion potential of the site soils is moderate. Maintaining cover measures atop disturbed ground typically provides the greatest reduction to the potential generation of turbid runoff and sediment transport. During the local wet season (October 1st through March 31st), exposed soil should not remain uncovered for more than 2 days unless it is actively being worked. Ground-cover measures can include erosion control matting, plastic sheeting, straw mulch, crushed rock or recycled concrete, or mature hydroseed.

Project planning and construction should follow local standards of practice with respect to temporary erosion and sedimentation control. Best management practices (BMPs) should include but not be limited to:

- Provide storm drain inlet protection;
- Route surface water away from work areas;
- Keep staging areas and travel areas clean and free of track-out;
- Cover work areas and stockpiled soils when not in use;
- Complete earthwork during dry weather and site conditions, if possible.

III. PRELIMINARY DESIGN RECOMMENDATIONS

8.0 INTRODUCTION

The site is underlain at shallow depths by recessional outwash and lodgement till which are suitable for structural support with proper preparation. Lodgement till is silty and sensitive to moisture contents above optimum for compaction purposes where recessional outwash is typically less moisture sensitive. Careful preparation and protection of lodgement till bearing surfaces will reduce the potential that remedial preparation will be needed. Aeration and drying of excavated lodgement till sediments is expected to be needed before they can be reused in compacted fill applications. Reuse of excavated lodgement till in structural fill applications is permitted if adequate compaction and moisture percentages can be achieved.

9.0 SITE PREPARATION

Site preparation of building and paving areas should include removal of all grass, trees, brush, debris, and any other deleterious materials. Existing fill, if encountered, should be removed. We recommend that any existing septic systems, wells, heating oil storage tanks, and other similar structures be decommissioned and removed in accordance with applicable regulations. Buried utilities should be removed from foundation areas, and should be abandoned in-place or removed from below planned new paving. Any depressions below planned final grades caused by demolition activities should be backfilled with structural fill, as discussed under the "Structural Fill" section.

Existing topsoil and fill should be stripped from structural areas. The actual observed in-place depth of topsoil and grass at the exploration locations is presented on the exploration logs in the Appendix, and was about 6 inches to 1 foot in AESI's six explorations. Fill was observed in our exploration extending 3 to 4 feet in depth in EP-1, EP-3, and EP-4. After stripping, remaining roots and stumps should be removed from structural areas. All soils disturbed by stripping and grubbing operations should be recompacted as described below for structural fill.

Once excavation to subgrade elevation is complete, the resulting surface should be proof-rolled with a loaded dump truck or other suitable equipment. Any soft, loose, yielding areas or areas exposing existing fill should be excavated to expose suitable bearing soils. The subgrade should then be compacted to at least 95 percent of the modified Proctor maximum dry density, as determined by the ASTM:D 1557 test procedure. Structural fill can then be placed to achieve desired grades, if needed.

9.1 Site Drainage and Surface Water Control

The site should be graded to prevent water from ponding in construction areas and/or flowing into excavations. Exposed grades should be crowned, sloped, and smooth drum-rolled at the end of each day to facilitate drainage. Accumulated water must be removed from subgrades and work areas immediately prior to performing further work in the area. Equipment access may be limited, and the amount of soil rendered unfit for use as structural fill may be greatly increased, if drainage efforts are not accomplished in a timely sequence. If an effective drainage system is not utilized, project delays and increased costs could be incurred due to the greater quantities of wet and unsuitable fill, or poor access and unstable conditions.

9.2 Subgrade Protection

If construction will proceed during the winter, we recommend the use of a working surface of sand and gravel, crushed rock, or quarry spalls to protect exposed soils, particularly in areas supporting concentrated equipment traffic. In winter construction staging areas and areas that will be subjected to repeated heavy loads, a minimum thickness of 12 inches of quarry spalls or 18 inches of pit run sand and gravel is recommended. If subgrade conditions are soft and silty, a geotextile separation fabric, such as Mirafi 500X or approved equivalent, should be used between the subgrade and the new fill. For building pads where floor slabs and foundation construction will be completed in the winter, a similar working surface should be used, composed of at least 6 inches of pit run sand and gravel or crushed rock.

9.3 Proof-Rolling and Subgrade Compaction

Following the recommended demolition, site stripping, and planned excavation, the stripped subgrade within the planned building and paving areas should be compacted to a firm and non-yielding condition and proof-rolled with heavy, rubber-tired construction equipment, such as a fully loaded tandem-axle dump truck. Proof-rolling should be performed prior to structural fill placement or foundation excavation. The proof-roll should be monitored by the geotechnical engineer so that any soft or yielding subgrade soils can be identified. Any soft/loose, yielding soils should be removed to a stable subgrade. Proof-rolling should only be attempted if soil moisture contents are at or near optimum moisture content. Proof-rolling of wet subgrades could result in further degradation. Low areas and excavations may then be raised to the planned finished grade with compacted structural fill. Subgrade preparation and selection, placement, and compaction of structural fill should be performed under engineering-controlled conditions in accordance with the project specifications.

9.4 Overexcavation/Stabilization

Construction during extended wet weather periods could create the need to overexcavate exposed soils if they become disturbed and cannot be recompacted due to elevated moisture content and/or weather conditions. Even during dry weather periods, soft/wet soils, which may need to be overexcavated, may be encountered in some portions of the site. If overexcavation is necessary, we recommend that overexcavation progress be observed by AESI. Soils that have become unstable may require remedial measures in the form of one or more of the following:

1. Drying and recompaction. Selective drying may be accomplished by scarifying or windrowing surficial material during extended periods of dry and warm weather.

2. Removal of affected soils to expose a suitable bearing subgrade and replacement with compacted structural fill.

3. Mechanical stabilization with a coarse-crushed aggregate compacted into the subgrade, possibly in conjunction with a geotextile.

4. Soil/cement admixture stabilization.

9.5 Wet Weather Conditions

If construction proceeds during an extended wet-weather construction period and the moisture-sensitive site soils become wet, they will become unstable. Therefore, the bids for site grading operations should be based upon the time of year that construction will proceed. It is expected that in wet conditions additional soils may need to be removed and/or other stabilization methods used, such as a coarse crushed-rock working mat, to develop a stable condition if silty subgrade soils are disturbed in the presence of excess moisture. The severity of construction disturbance will be dependent, in part, on the precautions that are taken by the contractor to protect the moisture- and disturbance-sensitive site soils. If overexcavation is necessary, it should be confirmed through continuous observation and testing by a representative of our firm.

9.6 Temporary and Permanent Cut Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction. For estimating purposes, however, temporary, unsupported cut slopes can be planned at 2H:1V (Horizontal:Vertical) in existing fill or recessional outwash. Temporary slopes in weathered lodgement till may be planned at 1.5H:1V and lodgement till at 1H:1V. During site development planning, sufficient space should be

allowed around excavations for construction of houses and the storm water vault while keeping temporary slopes inclined at the recommended angles on-site. If situations arise where temporary slopes at the recommended inclinations are not feasible, off-site easements or excavation shoring will be required. We should be allowed to offer situation–specific recommendations for excavation shoring, if shoring is added to the project.

The recommended temporary slope angles are for areas where ground water seepage is not present at the faces of the slopes. If ground or surface water is present when the temporary excavation slopes are exposed, flatter slope angles may be required. As is typical with earthwork operations, some sloughing and raveling may occur, and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times.

Permanent cut and structural fill slopes that are not intended to be exposed to surface water should be designed at inclinations of 2H:1V or flatter. Slopes that are intended to be exposed to surface water should be designed at inclinations of 3H:1V or flatter. All permanent fill slopes should be compacted to at least 95 percent of the modified Proctor maximum dry density, as determined by ASTM:D 1557. All permanent cut or fill slopes should be protected from erosion by sheet plastic until vegetation cover can be established during favorable weather.

9.7 Frozen Subgrades

If earthwork takes place during freezing conditions, all exposed subgrades should be allowed to thaw and then be recompacted prior to placing subsequent lifts of structural fill or foundation components. Alternatively, the frozen material could be stripped from the subgrade to reveal unfrozen soil prior to placing subsequent lifts of fill or foundation components. The frozen soil should not be reused as structural fill until allowed to thaw and adjusted to the proper moisture content, which may not be possible during winter months.

10.0 STRUCTURAL FILL

All references to structural fill in this report refer to subgrade preparation, fill type and placement, and compaction of materials, as discussed in this section. If a percentage of compaction is specified under another section of this report, the value given in that section should be used.

After stripping, planned excavation, and any required overexcavation have been performed to the satisfaction of the geotechnical engineer, exposed ground in areas to receive fill should be compacted to a firm and unyielding condition. If the subgrade contains silty soils and too much moisture, adequate recompaction may be difficult or impossible to obtain and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with

washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below.

After recompaction of the exposed ground is approved, or a free-draining rock course is laid, structural fill may be placed to attain desired grades. Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to 95 percent of the modified Proctor maximum density using ASTM:D 1557 as the standard. Use of soils from the site in structural fill applications is acceptable if the material meets the project specifications for the intended use, and if specifically allowed by project specifications. In the case of roadway and utility trench filling, structural fill should be placed and compacted in accordance with current City of Kirkland codes and standards. The top of the compacted fill should extend horizontally outward a minimum distance of 3 feet beyond the locations of the roadway edges before sloping down at an angle of 2H:1V. Structural fills with sloping faces that cannot be compacted directly by a vibratory roller should be compacted by overbuilding, then cutting back to a compacted slope core. Track walking alone is not an effective means of compacting a structural fill slope.

The contractor should note that any proposed fill soils must be evaluated by AESI prior to their use in fills. This would require that we have a sample of the material 72 hours in advance to perform a Proctor test and determine its field compaction standard. Soils in which the amount of fine-grained material (smaller than the No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. Use of moisture-sensitive soil in structural fills should be limited to favorable dry weather conditions, and is only permitted if specifically allowed by project plans and specifications. The native soils present on-site contained significant amounts of silt and are considered highly moisture-sensitive. If fill is placed during wet weather or if proper compaction cannot be obtained, a select import material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained material limited to 5 percent by weight when measured on the minus No. 4 sieve fraction with at least 25 percent retained on the No. 4 sieve.

A representative from our firm should observe the stripped subgrade and be present during placement of structural fill to monitor the work and perform a representative number of in-place density tests. In this way, the adequacy of the earthwork may be evaluated as filling progresses, and any problem areas may be corrected at that time. It is important to understand that taking random compaction tests on a part-time basis will not assure uniformity or acceptable performance of a fill. As such, we are available to aid the owner in developing a suitable monitoring and testing program.

11.0 FOUNDATIONS

Spread footings that are supported on structural fill or a combination of structural fill and native medium dense recessional outwash or medium dense to very dense lodgement till sediments may be designed with an allowable foundation soil bearing pressure of 2,500 pounds per square foot (psf), including both dead and live loads. An increase of one-third may be used for short-term wind or seismic loading. Higher bearing pressures may be achievable for foundations bearing completely on undisturbed, very dense native till.

Perimeter footings should be buried at least 18 inches into the surrounding soil for frost protection. However, all footings must penetrate to the prescribed bearing stratum, and no footing should be founded in or above organic or loose soils.

It should be noted that the area bound by lines extending downward at 1H:1V from any footing must not intersect another footing or intersect a filled area that has not been compacted to at least 95 percent of ASTM:D 1557. In addition, a 1.5H:1V line extending down from any footing must not daylight because sloughing or raveling may eventually undermine the footing. Thus, footings should not be placed near the edge of steps or cuts in the bearing soils.

Anticipated settlement of footings founded as described above should be on the order of ½ inch or less. However, disturbed soil not removed from footing excavations prior to footing placement could result in increased settlements. All footing areas should be inspected by AESI prior to placing concrete to verify that the design bearing capacity of the soils has been attained and that construction conforms to the recommendations contained in this report. Such inspections may be required by the governing municipality. Perimeter footing drains should be provided, as discussed under the "Drainage Considerations" section of this report.

11.1 Drainage Considerations

Foundations should be provided with foundation drains. Drains should consist of rigid, perforated, polyvinyl chloride (PVC) pipe surrounded by washed gravel. The drains should be constructed with sufficient gradient to allow gravity discharge away from the proposed buildings. No other runoff should be placed into the footing drain system.

12.0 FOUNDATION WALLS

All backfill behind foundation walls or around foundation units should be placed as per our recommendations for structural fill and as described in this section of the report. Backfilled walls, which are drained and free to yield laterally at least 0.1 percent of their height, may be designed to resist active lateral earth pressure represented by an equivalent fluid equal to

35 pounds per cubic foot (pcf). Fully restrained, drained, pressure backfilled, rigid walls that cannot yield should be designed for an at-rest equivalent fluid of 50 pcf. If parking areas are adjacent to walls, a surcharge equivalent to 2 feet of soil should be added to the wall height in determining lateral design forces. Walls with sloping backfill are not expected; however, if walls with sloping backfill are planned, we should be contacted to offer situation-specific surcharge recommendations.

As required by the 2012 IBC, retaining wall design should include a seismic surcharge pressure in addition to the equivalent fluid pressures presented above. Considering the site soils and the recommended wall backfill materials, we recommend a seismic surcharge pressure of 15H and 20H psf, where H is the wall height in feet, for the "active" and "at-rest" loading conditions, respectively. The seismic surcharge should be modeled as a rectangular distribution with the resultant applied at the midpoint of the walls.

The lateral pressures presented above are based on the conditions of a uniform backfill consisting of excavated on-site soils, or imported structural fill compacted to 95 percent of ASTM:D 1557. A higher degree of compaction is not recommended, as this will increase the pressure acting on the walls. A lower compaction may result in settlement of slab-on-grade floors or other structures supported above the walls. Thus, the compaction level is critical and must be tested by our firm during placement. Surcharges from adjacent footings or heavy construction equipment must be added to the above values. Perimeter footing drains should be provided for all retaining walls, as discussed under the "Drainage Considerations" section of this report.

It is imperative that proper drainage be provided so that hydrostatic pressures do not develop against the walls. This would involve installation of a minimum, 1-foot-wide blanket drain to within 1 foot of finish grade for the full wall height using imported, washed gravel against the walls.

12.1 Passive Resistance and Friction Factors

Lateral loads can be resisted by friction between the foundation and the natural glacial soils or supporting structural fill soils, and by passive earth pressure acting on the buried portions of the foundations. The foundations must be backfilled with structural fill and compacted to at least 95 percent of the maximum dry density to achieve the passive resistance provided below. We recommend the following allowable design parameters:

- Passive equivalent fluid = 250 pcf
- Coefficient of friction = 0.30

13.0 FLOOR SUPPORT

Slab-on-grade floors may be constructed on a minimum thickness of 2 feet of approved structural fill or on undisturbed native soils prepared as described in the "Site Preparation" section of this report. The floor should be cast atop a minimum of 4 inches of washed pea gravel or clean, uniformly graded crushed rock ("chip") to act as a capillary break. The capillary break should be covered by a minimum, 10-mil-thick, vapor barrier to prevent passage of moisture vapor through the floor. Below-grade floors and walls that cannot tolerate moisture intrusion should also be provided with effective waterproofing. If crawl-space floors are used, the subgrade beneath the flooring should also be covered with a vapor barrier.

14.0 DRAINAGE CONSIDERATIONS

All retaining and footing walls should be provided with a drain at the footing elevation. Drains should consist of rigid, perforated, PVC pipe surrounded by at least 6 inches of washed pea gravel. The gravel should be surrounded by a non-woven geotextile filter fabric, such as Mirafi 140N or equivalent. The level of the perforations in the pipe should be set at the bottom of the footing at all locations, and the drains should be constructed with sufficient gradient to allow gravity discharge away from the building.

In addition, all retaining walls and footing walls higher than 3 feet should be lined with a minimum, 12-inch-thick, washed gravel blanket provided to within 1 foot of finish grade that ties into the footing drain. Roof and surface runoff should not discharge into the footing drain system, but should be handled by a separate, rigid, tightline drain. In planning, exterior grades adjacent to walls should be sloped downward away from the structure to achieve surface drainage.

15.0 PAVEMENT RECOMMENDATIONS

Paving for the project is expected to include right-of-way, access roads, driveway areas and is expected to be supported by lodgement till and structural fill. All structural fill and all native subgrades less than 4 feet below finished grade for a planned roadway should be compacted to 95 percent of the modified Proctor maximum dry density as determined by ASTM:D-1557. Prior to structural fill placement or to placement of base course materials over native subgrades, the area should be proof-rolled under the observation of AESI with a loaded dump truck or other suitable equipment to identify any soft or yielding areas. Any soft or yielding areas should be repaired prior to continuing work.

It is our understanding the pavement sections for the project will incorporate standard sections for the City of Kirkland.

16.0 DETENTION STRUCTURE CONSIDERATIONS

Preliminary site plans indicate a proposed storm water vault in the southwest portion of the site. The elevation of the vault base is not indicated on plans, but we anticipate the foundation will bear on Vashon glacial till sediments. If these sediments are encountered at the base of the vault, the vault may be designed using an allowable foundation soil bearing pressure of 4,000 psf. The detention vault may be designed to resist at-rest lateral earth pressures as described in Section 12.0 of this report assuming drained conditions. If it is not possible to construct the vault with a foundation drain, hydrostatic surcharges must be incorporated and a lateral earth pressure of 90 pcf (equivalent fluid) should be assumed. If paved surfaces are to be constructed above the backfill soils, a uniform traffic surcharge of 70 pcf should be added.

17.0 ROCKERIES

Rockeries may be used to prevent erosion of cut slopes; however, they are not engineered structures and should not be used in place of retaining walls. Rockeries greater than 4 feet high should not be used in fill sections unless the fill is reinforced following an engineered geogrid design. Buildings should be set back from rockeries so that a 1H:1V line extending up from the rear base of the rockery does not intersect the footing. Rockery quality depends largely on the skill of the builder and the quality of the rock. See Figure 3 "Unreinforced Rockery Detail" for additional recommendations.

18.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

Our report is preliminary since project plans had not been finalized at the time this report was written. We recommend that AESI perform a geotechnical review of the plans prior to final design completion. In this way, we can confirm that our earthwork and foundation recommendations have been properly interpreted and implemented in the design.

We are also available to provide geotechnical engineering services during construction. Construction monitoring services are not part of this current scope of work. If these services are desired, please let us know, and we will prepare a cost proposal.

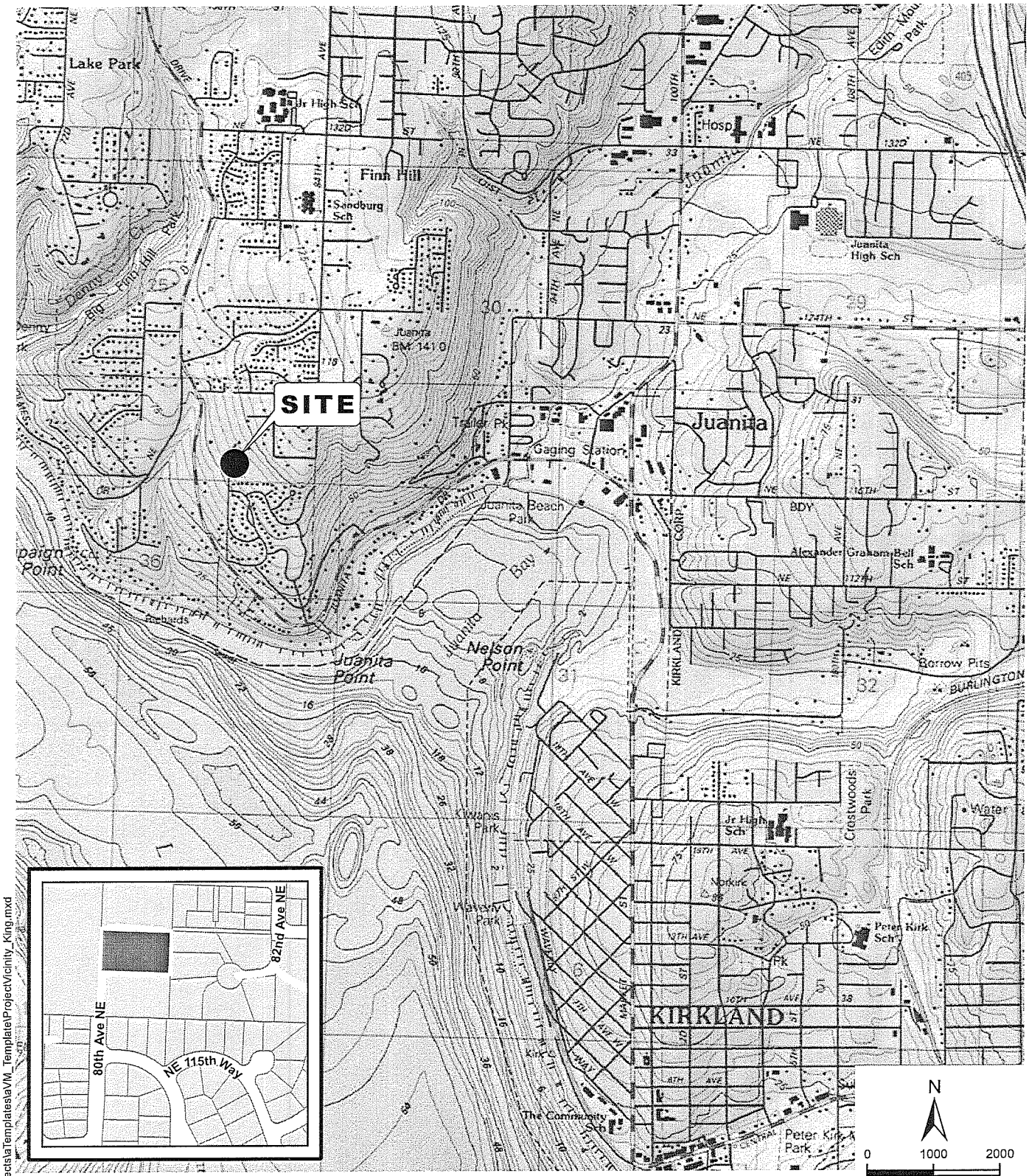
We have enjoyed working with you on this study and are confident that these recommendations will aid in the successful completion of your project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Kurt D. Merriman, P.E.
Senior Principal Engineer

Stephen A. Siebert, P.E.
Associate Geotechnical Engineer

Attachments:
Figure 1: Vicinity Map
Figure 2: Site and Exploration Plan
Figure 3: Unreinforced Rockery Detail
Appendix: Exploration Logs
Laboratory Testing Results



REFERENCE: USGS, KING CO

NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION.

Document Path: H:\GIS_Projects\aTemplates\aVM_Template\Project\Vicinity_King.mxd

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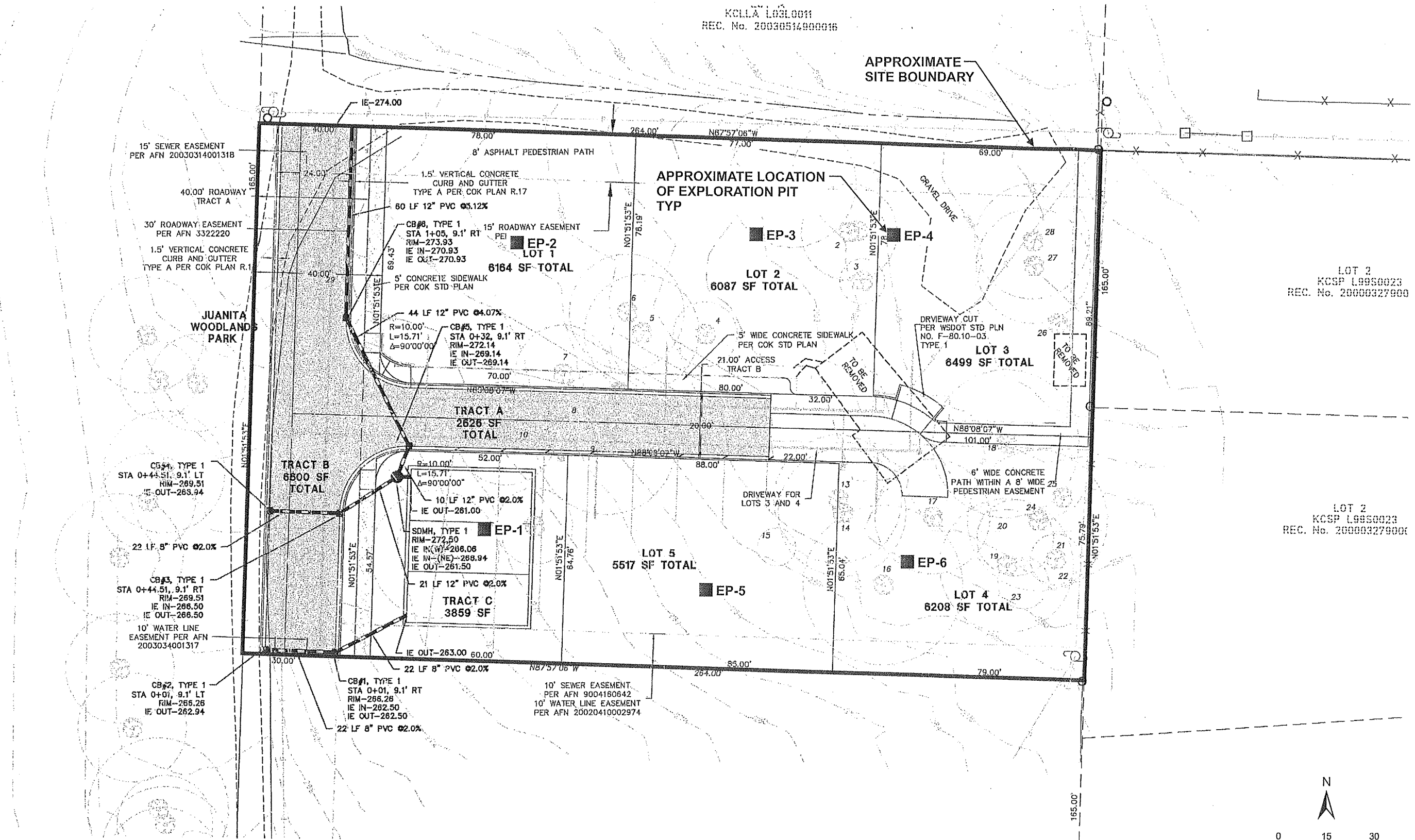
VICINITY MAP

ARTOUSH SHORT PLAT
KIRKLAND, WASHINGTON

FIGURE 1

DATE 12/14

PROJ. NO. KE140645A



REFERENCE: EASTSIDE CONSULTANTS, INC.

associated earth sciences incorporated

SITE AND EXPLORATION PLAN

ARTOUSH SHORT PLAT

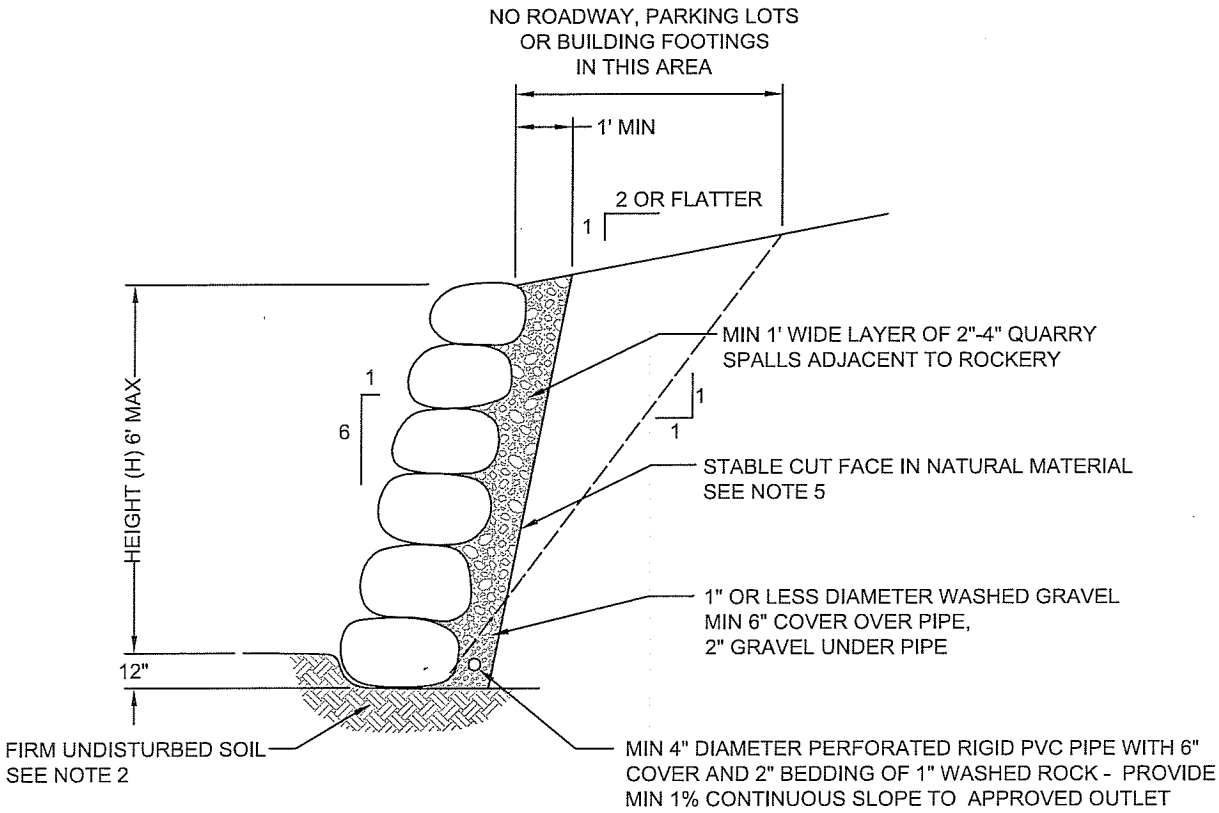
KIRKLAND, WASHINGTON

FIGURE 2

DATE 01/15

PROJ. NO. KE140645A

140645 Artoush Short Plat / 140645 Site and Exploration Plan.cdr



NOTES:

1. ROCKERIES HIGHER THAN 5' SHALL BE CONSTRUCTED OF ROCKS OF GRADUATED SIZES FROM 5-MAN TO 2-MAN, FROM BOTTOM TO TOP. ROCKERIES OF 5' OR LOWER SHALL BE CONSTRUCTED OF 3-MAN TO 2-MAN, FROM BOTTOM TO TOP.

2. INSPECTION OF SUBGRADE, PLACEMENT OF BASE COURSE AND DRAINAGE, AND FINISHED ROCKERY BY ENGINEER IS REQUIRED.

3. ROCK SHALL BE SOUND AND HAVE A MINIMUM DENSITY OF 160 POUNDS PER CUBIC FOOT.

4. THE LONG DIMENSION OF ALL ROCKS SHALL BE PLACED PERPENDICULAR TO THE WALL. EACH ROCK SHOULD BEAR ON TWO ROCKS IN THE TIER BELOW.

5. ROCKERIES ARE EROSION-CONTROL STRUCTURES, NOT RETAINING WALLS. NATURAL MATERIAL MUST BE STABLE AND FREE STANDING IN CUT FACE. MAXIMUM HEIGHT OF 3 FEET FOR ROCKERIES FACING UNREINFORCED FILL SOILS.

6. SEE TEXT OF REPORT FOR ADDITIONAL RECOMMENDATIONS.

ROCK	LB.	AVG. DIMENSION (IN.)
1-MAN	50-200	12 TO 18
2-MAN	200-700	18 TO 28
3-MAN	700-2000	28 TO 36
4-MAN	2000-4000	36 TO 48
5-MAN	4000-6000	48 TO 54

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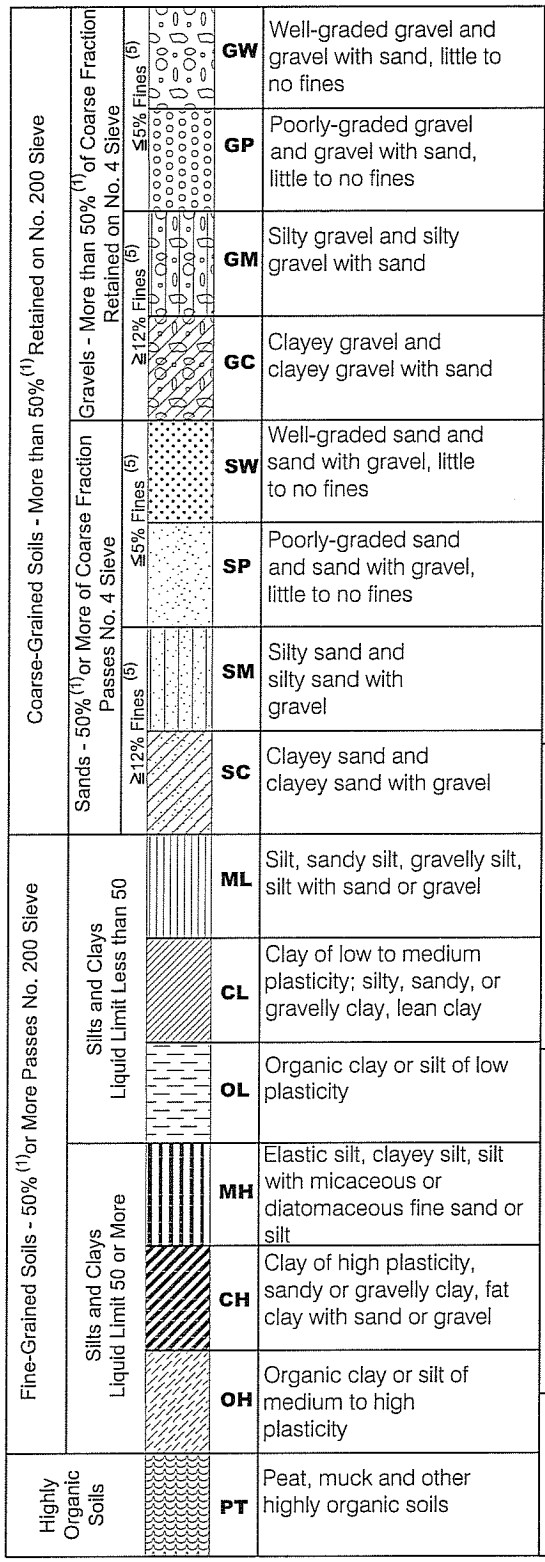
UNREINFORCED ROCKERY DETAIL

ARTOUSH SHORT PLAT
KIRKLAND, WASHINGTON

FIGURE 3
DATE 01/15
PROJECT NO. KE140645A

APPENDIX



Terms Describing Relative Density and Consistency

	Density	SPT (2) blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50
	Consistency	**SPT (2) blows/foot**
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

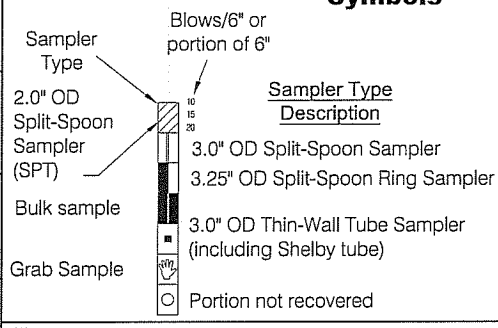
(3) Estimated Percentage

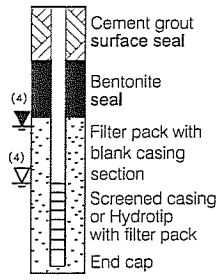
Component	Percentage by Weight
Trace	<5
Some	5 to <12
Modifier (silty, sandy, gravelly)	12 to <30
Very *modifier* (silty, sandy, gravelly)	30 to <50

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols





(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of ground water
ATD = At time of drilling
Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 12%

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

blocks \ dwg \ log_key.dwg LAYOUT: Layout 4 -2014 Qty Chng

LOG OF EXPLORATION PIT NO. EP-6

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered. **DESCRIPTION**
	Sod
1	**Vashon Recessional Outwash** Loose, moist, reddish brown, silty fine to medium SAND, trace to some gravel; nonstratified (SM).
2	
3	
4	Becomes medium dense.
5	
6	
7	
8	**Vashon Lodgement Till**
9	Dense, moist, grayish brown, silty fine to medium SAND, trace to some gravel; nonstratified (SM). Becomes very dense.
10	
11	Bottom of exploration pit at depth 10 feet No seepage. No caving.
12	
13	
14	
15	
16	
17	
18	
19	
20	

Artoush Short Plat
Kirkland, WA

Logged by: FC
Approved by:

associated earth sciences incorporated

Project No. KE140645A
12/22/14

KCTP3 140645.GPJ January 7, 2015

LOG OF EXPLORATION PIT NO. EP-1

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Organics / Brush Debris
1	**Fill**
2	Loose, moist, reddish brown, silty fine to medium SAND, trace to few gravel; nonstratified (SM).
3	Becomes medium dense, wet, grayish brown with reddish brown mottling.
4	**Vashon Lodgement Till**
	Minor seepage and caving at 4 feet.
5	Dense, moist, grayish brown, silty fine to medium SAND, trace to few gravel; nonstratified (SM).
6	
7	
8	Becomes very dense.
9	
10	
11	
12	
13	
14	
15	
16	Bottom of exploration pit at depth 15 feet Minor seepage at 4 feet. Minor caving associated with seepage.
17	
18	
19	
20	

Artoush Short Plat
Kirkland, WA

Logged by: FC

Approved by:

associated earth sciences incorporated

Project No. KE140645A

12/22/14

KCTP3 140645.GPJ January 7, 2015

LOG OF EXPLORATION PIT NO. EP-2

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Organics / Brush Debris
1	**Weathered Vashon Lodgement Till**
2	Loose, moist, reddish brown, silty fine to medium SAND, trace to few gravel; nonstratified (SM).
3	
4	Becomes medium dense.
5	
6	**Vashon Lodgement Till**
7	Dense, moist, grayish brown, silty fine to medium SAND, trace to few gravel; nonstratified (SM).
8	Becomes very dense.
9	Bottom of exploration pit at depth 8 feet No seepage. No caving.
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Artoush Short Plat
Kirkland, WA

Logged by: FC
Approved by:

associated earth sciences incorporated

Project No. KE140645A
12/22/14

KCTP3 140645.GPJ January 7, 2015

LOG OF EXPLORATION PIT NO. EP-3

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Sod
1	**Weathered Vashon Lodgement Till / Fill** Loose, moist, reddish brown, silty fine to medium SAND, trace to few gravel; nonstratified (SM).
2	
3	**Vashon Lodgement Till** Becomes medium dense, grayish brown with reddish brown mottling from 3 to 4 feet.
4	
5	Dense, moist, grayish brown, silty fine to medium SAND, trace to few gravel; nonstratified (SM).
6	Becomes very dense.
7	
8	Bottom of exploration pit at depth 7 feet No seepage. No caving.
9	
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KCTP3 140645.GPJ January 7, 2015

Artoush Short Plat
Kirkland, WA

Logged by: FC
Approved by:

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Project No. KE140645A

12/22/14

LOG OF EXPLORATION PIT NO. EP-4

Depth (ft)

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

DESCRIPTION

Sod

Roots / Topsoil

Weathered Vashon Lodgement Till / Fill

Loose to medium dense, moist, reddish brown, silty fine to medium SAND, trace to few gravel; nonstratified (SM).

Becomes medium dense, grayish brown with reddish brown mottling.

Vashon Lodgement Till

Dense, moist, grayish brown, silty fine to medium SAND, trace to few gravel; nonstratified (SM).

Becomes very dense.

Bottom of exploration pit at depth 6 feet
No seepage. No caving.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

KCTP3 140645.GPJ January 7, 2015

Artoush Short Plat
Kirkland, WA

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Project No. KE140645A

12/22/14

LOG OF EXPLORATION PIT NO. EP-5

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Sod
	Weathered Vashon Lodgement Till
1	Loose to medium dense, moist, reddish brown, silty fine to medium SAND, trace to some gravel;
2	nonstratified (SM).
3	Seepage at approximately 3 feet.
4	Becomes dense, grayish brown with reddish brown mottling.
5	
6	**Vashon Lodgement Till**
7	Dense, moist, grayish brown, silty fine to medium SAND, trace to some gravel; nonstratified (SM). Becomes very dense.
8	
9	Bottom of exploration pit at depth 8 feet Minor seepage at 3 feet. Minor caving associated with seepage.
10	
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Artoush Short Plat
Kirkland, WA

Logged by: FC
Approved by:

associated earth sciences incorporated

Project No. KE140645A
12/22/14

KCTP3 140645.GPJ January 7, 2015

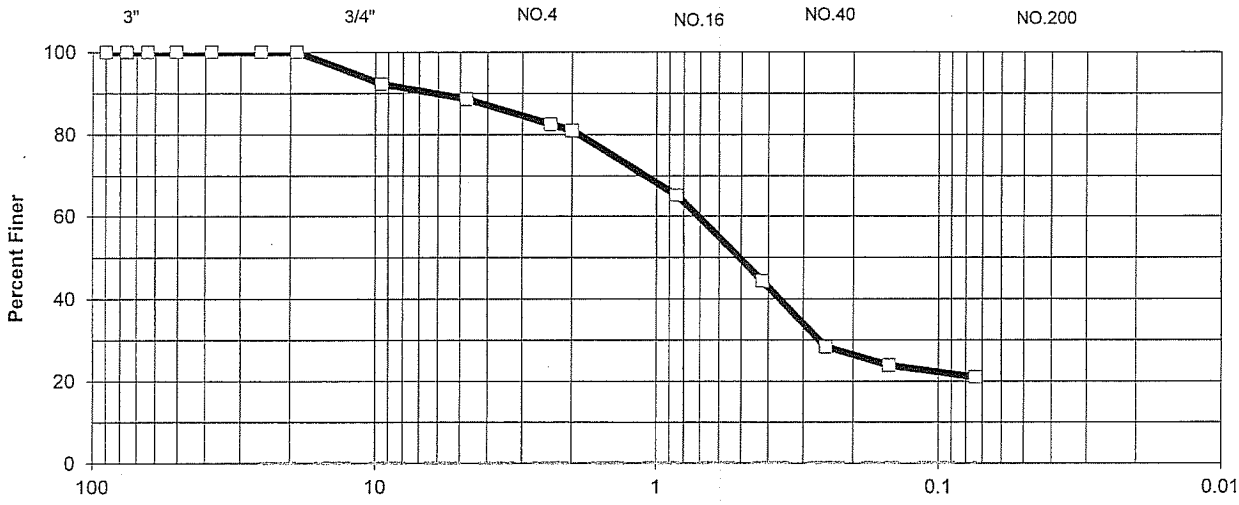
GRAIN SIZE ANALYSIS - MECHANICAL

Date Sampled	Project	Project No.		Soil Description
1/1/2015	Artoush	KE140645A		Silty sand some gravel
Tested By	Location	EB/EP No	Depth	Intended Use / Specification
MS	Onsite	EP-5	8'	

Wt. of moisture wet sample + Tare	240.36	Total Sample Tare	452.61
Wt. of moisture dry Sample + Tare	228.92	Total Sample wt + tare	1382.81
Wt. of Tare	99.97	Total Sample Wt	930.2
Wt. of moisture Dry Sample	128.95	Total Sample Dry Wt	854.4
Moisture %	9%		

					Specification Requirements	
Sieve No.	Diam. (mm)	Wt. Retained (g)	% Retained	% Passing	Minimum	Maximum
3.5	90		-	100.00	-	-
3	76.1		-	100.00	-	-
2.5	64		-	100.00	-	-
2	50.8		-	100.00	-	-
1.5	38.1		-	100.00	-	-
1	25.4		-	100.00		
3/4	19		-	100.00		
3/8	9.51	65.98	7.72	92.28		
#4	4.76	97.33	11.39	88.61		
#8	2.38	149.52	17.50	82.50		
#10	2	162.12	18.97	81.03		
#20	0.85	296.99	34.76	65.24		
#40	0.42	475.3	55.63	44.37		
#60	0.25	612.63	71.70	28.30		
#100	0.149	650.64	76.15	23.85		
#200	0.074	675.38	79.05	20.95		

US STANDARD SIEVE NOS.



Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Grain Size, mm

ASSOCIATED EARTH SCIENCES, INC.

911 5th Ave., Suite 100 Kirkland, WA 98033 425-827-7701 FAX 425-827-5424

Associated Earth Sciences, Inc.

Moisture Content
ASTM D 2216

Date Sampled	Project	Project No.		Soil Description
1/1/2015	Artoush	KE140645A		
Tested By	Location	EB/EP No.	Depth	Various
MS	Onsite			

Sample ID	EP-1 15'	EP-2 5'	EP-3 7'
Wet Weight + Pan	356.2	431.0	472.1
Dry Weight + Pan	334.5	390.0	439.5
Weight of Pan	97.7	100.4	98.2
Weight of Moisture	21.7	41.0	32.6
Dry Weight of Soil	236.7	289.6	341.3
% Moisture	**9.2**	**14.2**	**9.6**

Sample ID	EP-5 3'	EP-5 6'
Wet Weight + Pan	341.0	333.1
Dry Weight + Pan	310.0	304.3
Weight of Pan	97.8	100.8
Weight of Moisture	31.0	28.9
Dry Weight of Soil	212.2	203.5
% Moisture	**14.6**	**14.2**

Tree Solutions Inc
Consulting Arborists

TO:	Artoush Fanaiyan, Artoush Construction
JOB SITE:	11622 80th Ave NE. Kirkland, WA 98033
SUBJECT:	Tree Inventory & Assessment
DATE:	January 29, 2014
PREPARED BY:	Sean Dugan, Registered Consulting Arborist #457 ISA Certified Board Certified Master Arborist PN-5459B ISA Qualified Tree Risk Assessor

Contents

Summary
Assignment & Scope of Report
Methods
Observations
Discussion
Recommendations
Glossary
References
Appendix A – Assumptions & Limiting Conditions
Appendix B - Kirkland Tree Protection Specifications
Attachments:
Table of Trees
Marked Up Site Plan

Summary

I have identified twenty-nine (29) trees of significant size that stand on site. For this 43,560 sq. ft. property the city of Kirkland Zoning Code (95.33) requires a minimum tree density of 30 tree credits. The site currently has enough viable trees for potentially having 81.5 tree credits that can be retained and exceed the City requirements. However, it appears that only 30.5 tree credits will be retained due to proposed site design.

Trees 6, 7, 13, 14, and 18 might be considered High retention value trees that need to be retained. Tree 6 appears to be the only tree where this might be feasible, depending on how access is developed throughout the site. Tree 18 is a poor candidate for retention due to health and structural issues.

Two (2) trees on the adjacent property to the north have canopies that overhang the job site. These trees are unlikely to be negatively impacted due to the distance from the property line. The limits of disturbance for this tree should be at the property line.

Assignment & Scope of Report

This report outlines the site inspection by Sean Dugan, of Tree Solutions Inc., on January 17, 2013. I was asked to conduct a site visit to inventory all significant trees with descriptions of species, diameter size, health and structural condition, limits of disturbance, drip line radius, proposed action, and notes for each tree. I was asked to develop a formal arborist report addressing city of Kirkland requirements for tree preservation.

Included in the report are observations from the site located at 11622 80th Ave. NE., discussion, and recommendations. Artoush Fanaiyan, of Artoush Construction, requested these services to acquire information for project planning in accordance with requirements set by the city of Kirkland.

Limits of Assignment

Unless stated otherwise: 1) information contained in this report covers only those trees that were examined and reflects the condition of those trees at the time of inspection; and 2) the inspection is limited to visual examination of the subject trees without dissection, excavation, probing, climbing, or coring unless explicitly specified. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject trees may not arise in the future.

I was provided a survey of the site with limited information regarding future development plans. Additional Assumptions and Limiting Conditions can be found in Appendix A.

Methods

I measured the diameter of each tree at standard height (DSH). I calculated the equivalent single-stem diameter for multi-stemmed trees using the Guide to Trunk Area outlined in the Guide for Plant Appraisal (9th Edition). Tree species, size, health and structural condition, limit of disturbance, drip line radius, proposed action, tree credit value, and notes for each tree can be found in the attached Table of Trees. Numbers in the series 1 thru 29 on the Table correspond with the numbers on the attached Marked-up Site Plan. Two trees on adjacent site to the north with overhanging canopy are labeled using letters A and B.

I evaluated tree health and structure utilizing visual tree assessment (VTA) methods. The basis behind VTA is the identification of symptoms, which the tree produces in reaction to a weak spot or area of mechanical stress. A tree reacts to mechanical and physiological stresses by growing more vigorously to re-enforce weak areas, while depriving less stressed parts. (Mattheck & Breloer 1994) An understanding of the uniform stress allows me to make informed judgments about the condition of a tree.

Observations

The Site

The 43,560 square foot lot is located in a residential neighborhood in the city of Kirkland. The site is currently developed with a single family structure. The site abuts developed residential properties on the north, east, and south border. To the west of the site is 80th Ave NE. Beyond this area to the west appears to be open space.

The topography of the site is gradually sloped with mostly a southwest aspect. There are no environmental critical areas listed for the property.

The site is proposed for subdivision into five lots with an open space tract and a 21 foot wide access easement. The existing structures will be removed and the site will be extensively graded.

The Trees

Twenty-nine significant size trees exist on the site. Tree species include Douglas-fir (*Psuedotsuga menziesii*), Ponderosa pine *(Pinus ponderosa),* English holly *(Ilex aquifolium),* Norway maple (*Acer platanoides),* Western Red cedar (*Thuja plicata),* Willow species *(Salix sp.),* Big leaf maple *(Acer macrophyllum),* and Bitter cherry (*Prunus emarginatta)* trees. Information specific to each tree can be found in the attached Table of Trees.

Nineteen trees are in good health condition, nine are in fair condition and one is in poor condition. The tree in poor health condition has a poor structural condition as well. All of the trees present a low risk rating to the surrounding targets except for tree 18, which presents a moderate risk rating.

The trees on the adjacent site with the overhanging canopy are a Pacific madrone *(Arbutus menziesi),* and a Douglas-fir tree. Both of the trees are in good condition.

Discussion

Trees 2, 5, 8, 15, 18, 22, 23, should be removed due to issues relating to health and structure. Trees 8, 9, 10, and 35 appear to be in the access easement and will need to be removed for entry into the site and right-of-way improvements. Tree 3 should be removed due to being an invasive species.

Trees 4, 6, 7, 13, 14, and 18 might be considered as high Retention value by the City as they are located in the required property setbacks. Based on our discussion it appears that it may only be feasible to retain tree 6. This tree should be tested for decay at the base if retained. The City desires to retain these trees to the maximum extent possible and may require design changes to achieve this goal.

There appears to be three tree groves present on the site. Groves contain trees (7 - 9), (19-25), and (26-28). Based on our discussion none of these groves can be retained. The City considered groves to be of high retention value.

Prior to site development, tree protection measures, as outlined in the Kirkland Zoning Code Section 95.34 Tree Protection during Development Activity, will need to be implemented around trees to be preserved. These measures can be found in Appendix B of this report.

Tree Density Credits

The Kirkland Zoning Code (95.33) requires tree density to satisfy 30 tree credits per acre. The property is 43,560 sq. ft., or 1 acre. Therefore, a tree density worth 30 tree credits (1.0 x 30 = 30) is required in order to meet the minimum requirement. The property currently has 187 tree credits, 81.5 credits are from viable trees. As proposed, 30.5 tree credits will remain.

With additional testing it might be feasible to retain tree 1. If tree 1 is retained an additional 11.5 tree credits can be added to the site for a total of 42 tree credits.

Adjacent Site Trees

Trees A and B on the north property border are unlikely to be negatively impacted by the proposed development due to the distance away from the job site. The limits of the disturbance can be to the property's edge.

Recommendations

- Determine which trees can be preserved based on the location of proposed structures and infrastructure to be installed.
- Meet with City Planners to determine if the proposed site plans are acceptable or if they will require adjustments.
- Obtain all necessary permits and approval from the City prior to commencement of site work.
- Provide basic tree protection measures around trees to be preserved.

Glossary

DBH or DSH: diameter at breast or standard height; the diameter of the trunk measured 54 inches (4.5 feet) above grade (Matheny *et al.* 1998)

Grove: A group of three (3) or more significant trees with overlapping or touching crowns. **ISA:** International Society of Arboriculture (KZC)

Limit of Disturbance: The boundary between the protected area around a tree and the allowable site disturbance as determined by a qualified professional measured in feet from the trunk (KZC)

Retention Value: The Planning Official's designation of a tree based on information provided by a qualified professional that is one (1) of the following:

a. High, a viable tree, located within required yards and/or required landscape areas. Tree retention efforts shall be directed to the following trees if they are determined to be healthy and windfirm by a qualified professional, and provided the trees can be safely retained when pursuing alternatives to development standards pursuant to KZC 95.32:

1) Specimen trees;
2) Tree groves and associated vegetation that are to be set aside as preserved groves pursuant to KZC 95.51(3);
3) Trees on slopes of at least 10 percent; or
4) Trees that are a part of a grove that extends into adjacent property, such as in a public park, open space, sensitive area buffer or otherwise preserved group of trees on adjacent private property. If significant trees must be removed in these situations, an adequate buffer of trees may be required to be retained or planted on the edge of the remaining grove to help stabilize; (KZC)

References

ANSI A300 (Part 1) – 2008 American National Standards Institute. American National Standard for Tree Care Operations: Tree, Shrub, and Other Woody Plant Maintenance: Standard Practices (Pruning). New York: Tree Care Industry Association, 2008.

Kirkland Zoning Code. Chapter 95 – TREE MANAGEMENT AND REQUIRED LANDSCAPING. http://www.codepublishing.com/wa/kirkland/ (accessed January 28, 2014)

Lilly, Sharon. Arborists' Certification Study Guide. Champaign, IL: The International Society of Arboriculture, 2001.

Matheny, Nelda and James R. Clark. Trees and Development: A Technical Guide to Preservation of Trees During Land Development. Champaign, IL: International Society of Arboriculture, 1998.

Mattheck, Claus and Helge Breloer, The Body Language of Trees.: A Handbook for Failure Analysis. London: HMSO, 199

Appendix A – Assumptions & Limiting Conditions

1. Consultant assumes that any legal description provided to Consultant is correct and that title to property is good and marketable. Consultant assumes no responsibility for legal matters. Consultant assumes all property appraised or evaluated is free and clear, and is under responsible ownership and competent management.

2. Consultant assumes that the property and its use do not violate applicable codes, ordinances, statutes or regulations.

3. Although Consultant has taken care to obtain all information from reliable sources and to verify the data insofar as possible, Consultant does not guarantee and is not responsible for the accuracy of information provided by others.

4. Client may not require Consultant to testify or attend court by reason of any report unless mutually satisfactory contractual arrangements are made, including payment of an additional fee for such Services as described in the Consulting Arborist Agreement.

5. Unless otherwise required by law, possession of this report does not imply right of publication or use for any purpose by any person other than the person to whom it is addressed, without the prior express written consent of the Consultant.

6. Unless otherwise required by law, no part of this report shall be conveyed by any person, including the Client, the public through advertising, public relations, news, sales or other media without the Consultant's prior express written consent.

7. This report and any values expressed herein represent the opinion of the Consultant, and the Consultant's fee is in no way contingent upon the reporting of a specific value, a stipulated result, the occurrence of a subsequent event or upon any finding to be reported.

8. Sketches, drawings and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys. The reproduction of any information generated by architects, engineers or other consultants and any sketches, drawings or photographs is for the express purpose of coordination and ease of reference only. Inclusion of such information on any drawings or other documents does not constitute a representation by Consultant as to the sufficiency or accuracy of the information.

9. Unless otherwise agreed, (1) information contained in this report covers only the items examined and reflects the condition of the those items at the time of inspection; and (2) the inspection is limited to visual examination of accessible items without dissection, excavation, probing, climbing, or coring. Consultant makes no warranty or guarantee, express or implied, that the problems or deficiencies of the plans or property in question may not arise in the future.

10. Loss or alteration of any part of this Agreement invalidates the entire report.

Appendix B - Kirkland Tree Protection Specifications – as stated in Chapter 95.34 of KZC

6. Tree Protection during Development Activity. Prior to development activity or initiating tree removal on the site, vegetated areas and individual trees to be preserved shall be protected from potentially damaging activities pursuant to the following standards:

a. Placing Materials near Trees. No person may conduct any activity within the protected area of any tree designated to remain, including, but not limited to, operating or parking equipment, placing solvents, storing building material or soil deposits, or dumping concrete washout or other chemicals. During construction, no person shall attach any object to any tree designated for protection.

b. Protective Barrier. Before development, land clearing, filling or any land alteration, the applicant shall:

1) Erect and maintain a readily visible temporary protective tree fencing along the limits of disturbance which completely surrounds the protected area of all retained trees or groups of trees. Fences shall be constructed of chain link and be at least four feet high, unless other type of fencing is authorized by the Planning Official.

2) Install highly visible signs spaced no further than 15 feet along the entirety of the protective tree fence. Said sign must be approved by the Planning Official and shall state at a minimum "Tree Protection Area, Entrance Prohibited" and provide the City phone number for code enforcement to report violations.

3) Prohibit excavation or compaction of earth or other potentially damaging activities within the barriers; provided, that the Planning Official may allow such activities approved by a qualified professional and under the supervision of a qualified professional retained and paid for by the applicant.

4) Maintain the protective barriers in place until the Planning Official authorizes their removal.

5) Ensure that any approved landscaping done in the protected zone subsequent to the removal of the barriers shall be accomplished with light machinery or hand labor.

6) In addition to the above, the Planning Official may require the following:

a) If equipment is authorized to operate within the critical root zone, cover the areas adjoining the critical root zone of a tree with mulch to a depth of at least six inches or with plywood or similar material in order to protect roots from damage caused by heavy equipment.

b) Minimize root damage by excavating a two-foot-deep trench, at edge of critical root zone, to cleanly sever the roots of trees to be retained.

c) Corrective pruning performed on protected trees in order to avoid damage from machinery or building activity.

d) Maintenance of trees throughout construction period by watering and fertilizing.

c. Grade.

1) The grade shall not be elevated or reduced within the critical root zone of trees to be preserved without the Planning Official's authorization based on recommendations from a qualified professional. The Planning Official may allow coverage of up to one half of the area of the tree's critical root zone with light soils (no clay) to the minimum depth necessary to carry out grading or landscaping plans, if it will not imperil the survival of the tree. Aeration devices may be required to ensure the tree's survival.

2) If the grade adjacent to a preserved tree is raised such that it could slough or erode into the tree's critical root zone, it shall be permanently stabilized to prevent suffocation of the roots.

3) The applicant shall not install an impervious surface within the critical root zone of any tree to be retained without the authorization of the Planning Official. The Planning Official may require specific construction methods and/or use of aeration devices to ensure the tree's survival and to minimize the potential for root-induced damage to the impervious surface.

4) To the greatest extent practical, utility trenches shall be located outside of the critical root zone of trees to be retained. The Planning Official may require that utilities be tunneled under the roots of trees to be retained if the Planning Official determines that trenching would significantly reduce the chances of the tree's survival.

5) Trees and other vegetation to be retained shall be protected from erosion and sedimentation. Clearing operations shall be conducted so as to expose the smallest practical area of soil to erosion for the least possible time. To control erosion, it is encouraged that shrubs, ground cover and stumps be maintained on the individual lots, where feasible.

d. Directional Felling. Directional felling of trees shall be used to avoid damage to trees designated for retention.

e. Additional Requirements. The Planning Official may require additional tree protection measures that are consistent with accepted urban forestry industry practices.

Attachments:

Table of Trees
Marked-up Site Plan

Tree Solutions Inc
Consulting Arborists

Artoush Construction - Table of Trees
11622 80th Ave. NE, Kirkland

Date of Inventory: January 17, 2014
Table Prepared: January 24, 2014

Tree #	Common/Scientific Name	DSH (inches)	Health Condition	Structural Condition	Limits of Disturbance	Drip Line Radius (ft)	Viability	Risk Rating	Proposed Action	Credits	Notes
1	*Douglas-fir/ Psuedotsuga menziesii*	31.2	Good	Good	Trunk	20	*Possible	Low	Remove/ Grading	0	Tip dieback in lowe canopy, Phaeolus schweinitzii fruiting body at base; ***Advanced test for decay if proposed for retention**
2	*Ponderosa pine/ Pinus ponderosa*	36.3	Fair	Fair	Trunk	15	NO	Low	Remove/ Health	0	Tree appears to be in decline; Two trunks with the smaller being girdled by a wire that will likely lead to death; sparse canopy due to foliar disease; 31+19 DSH trunks
3	*English holly/ Ilex aquifolium*	10.9	Good	Fair	Trunk	7	NO	Low	Remove/ Species	0	Invasive species; 4+5+5+7.3 DSH trunks
4	*Norway maple/ Acer platanoides*	8.2	Fair	Fair	Trunk	10	Yes	Low	Remove/ Grading	0	canker at base may be early symptom of Verticillium wilt, monitor foliage in spring
5	*Douglas-fir/ Psuedotsuga menziesii*	24.5	Good	Fair	Trunk	18	NO	Low	Remove/ Structure	0	Trunk leans to the north and has corrected, failed at roots in the past and has been leaning on tree 6, can only be retained if 6 is retained
6	*Douglas-fir/ Psuedotsuga menziesii*	20.5	Good	Good	Drip line	18	Yes*	Low	Retain	5	tip dieback on some branches, root wads of trees that previously failed near the base of this tree; ***suggest advanced decay testing if tree is retained to determine if there are any internal issues at the base of the tree.**
7	*Douglas-fir/ Psuedotsuga menziesii*	26.5	Good	Good	Trunk	15	NO	Low	Remove/ Access	0	Becoming suppressed by trees 7 and 9, large fruiting body from Phaeolus schweinitzii at the base, will be compromised by access road; poor candidate for retention
8	*Douglas-fir/ Psuedotsuga menziesii*	17.5	Fair	Fair	Trunk	12	NO	Low	Remove/ Access	0	Phaeolus schweinitzii at base
9	*Douglas-fir/ Psuedotsuga menziesii*	39.0	Fair	Good	Trunk	22	Yes	Low	Remove/ Access	0	
10	*Douglas-fir/ Psuedotsuga menziesii*	25.0	Good	Good	Trunk	16	Yes	Low	Remove/ Access	0	
11	*Douglas-fir/ Psuedotsuga menziesii*	26.0	Good	Good	Drip line east, 24 ft in other directions	12	Yes	Low	Retain	9	
12	*Douglas-fir/ Psuedotsuga menziesii*	33.0	Good	Good	Drip line	20	Yes	Low	Retain	12.5	
13	*Western Red cedar/ Thuja plicata*	26.0	Fair	Good	Trunk	20	Yes	Low	Remove/ Grading	0	Canopy sparse and off color; tree roots will be compromised by access to site
14	*Western Red cedar/ Thuja plicata*	29.0	Fair	Good	Trunk	20	Yes	Low	Remove/ Grading	0	Canopy sparse and off color; tree roots will be compromised by access to site
15	*Willow species/ Salix sp.*	11.0	Poor	Poor	Trunk	6	NO	Low	Remove/ Health	0	Split at base with extensive decay, multiple part failure; trunks measured 4+5+9 DSH
16	*Big leaf maple/ Acer macrophyllum*	31.0	Good	Good	Trunk	25	Yes	Low	Remove/ Grading	0	Large surface roots, low density moderate size dead wood, crown clean if retained
17	*Big leaf maple/ Acer macrophyllum*	14.9	Fair	Fair	Trunk	18	Yes	Low	Remove/ Grading	0	slow growth rate, smaller lead previously failed, disturbance in the root zone; trunks measured 10+11 DSH

Tree Solutions Inc
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Artoush Construction - Table of Trees
11622 80th Ave. NE, Kirkland

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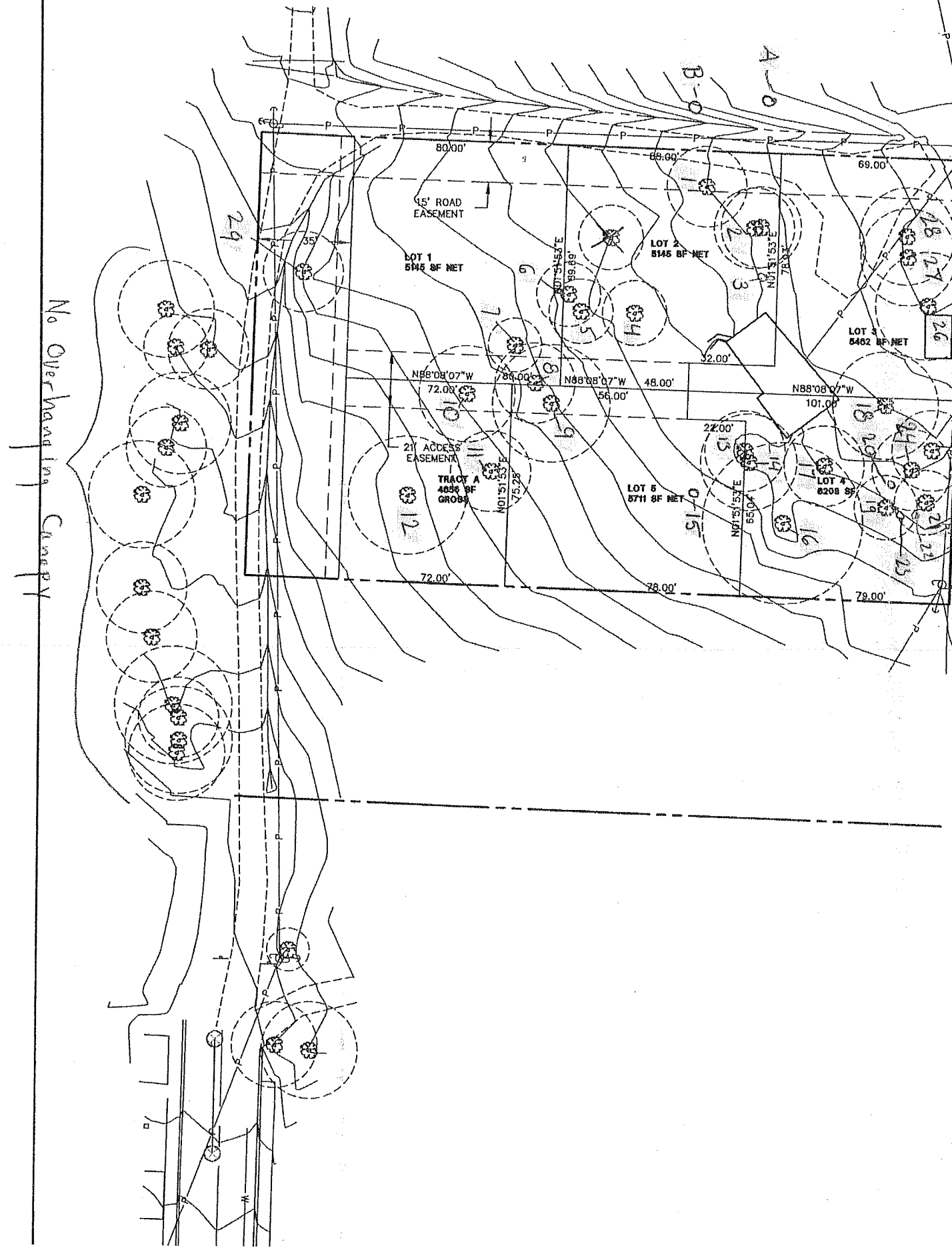
Tree #	Common/Scientific Name	DSH (inches)	Health Condition	Structural Condition	Limits of Disturbance	Drip Line Radius (ft)	Viability	Risk Rating	Proposed Action	Credits	Notes
1	*Douglas-fir/ Psuedotsuga menziesii*	31.2	Good	Good	Trunk	20	*Possible	Low	Remove/ Grading	0	Tip dieback in lowe canopy, Phaeolus schweinitzii fruiting body at base; ***Advanced test for decay if proposed for retention**
2	*Ponderosa pine/ Pinus ponderosa*	36.3	Fair	Fair	Trunk	15	NO	Low	Remove/ Health	0	Tree appears to be in decline; Two trunks with the smaller being girdled by a wire that will likely lead to death; sparse canopy due to foliar disease; 31+19 DSH trunks
3	*English holly/ Ilex aquifolium*	10.9	Good	Fair	Trunk	7	NO	Low	Remove/ Species	0	Invasive species; 4+5+5+7.3 DSH trunks
4	*Norway maple/ Acer platanoides*	8.2	Fair	Fair	Trunk	10	Yes	Low	Remove/ Grading	0	canker at base may be early symptom of Verticillium wilt, monitor foliage in spring
5	*Douglas-fir/ Psuedotsuga menziesii*	24.5	Good	Fair	Trunk	18	NO	Low	Remove/ Structure	0	Trunk leans to the north and has corrected, failed at roots in the past and has been leaning on tree 6, can only be retained if 6 is retained
6	*Douglas-fir/ Psuedotsuga menziesii*	20.5	Good	Good	Drip line	18	Yes*	Low	Retain	5	tip dieback on some branches, root wads of trees that previously failed near the base of this tree; ***suggest advanced decay testing if tree is retained to determine if there are any internal issues at the base of the tree.**
7	*Douglas-fir/ Psuedotsuga menziesii*	26.5	Good	Good	Trunk	15	NO	Low	Remove/ Access	0	Becoming suppressed by trees 7 and 9, large fruiting body from Phaeolus schweinitzii at the base, will be compromised by access road; poor candidate for retention
8	*Douglas-fir/ Psuedotsuga menziesii*	17.5	Fair	Fair	Trunk	12	NO	Low	Remove/ Access	0	Phaeolus schweinitzii at base
9	*Douglas-fir/ Psuedotsuga menziesii*	39.0	Fair	Good	Trunk	22	Yes	Low	Remove/ Access	0	
10	*Douglas-fir/ Psuedotsuga menziesii*	25.0	Good	Good	Trunk	16	Yes	Low	Remove/ Access	0	
11	*Douglas-fir/ Psuedotsuga menziesii*	26.0	Good	Good	Drip line east, 24 ft in other directions	12	Yes	Low	Retain	9	
12	*Douglas-fir/ Psuedotsuga menziesii*	33.0	Good	Good	Drip line	20	Yes	Low	Retain	12.5	
13	*Western Red cedar/ Thuja plicata*	26.0	Fair	Good	Trunk	20	Yes	Low	Remove/ Grading	0	Canopy sparse and off color; tree roots will be compromised by access to site
14	*Western Red cedar/ Thuja plicata*	29.0	Fair	Good	Trunk	20	Yes	Low	Remove/ Grading	0	Canopy sparse and off color; tree roots will be compromised by access to site
15	*Willow species/ Salix sp.*	11.0	Poor	Poor	Trunk	6	NO	Low	Remove/ Health	0	Split at base with extensive decay, multiple part failure; trunks measured 4+5+9 DSH
16	*Big leaf maple/ Acer macrophyllum*	31.0	Good	Good	Trunk	25	Yes	Low	Remove/ Grading	0	Large surface roots, low density moderate size dead wood, crown clean if retained
17	*Big leaf maple/ Acer macrophyllum*	14.9	Fair	Fair	Trunk	18	Yes	Low	Remove/ Grading	0	slow growth rate, smaller lead previously failed, disturbance in the root zone; trunks measured 10+11 DSH

Tree Solutions Inc
Consulting Arborists

Artoush Construction - Table of Trees
11622 80th Ave. NE, Kirkland

Date of Inventory: January 17, 2014
Table Prepared: January 24, 2014

18	*Big leaf maple/ Acer macrophyllum*	29.0	Fair	Poor	Trunk	23	NO	Moderate	Remove/ Structure	0	Large tearout in lower trunk with cavity and decay, wounds on multiple sides of the tree, verticillium wilt, moderate density of moderate size dead wood
19	*Douglas-fir/ Psuedotsuga menziesii*	32.0	Good	Good	Trunk	21	Yes	Low	Remove/ Grading	0	
20	*Big leaf maple/ Acer macrophyllum*	6.0	Good	Good	Trunk	12	Yes	Low	Remove/ Grading	0	Intermediate canopy
21	*Western Red cedar/ Thuja plicata*	16.0	Good	Fair	12 feet from trunk	8	Yes	Low	Retain	4	Forks at five feet above grade, narrow angle of attachment with included bark
22	*Big leaf maple/ Acer macrophyllum*	6.5	Good	Fair	Trunk	8	NO	Low	Remove/ Structure	0	
23	*Big leaf maple/ Acer macrophyllum*	7.6	Good	Fair	Trunk	8	NO	Low	Remove/ Structure	0	Trunks measured 3+7 DSH
24	*Douglas-fir/ Psuedotsuga menziesii*	26.0	Good	Good	Trunk	22	Yes	Low	Remove/ Grading	0	
25	*Bitter cherry/ Prunus emarginatta*	9.7	Fair	Fair	Trunk	12	Yes	Low	Remove/ Grading	0	Tall trunks with narrow taper, trunks measure 2+3.5+6+6.5 DSH
26	*Western Red cedar/ Thuja plicata*	~48	Good	Good	Trunk	25	Yes	Low	Remove/ Grading	0	debris around the base limited access to trunk
27	*Western Red cedar/ Thuja plicata*	28.0	Good	Good	Trunk	18	Yes	Low	Remove/ Grading	0	debris around the base limited access to trunk
28	*Western Red cedar/ Thuja plicata*	28.0	Good	Good	Trunk	18	Yes	Low	Remove/ Grading	0	debris around the base limited access to trunk
29	*Douglas-fir/ Psuedotsuga menziesii*	27.0	Good	Good	Trunk	18	Yes	Low	Remove/ Access	0	Power line below canopy, difficult access due to black berry
									Total Tree Credits	30.5	
						Adjacent Site					
A	*Pacific madrone/ Arbutus menziesii*	~15	Good	Good	Drip line	23	Yes	Low	Retain	0	tree trunk is approximately 20 feet from the property line
B	*Douglas-fir/ Psuedotsuga menziesii*	~20	Good	Good	Drip line	18	Yes	Low	Retain	0	Tree trunk is approximately 15 feet from the property line



SCALE: 1"=30'

30 0 30 60

MERIDIAN: LAMBERT GRID NORTH
WASHINGTON STATE COORDINATE SYSTEM
OF NAD 83/91 – NORTH ZONE

AVERAGE COMBINED FACTOR = 0.9999589
ALL DISTANCES SHOWN HEREON ARE GRID
DISTANCE UNLESS OTHERWISE NOTED.

LEGEND:

- = FOUND SECTION CORNER
- = CALCULATED SECTION CORNER
- = FOUND CONCRETE MONUMENT WITH BRASS CAP IN CASE
- = SET 1/2" REBAR & CAP P.L.S. # 16915
- = SET MAG NAIL AND BRASS FLASHER
- = FOUND REBAR OR OTHER PROPERTY CORNER MARKER
- SB = BUILDING SETBACK
- = TREE TYPE/DIA./DRIP LINE DIA.

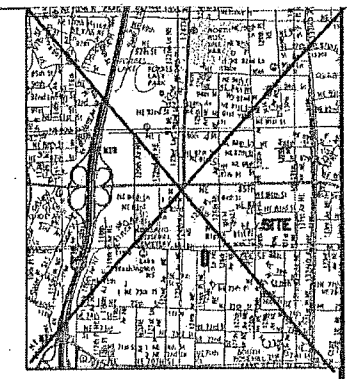
DEVELOPER/AGENT:
ARTOUSH FANAIYAN
9517 132ND AVW NE
KIRKLAND, WA 98033

PROPERTY ADDRESS
11622 80TH AVE NE.
KIRKLAND, WA 98033

SURVEYOR/ENGINEER
EASTSIDE CONSULTANTS, INC.
1320 NW MALL STREET, STE B
ISSAQUAH, WA 98027

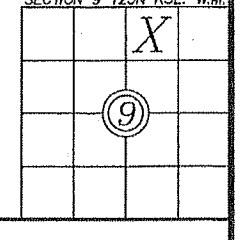
ZONING
RSA 6

TAX ACCOUNT NO.
2526049024



VICINITY MAP
NTS

LOCATION INDEX:
SECTION 9 T25N R5E. W.M.



RICHARD R. KITZ
STATE OF WASHINGTON
16915
REGISTERED
PROFESSIONAL LAND SURVEYOR

PRELIMINARY

EASTSIDE CONSULTANTS, INC.
ENGINEERS-SURVEYORS
1320 N.W. MALL ST., SUITE B
ISSAQUAH, WASHINGTON 98027
PHONE: (425)392-5351
FAX: (425)392-4676

CITY OF KIRKLAND
SHORT PLAT No.
PORTION NW1/4, NE1/4 SEC. 9, T25N R5E.

DWN BY	DATE	JOB NO.
S.KITZ	6/13	13050
CHKD BY	SCALE	SHEET

T.I.R. Section VII: Basin & Community Planning Areas

None

T.I.R. Section VIII: Other Permits

T.I.R. Section IX: Erosion/Sedimentation Control Design

A TESC and SWPPP Plan is included with the project engineering plans. A SWPPP has been prepared and a Notice of Intent has been filed with the Department of Ecology

Sediment Trap Design

Q_2 for basin = 0.162 cfs

SA Required (North Trap):
Required SA = $2*Q_2/0.00096$
Q_2 = 0.162 cfs
Required SA = 338 sf

SA Provided:

Provide a minimum 20'x20' trap
Provided SA = 400 sf > 338 sf **o.k.**

T.I.R. Section X: Improvement Evaluation Package, Facilities Summaries, and Declaration of Covenant

PUBLIC WORKS DEPARTMENT
IMPROVEMENT EVALUATION SUMMARY

Type of project:	[X] Subdivision	[ ] Commercial	[ ] Single Family
	[ ] Multi-Family	[ ] Muni/Gov't	[ ] Miscellaneous

Project Name: ARTOUSH SHORT PLAT

Project Location: 11622 80TH AVE NE, KIRKLAND

Permit No.:

Contact: RON FREDERIKSEN **Phone No.:** 425-392-5351

2012 Edition

**** FOR CITY USE ONLY ****

1. Total Value of Public Work Required:	$512,919
2. Review & Inspection Fee * :	$51,292
3. Total Value of Private Work Required:	$6,440
4. Performance Security (Recording) ** :	$793,321
5. Maintenance Security Value:	$66,679

*The Review and Inspection Fee is 10% of Total Value of Public Work Required (column 1), plus value of private storm (column 2, #5)

** 17.5% of the total construction value will be added to the Performance Security for Mobilization, Traffic Control, Surveying, Engineering, and

CONSTR. STORM DRAINAGE - PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
Silt Fence, Installed	LF	608	$6.00	$3,648.00
Grading for Drainage Swales	LF	228	$6.00	$1,368.00
Sod for Drainage Swales	SY		$6.00	$0.00
Hydroseeding	SY	500	$3.00	$1,500.00
Construction Entrance	EA	1	$1,500.00	$1,500.00
Inlet Protection	EA	3	$80.00	$240.00
				$0.00

Construction Storm Drainage - Total	$8,256.00

CLEARING AND GRADING - PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
Half-Street Improvements	LF		$12.00	$0.00
Full Street Improvements	LF	551	$24.00	$13,224.00
				$0.00
				$0.00

Clearing and Grading - Total	$13,224.00

WATER SYSTEM - PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
Water service - 3/4" to 1"	LS		$1,600.00	$0.00
Water service - 1 1/2" to 2"	LS		$3,400.00	$0.00
4" Pipe	LF		$65.00	$0.00
6" Pipe	LF		$70.00	$0.00
8" Pipe	LF		$100.00	$0.00
2" Gate Valve (G.V.)	EA		$300.00	$0.00
4" G.V.	EA		$600.00	$0.00
6" G.V.	EA		$800.00	$0.00
8" G.V.	EA		$1,000.00	$0.00
Connection to ex. Main	EA		$4,500.00	$0.00
Fire Hydrant Assembly	EA		$3,600.00	$0.00
2" Blow Off	EA		$2,200.00	$0.00
Air and Vacuum Assembly	EA		$2,500.00	$0.00
Valve Marker Post	EA		$200.00	$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00

Water System - Total	$0.00

SANITARY SEWER SYSTEM- PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
6" PVC pipe	LF		$100.00	$0.00
8" PVC pipe	LF		$120.00	$0.00
12" PVC pipe	LF		$150.00	$0.00
Extra Depth Excav. (over 12' deep)	FT*LF		$8.00	$0.00
Manhole, 48"	EA		$3,600.00	$0.00
Manhole, 54" (for drop MH's only)	EA		$4,000.00	$0.00
Internal Drop Structure	EA		$970.00	$0.00
Rechannel Existing MH	EA		$2,660.00	$0.00
Cast Iron Clean-Out Cover	EA		$160.00	$0.00
Clean Out Assembly	EA		$400.00	$0.00
				$0.00
				$0.00

Sanitary Sewer System - Total	$0.00

STORM DRAINAGE SYSTEM - PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
8" Pipe	LF	28	$40.00	$1,120.00
12" Pipe	LF	805	$50.00	$40,250.00
18" Pipe	LF		$60.00	$0.00
24" Pipe	LF		$75.00	$0.00
30" Pipe	LF		$80.00	$0.00
36" Pipe	LF		$90.00	$0.00
48" Pipe	LF		$100.00	$0.00
Detention Pipe	LF	50	$250.00	$12,500.00
Detention Vault	LS	1	125000	$125,000.00
Extra Depth Excav. (over 12' deep)	FT*LF		$6.00	$0.00
Curb Inlet	EA		$880.00	$0.00
Type I Catch Basin	EA	8	$1,200.00	$9,600.00
Type IL Catch Basin	EA		$1,400.00	$0.00
Type II CB - 48"	EA	9	$3,900.00	$35,100.00
Type II CB - 54"	EA		$4,000.00	$0.00
CMP Access Riser	EA		$1,600.00	$0.00
Connection to Existing CB	EA	1	$1,100.00	$1,100.00
Restrictor/Pollution Control - 8"	EA		$900.00	$0.00
Restrictor/Pollution Control - 12"	EA	1	$900.00	$900.00
Pollution Control Tee	EA		$500.00	$0.00
Debris Barrier	EA		$250.00	$0.00
Biofiltration Swale	LF		$15.00	$0.00
Contech StormFilter	EA	1	17000	$17,000.00
				$0.00

Storm Drainage System - Total	$242,570.00

Low Impact Development - Public Storm Drainage

Item	Unit	Quantity	Unit Price	Amount
Pervious Concrete (5' wide)	LF		$60.00	$0.00
Porous Asphalt	SY		$80.00	$0.00
Rain Gardens	SY		$120.00	$0.00
Infiltration Trench (10 ft)	EA		$300.00	$0.00
Porous Pavers	SY		$50.00	$0.00
				$0.00
				$0.00

LID Drainage (Public) - Total	$0.00

PAVING - PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
AC Pavement Patching	SY		$40.00	$0.00
4" Crushed Rock	SY	1366	$10.00	$13,660.00
Bank Run Gravel: 3" minus, in place	CY		$30.00	$0.00
4" Asphalt Treated Base (ATB)	SY	1366	$35.00	$47,810.00
2" Class B Asphalt Pavement	SY	1366	$20.00	$27,320.00
Saw Cut AC Pavement	LF	28	$2.00	$56.00
Cold Planing (Grinding) & Hauling	SY	174	$12.00	$2,088.00
Adjust Existing Utility	EA		$350.00	$0.00
3" Class B Asphalt Pavement	SY		$30.00	$0.00
				$0.00

Paving - Total	$90,934.00

CURB AND GUTTER - PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
Concrete Extruded Curb	LF		$8.00	$0.00
Asphalt Extruded Curb	LF		$8.00	$0.00
Conc. Curb & Gutter, Type A	LF	871	$35.00	$30,485.00
				$0.00
				$0.00

Curb and Gutter - Total	$30,485.00

SIDEWALKS - PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
5' Concrete Sidewalk	LF	586	$30.00	$17,580.00
Concrete Sidewalk (other than 5')	SF		$6.00	$0.00
5' Concrete Driveway	LF	60	$35.00	$2,100.00
Asphalt Walkways, Class B	SY		$18.00	$0.00
Wheel Chair Ramps	EA	2	$1,400.00	$2,800.00
Steel Pipe Handrail	LF		$80.00	$0.00
Vinyl Fencing	LF		$40.00	$0.00
Speed Hump Restoration	EA		$1,500.00	$0.00
5' Pervious Sidewalk	LF		$40.00	$0.00
				$0.00
				$0.00

Sidewalks - Total	$22,480.00

LANDSCAPING - PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
Street Trees	EA	3	$450.00	$1,350.00
Sod	SY		$10.00	$0.00
Rockery Wall	SY		$400.00	$0.00
				$0.00
				$0.00

Landscaping - Total	$1,350.00

MISCELLANEOUS - PUBLIC WORK

Item	Unit	Quantity	Unit Price	Amount
Monuments	EA	1	$380.00	$380.00
Street Signs	EA	2	$220.00	$440.00
Pavement Marking	LF		$1.00	$0.00
Mailbox Structure	EA	1	$700.00	$700.00
Type III Fixed Barricade	EA		$400.00	$0.00
Bollards	EA	3	$700.00	$2,100.00
Thermoplastic Crosswalk Markings	LF		$2.85 or $500 min	
Street Light	EA		$4,000.00	$0.00
PED Light	EA		$5,000.00	$0.00
				$0.00
				$0.00

Miscellaneous - Total	$3,620.00

PAVING - PRIVATE WORK

Item	Unit	Quantity	Unit Price	Amount
4" Crushed Rock	SY		$10.00	$0.00
4" Asphalt Treated Base (ATB)	SY		$35.00	$0.00
2" Class B Asphalt Pavement	SY		$20.00	$0.00
				$0.00
				$0.00

Paving - Total	$0.00

MISCELLANEOUS - PRIVATE WORK

Item	Unit	Quantity	Unit Price	Amount
Property Corners	EA	20	$300.00	$6,000.00
Street Signs	EA	2	$220.00	$440.00
Fire Lane Marking	LF		$2.00	$0.00
UG Utilities to Existing House	EA		$2,500.00	$0.00
Tight-Line ex. House Roof Drains	LF		$15.00	$0.00
				$0.00
				$0.00

Miscellaneous - Total	$6,440.00

STORM DRAINAGE SYSTEM - PRIVATE WORK

Item	Unit	Quantity	Unit Price	Amount
4" - 6" Pipe	LF		$15.00	$0.00
8" Pipe	LF		$40.00	$0.00
12" Pipe	LF		$50.00	$0.00
18" Pipe	LF		$60.00	$0.00
24" Pipe	LF		$75.00	$0.00
Detention Pipe	LF		$250.00	$0.00
Detention Vault	LS		100000	0
Yard Basin	EA		$265.00	$0.00
Curb Inlet	EA		$880.00	$0.00
Type I Catch Basin	EA		$1,200.00	$0.00
Type IL Catch Basin	EA		$1,400.00	$0.00
Type II CB - 48"	EA		$3,900.00	$0.00
Type II CB - 54"	EA		$4,000.00	$0.00
CMP Access Riser	EA		$1,600.00	$0.00
Connection to Existing CB	EA		$1,100.00	$0.00
Restrictor/Pollution Control - 8"	EA		$900.00	$0.00
Restrictor/Pollution Control - 12"	EA		$900.00	$0.00
Pollution Control Tee	EA		$500.00	$0.00
Debris Barrier	EA		$250.00	$0.00
Biofiltration Swale	LF		$15.00	$0.00
				$0.00
				$0.00

Storm Drainage System - Total	$0.00

Low Impact Development - Private Storm Drainage

Item	Unit	Quantity	Unit Price	Amount
Pervious Concrete (5' wide)	LF		$60.00	$0.00
Porous Asphalt	SY		$80.00	$0.00
Rain Gardens	SY		$120.00	$0.00
Infiltration Trench (10 ft)	EA		$300.00	$0.00
Porous Pavers	SY		$50.00	$0.00
				$0.00
				$0.00

LID Drainage (Private) - Total	$0.00

Other Agency Improvements

Item	Unit	Quantity	Unit Price	Amount
Northshore Utility District	LS	100000		$0.00
Woodinville Water District	LS			$0.00
Puget Sound Energy	LS	20000		$0.00
				$0.00
				$0.00

Other Agency - Total	$0.00

IMPROVEMENT EVALUATION

This form must be completed by the developer (or representative) and shall inclu work required by the official Notice of Approval or conditions on the permit. Quantity take-offs shall be from documents approved by the City of Kirkland.

PUBLIC WORK will be owned and maintained by the City after the appropriate maintenance period and will be subject to review and inspection fees per KMC Section 5.74.040. For subdivision work, this will include the on-site detention sys

PRIVATE WORK will be owned and maintained by the property owner(s), and is subject to the above fees. For subdivisions, include the remainder of the on-site drainage system (excluding the detention system) and any easement road pavin all other types of projects, include the on-site storm drainage system only.

	Column 1	*Column 2*	*Column 3*
Items Required	**Value of Public Work**	**Value of Private Work**	**Total Value**
1. Constr. Storm Drainage	8256		8256
2. Clearing and Grading	13224		13224
3. Water System	0		0
4. Sanitary Sewer System	0		0
5. Storm Drainage System	242570	0	242570
6. LID - Storm Drainage	0	0	0
7. Paving	90934	0	90934
8. Curb and Gutter	30485		30485
9. Sidewalks	22480		22480
10. Landscaping	1350		1350
11. Miscellaneous	3620	6440	10060
12. Other Agency Improvements	100000		100000
13			0
TOTALS	$512,919.00	$6,440.00	$519,359.00

I hereby certify the above to be an accurate representation of the required construction for the above referenced project.

Agent/Owner	Date
City	Date

T.I.R. Section XI: Maintenance & Operations Manual

NO. 3 – DETENTION TANKS AND VAULTS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash and debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Tank or Vault Storage Area	Trash and debris	Any trash and debris accumulated in vault or tank (includes floatables and non-floatables).	No trash or debris in vault.
	Sediment accumulation	Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than ½ length of tank.	All sediment removed from storage area.
Tank Structure	Plugged air vent	Any blockage of the vent.	Tank or vault freely vents.
	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank repaired or replaced to design.
	Gaps between sections, damaged joints or cracks or tears in wall	A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.	No water or soil entering tank through joints or walls.
Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.
Inlet/Outlet Pipes	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 3 – DETENTION TANKS AND VAULTS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open manhole requires immediate maintenance.**	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the structure opening or is blocking capacity of the structure by more than 10%.	No Trash or debris blocking or potentially blocking entrance to structure.
		Trash or debris in the structure that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the structure.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Sediment	Sediment exceeds 60% of the depth from the bottom of the structure to the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section or is within 6 inches of the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section.	Sump of structure contains no sediment.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering structure through cracks, or maintenance person judges that structure is unsound.	Structure is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering structure through cracks.	No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Structure has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Ladder rungs missing or unsafe	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
FROP-T Section	Damage	T section is not securely attached to structure wall and outlet pipe structure should support at least 1,000 lbs of up or down pressure.	T section securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight or show signs of deteriorated grout.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes—other than designed holes—in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or missing	Cleanout gate is missing.	Replace cleanout gate.

NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		Cleanout gate is not watertight.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
Orifice Plate	Damaged or missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
	Deformed or damaged lip	Lip of overflow pipe is bent or deformed.	Overflow pipe does not allow overflow at an elevation lower than design
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Metal Grates (If Applicable)	Unsafe grate opening	Grate with opening wider than $^{7}/_{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance.**	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $^{7}/_{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate. **Any open structure requires urgent maintenance.**	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance.**	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 6 – CONVEYANCE PIPES AND DITCHES

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

NO. 17 – WETVAULT

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash and debris	Trash and debris accumulated on facility site.	Trash and debris removed from facility site.
Treatment Area	Trash and debris	Any trash and debris accumulated in vault (includes floatables and non-floatables).	No trash or debris in vault.
	Sediment accumulation	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches.	No sediment in vault.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks, vault does not retain water or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.
	Baffles damaged	Baffles corroding, cracking, warping and/or showing signs of failure or baffle cannot be removed.	Repair or replace baffles or walls to specifications.
	Ventilation	Ventilation area blocked or plugged.	No reduction of ventilation area exists.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Access Manhole	Access cover/lid damaged or difficult to open	Access cover/lid cannot be easily opened by one person. Corrosion/deformation of cover/lid.	Access cover/lid can be opened by one person.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Access doors/plate has gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.