INSIGHT ENGINEERING CO.

STORMWATER SITE PLAN
For
Marysville Ford Pro Elite

Prepared for
City of Marysville
80 Columbia Ave.
Marysville, WA 98270

Project Site Location:
16100 Smokey Point Blvd.
Marysville, WA 98271

Applicant:
Kendall Auto Group
8854 W. Emerald St, Ste. 260
Boise, ID 83704

Contact:
IECO
P.O. Box 1478
Everett, WA 98206
425-303-9363

Tax Id: 31052900400600
IECO Project: 21-1131

Certified Erosion and Sedimentation Control Lead:
To be named by contractor

Stormwater Site Plan Prepared By:

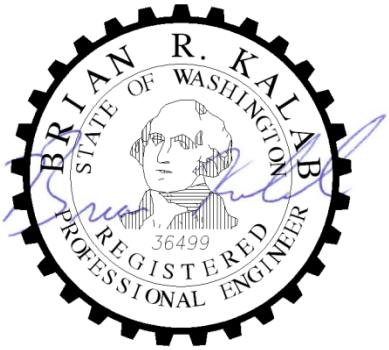
Ryan J. Korte

Stormwater Site Plan Preparation Date:

October 12th, 2022

Approximate Construction Date:

January 1st, 2024



10/13/2023

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info@insightengineering.net

TABLE OF CONTENTS

Figures

Acronyms and Abbreviations

BMP	Best Management Practices
DOE	Department of Ecology
ESC	Erosion and Sediment Control
IECO	Insight Engineering Company
MR	Minimum Requirement
SWPPP	Stormwater Pollution Prevention Plan
SWMMWW	Stormwater Management Manual for Western Washington
TESC	Temporary Erosion and Sediment Control
WWHM	Western Washington Hydrology Model

1.0 Executive Summary

The proposed project ***Marysville Ford Pro Elite*** is located at 16100 Smokey Point BLVD in City of Marysville, Washington. More generally, the site is located within the NE ¼ of Section 29, Township 31 North, and Range 5 East of the Willamette Meridian. Please refer to the Vicinity Map attached later in the section. This report follows City of Marysville Drainage and Erosion Control Design Standards (April 1999, revised December 2016) and the 2019 SWMMWW.

The site contains 4.32 acres. The existing site is undeveloped overgrown brush and grass. No trees are present onsite. Based on the topography the site is flat and contains one drainage basin that drains to an existing storm system along the south property line. Per NRCS survey of Snohomish County, the project site contains Custer soils that have a hydrologic classification of Type "D". Please refer to the soils map and descriptions attached later in this report for more details. Refer to section 4 of this report for the existing basin summary.

The project proposal is to develop the site by constructing a commercial truck service center and parking lot. The total clearing area is 4.32 acres. The new impervious area onsite is 159,969 SF.

Per conversation with the City minimum requirements #1-5 shall apply for this project. Minimum Requirements #6-9 are taken care of through the existing storm system on site that flows to a regional detention pond that will provide the site flow control and water quality. See Section 1.2 for Minimum Requirements Summary included later in this report.

Onsite stormwater management was evaluated using List #1 per section 2.5.5 of the SWMMWW. Full dispersion was considered infeasible due to a lack of native vegetation, Permeable pavement, rain gardens, and bioretention have been deemed infeasible due to high groundwater levels. Groundwater levels have been observed as shallow as 2-feet below grade. Please refer to the geotechnical report in section 5B for more details. Sheet flow dispersion is also infeasible as the required vegetated flow paths could not be met due to the large impervious footprint of the project. BMP T5.13 will be used for all pervious areas. Pervious areas will infiltrate

into the underlaying soils. Impervious areas will be conveyed to the existing stormwater system which will provide flow control and water quality. The downstream public channel should not experience any future flooding problems as the system has been designed to handle the impervious development area.

VICINITY MAP

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Figure 1 -Vicinity Map
Marysville Ford Pro Elite
Marysville, Washington

SCALE: NTS	**DATE:** 10/13/23	**JOB #:** 21-1131
BY: RJK	**FILE NAME:** 21-1131 /doc/drainage report	

1.2 Minimum Requirements Summary

MR : Minimum Requirement

SWPPP : Stormwater Pollution Prevention Plan

MR #1 Stormwater Site Plan Narrative: This report follows City of Marysville Drainage and Erosion Control Design Standards (April 1999, revised December 2016) and the 2019 SWMMWW.

MR #2 SWPPP Narrative: A SWPPP has been included in section 5 of this report.

MR #3 Water Pollution Source Control for New Development: No source control pollutants pertain to the proposed project, therefore no BMP's are required for the proposed project.

MR #4 Preservation of Natural Drainage Systems and Outfalls: The runoff from the storage lot will be connected to the existing drainage system on-site to continue following the natural drainage flow path.

MR #5 Onsite Stormwater Management: Onsite stormwater management was evaluated using List #1 per section 2.5.5 of the SWMMWW. Full dispersion was considered infeasible due to a lack of native vegetation, Permeable pavement, rain gardens, and bioretention have been deemed infeasible due to high groundwater levels. Groundwater levels have been observed as shallow as 2-feet below grade. Please refer to the geotechnical report in section 5B for more details. Sheet flow dispersion is also infeasible as the required vegetated flow paths could not be met due to the large impervious footprint of the project. BMP T5.13 will be used for all pervious areas. Pervious areas will infiltrate into the underlaying soils.

2.0 Existing Conditions

The proposed project ***Marysville Ford Pro*** Elite is located at 16100 Smokey Point BLVD in City of Marysville, Washington. More generally, the site is located within the NE ¼ of Section 29, Township 31 North, and Range 5 East of the Willamette Meridian. Please refer to the Vicinity Map attached later in the section.

The existing site is undeveloped, overgrown brush and grass. No trees are present onsite. Based on the topography the site is flat and contains one drainage basin that drains to an existing storm system along the south property line. Per NRCS survey of Snohomish County, the project site contains Custer soils that have a hydrologic classification of Type "D". Please refer to the soils map and descriptions attached later in this report for more details. Refer to section 4 of this report for the existing basin summary.

SOIL MAP

SOILS LEGEND

13- Custer fine sandy loam

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Figure 2 - Soil Map
Marysville Ford Pro Elite
Marysville, Washington

SCALE: NONE	**DATE:** 10/13/23	**JOB #:** 21-1131
BY: RJK	**FILE NAME:** 21-1131 \docs\drainage report	

Snohomish County Area, Washington

13—Custer fine sandy loam

Map Unit Setting

- *National map unit symbol:* 2hy0
- *Elevation:* 0 to 150 feet
- *Mean annual precipitation:* 32 to 50 inches
- *Mean annual air temperature:* 48 to 50 degrees F
- *Frost-free period:* 150 to 200 days
- *Farmland classification:* Prime farmland if irrigated and drained

Map Unit Composition

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

Description of Custer, Undrained

Setting

- *Landform:* Outwash plains
- *Parent material:* Glacial outwash

Typical profile

- *H1 - 0 to 9 inches:* fine sandy loam
- *H2 - 9 to 35 inches:* sand
- *H3 - 35 to 60 inches:* sand

Properties and qualities

- *Slope:* 0 to 2 percent
- *Depth to restrictive feature:* 20 to 40 inches to strongly contrasting textural stratification
- *Natural drainage class:* Poorly drained
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
- *Depth to water table:* About 0 to 12 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- *Available water storage in profile:* Low (about 3.1 inches)

Interpretive groups

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

Minor Components

Norma, undrained

- *Percent of map unit:* 5 percent
- *Landform:* Depressions

- *Hydric soil rating:* Yes

Custer, drained

- *Percent of map unit:* 5 percent
- *Landform:* Depressions
- *Hydric soil rating:* Yes

Indianola

- *Percent of map unit:* 5 percent
- *Hydric soil rating:* No

3.0 Offsite Analysis

The site contains 4.32 acres. The existing site is undeveloped overgrown brush and grass. No trees are present onsite. No visible on-site drainage problems were observed at the time of field investigations.

3.1 Upstream Analysis

Based on the site reconnaissance and the topographic survey of the site, the upstream flows appear to be minimal.

3.2 Downstream Analysis

The entire site is generally flat and contains one drainage basin that drains to an existing 24" storm system along the south property line that flows to the frontage. At the frontage the flow crosses to the east side of Smokey Point Blvd via a 30-inch Corrugated Polyethylene Pipe (CPP). The flow then continues south along Smokey Point Blvd for 325-feet through 30-inch CPP before transitioning to 36-inch CPP and continuing south for approximately 1060-feet. The flow then turns east at 156th St NW flowing through 36" High Density Polyethylene Pipe (HDPE) for approximately 1,240-feet to 39th Ave NE. The flow then follows the west side of 39th for about 1,360-feet via 42-inch concrete pipe. The flow then turns east along 152nd St NE for about 625-feet before crossing and continuing south through an undeveloped parcel for approximately 1,350-feet to the regional detention pond. This is where the downstream analysis was completed. There did not appear to be any restrictions or erosion problems within this distance.

DOWNSTREAM ANALYSIS MAP

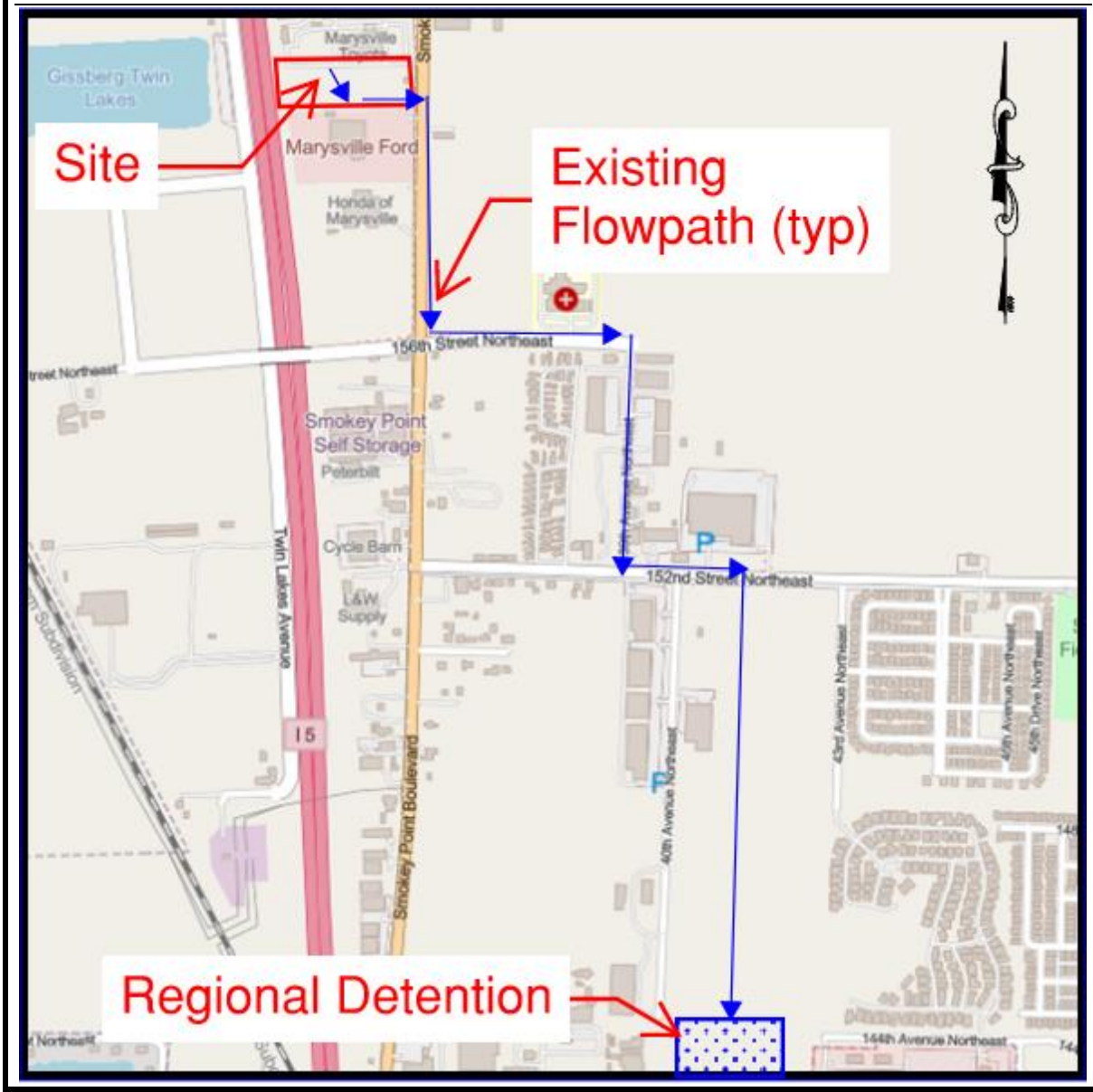

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Figure 3 – Downstream Analysis
Marysville Ford Pro Elite
Marysville, Washington

SCALE: NONE	**DATE:** 10/13/23	**JOB #:** 21-1131
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4.0 Permanent Stormwater Control Plan

The proposed project ***Marysville Ford Pro*** Elite is located at 16100 Smokey Point BLVD in City of Marysville, Washington. More generally, the site is located within the NE ¼ of Section 29, Township 31 North, and Range 5 East of the Willamette Meridian. Please refer to the Vicinity Map attached later in the section. Based on the topography the site is flat and contains one drainage basin that drains to an existing storm system along the south property line. Per NRCS survey of Snohomish County, the project site contains Custer soils that have a hydrologic classification of Type "D".

The project proposal is to develop the site by constructing a commercial truck service center and parking lot. The total clearing area is 4.32 acres. The new impervious area onsite is 159,969 SF.

Per conversation with the City minimum requirements #1-5 shall apply for this project. Minimum Requirements #6-9 are taken care of through the existing storm system on site that flows to a regional detention pond that will provide the site flow control and water quality. See Section 1.2 for Minimum Requirements Summary included later in this report.

Onsite stormwater management was evaluated using List #1 per section 2.5.5 of the SWMMWW. Full dispersion was considered infeasible due to a lack of native vegetation, Permeable pavement, rain gardens, and bioretention have been deemed infeasible due to high groundwater levels. Groundwater levels have been observed as shallow as 2-feet below grade. Please refer to the geotechnical report in section 5B for more details. Sheet flow dispersion is also infeasible as the required vegetated flow paths could not be met due to the large impervious footprint of the project. BMP T5.13 will be used for all pervious areas. Pervious areas will infiltrate into the underlaying soils. Impervious areas will be conveyed to the existing stormwater system which will provide flow control and water quality. The downstream public channel should not experience any future flooding problems as the system has been designed to handle the impervious development area.

4.1 Existing Basin Summary

Site Area = 4.32 Acres

Existing ground cover conditions consist of overgrown brush and grass. No trees are present onsite.

4.2 Developed Basin Summary

Site Area = 4.32 Acres

Site Impervious:

Roof	= 46,168 SF (1.06 acres)
Parking Lot	= 113,801 SF (2.61 acres)
Total Impervious	= 159,969 SF (3.67 acres)

Permeable Area (Landscaping)**:** = 0.69 acres

END OF LIMITS OF LANDSCAPING 1' SOUTH OF LINE

"TOYOTA" BUSINESS SIGN 2.9' NORTH OF LINE

SE1/4 OF SECTION 29,

LIMITS OF LANDSCAPING, 0.2' SOUTH OF LINE

LIMITS OF MOWING

RECOVERED 1/2" REBAR & CAP "GOLDSMITH 28070"

186.13'

LIMITS OF MOWING

5' WIRE FENCE 18' SOUTH OF LINE

FENCE POST

FENCE POST

INTERSTATE 5

S5° 45' 35"E 239.05'

FENCE POST

FENCE POST

FENCE POST

FENCE POST

SDMH 48"CONC RIM=113.78' IE=108.58'(24"PVC-E)

FENCE POST

RECOVERED 1/2" REBAR & CAP "H.G.G. PEL _6422"

END 6' CHAIN LINK FENCE, 0.7' SOUTH OF LINE

"FORD" BUSINESS SIGN CONCRETE BASE

6' CHAIN LINK FENCE, ON LINE

156.05'

S89° 59' 59"E

777.11'

(TBR) (TBR) (TBR) (TBR)

ASPHALT

SDMH 48"CONC RIM=113.88' IE=108.21'(24"PVC-W) IE=108.16'(24"PVC-E)

PAY STATION

GAS REGULATOR

CAR WASH BUILDING

ARBORVITAE HEDGE

CONCRETE CAR VACUUM PAD

6' CHAIN LINK FENCE, 0.8' NORTH OF LINE

UTILITY VAULT

NO EASEMENT IDENTIFIED IN TITLE FOR STORM DRAIN LINE

EX. BASIN (XX AC)

24" SD

24" SD

24" SD

30" SD

"CANTEX" UTILITY VAULT

PPA PIN FLAG

PPA PIN FLAG

PPA PIN FLAG

8" W

8" W

8" W

SDMH 48"CONC ~~RIM=113.92'~~ **(CONTRACTOR TO RAISE RIM TO 115.5)** IE=107.67'(24"PVC-W) IE=107.62'(24"PVC-E)

FIRE HYDRANT LOWER FLANGE ELEV=114.67'

SDMH 48"CONC ~~RIM=114.92'~~ **(CONTRACTOR TO RAISE RIM TO 114.95)** IE=107.12'(24"PVC-W) IE=107.12'(30"PVC-E)

LIMITS OF LANDCAPING & END OF 6' CHAIN LINK FENCE, 0.6' NORTH OF LINE

(TO BE RELOCATED TO PLANTER)

6' CHAIN LINK FENCE GATE **(TBR)**

S87° 48' 04"W

S LINE OF THE NE1/4 OF THE SE1/4

POWER POLE, LIGHT(E) 4"RISER(S)

GRAVEL (TBR)

FENCE POST

FENCE POST

FENCE POST

FENCE POST

40' UTILITY EASEMENT

2673.94'

10' UTILITY EASEMENT

SMOKEY POINT BLVD

S1° 32' 54"W

SDMH 48"CONC RIM=115.02' IE=106.52'(30"PVC-W) IE=106.42'(30"PVC-E)

LIMITS OF LANDCAPING CONCRETE UTILITY VAULT

2-1"PVC PIPES SDCB TYPE 1 RIM=114.87' IE=112.12'(21"CPP-E)

WATER VALVE RIM=115.02' TOP NUT=110.57'

SSMH 48"CONC RIM=114.96' CL CHANNEL=99.94'FLOW(S) IE=100.11'(E) IE=100.88(W)

97.05'

N1° 32' 54"E

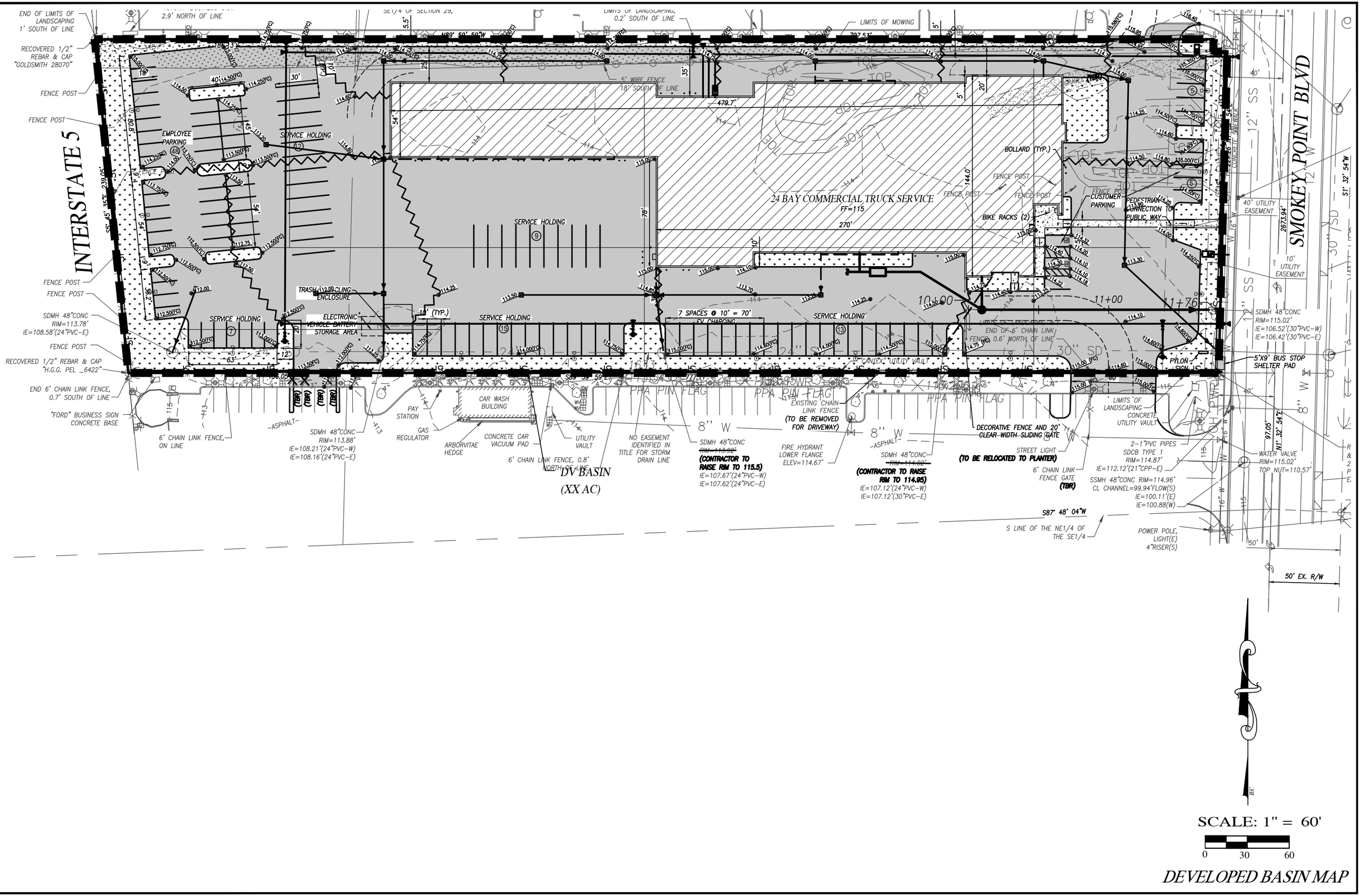
50'

50' EX. R/W

SCALE: 1" = 60'

0 30 60

EXISTING BASIN MAP



DEVELOPED BASIN MAP

5.0 Special Reports and Studies

A. SWPPP
B. Geotechnical Report

A. SWPPP

Construction Stormwater General Permit

Stormwater Pollution Prevention Plan (SWPPP)

for

Marysville Ford Pro Elite

Prepared for:

The Washington State Department of Ecology
Northwest Regional Office
3190 – 160th Avenue SE
Bellevue, WA 98008

Permittee / Owner	Developer	Operator / Contractor
Kendall Development Group, LLC	Kendall Development Group, LLC	To be determined
3449 E Copper Point Drive	3449 E Copper Point Drive	
Meridian, ID 83642	Meridian, ID 83642	

Project Site Location

16110 Smokey Point Blvd
Marysville, WA 98223

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
Brian R. Kalab, P. E.	Insight Engineering	425-303-9363

SWPPP Prepared By

Name	Organization	Contact Phone Number
Ryan J. Korte	Insight Engineering	425-303-9363

SWPPP Preparation Date

October 12, 2023

Project Construction Dates

Activity / Phase	Start Date	End Date
Construction Duration	January 1, 2024	January 15, 2025

Table of Contents

List of Tables

List of Appendices

List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO_2	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

1 Project Information

Project/Site Name: Marysville Ford Pro Elite
Street/Location: 16100 Smokey Point Blvd
City: Marysville State: WA Zip code: 98223
Subdivision:
Receiving waterbody:
Hayho Creek

1.1 Existing Conditions

Total acreage (including support activities such as off-site equipment staging yards, material storage areas, borrow areas).

Total acreage: 4.32 acres
Disturbed acreage: 4.32 acres
Existing structures: 0 acres
Landscape topography: 4.32 acres
Drainage patterns: Sheet Flow
Existing Vegetation: Mowed lawn
Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes): N/A Buffer area provided from wetland

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody:

N/A

1.2 Proposed Construction Activities

Description of site development (example: subdivision):
The project proposal is to clear, grade, and pave a parking lot for a car dealership.

Description of construction activities (example: site preparation, demolition, excavation):
Prepare the site for construction by the installation of the indicated BMP's. Excavate the site for the new parking lot.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:

Description of final stabilization (example: extent of revegetation, paving, landscaping):
The site will be cleared and graded then stabilized by hydroseeding with a construction entrance located on the east side of the site along Smokey Point Blvd.
Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge): N/A

2 Construction Stormwater Best Management Practices (BMPs)

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e., hand-written notes and deletions). Update the SWPPP when the CESCL or local agency has noted a deficiency in BMPs or deviation from original design.

2.1 The 13 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. Trees that are to be preserved, as well as all sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans. In general, natural vegetation and native topsoil shall be retained in an undisturbed state to the maximum extent possible.

List and describe BMPs: • High Visibility Plastic or Metal Fence (BMP C103)
Install orange barrier fencing along the clearing limits, according to the approved construction plans, prior to any construction activities. Maintain until all construction activities are completed.

Installation Schedules: The limits of construction will be clearly marked before land-disturbing activities begin.
Inspection and Maintenance plan: Site inspections will be conducted at least once a week and within 24 hours following any rainfall event which causes a discharge of stormwater from the site. For sites with temporary stabilization measures, the site inspection frequency can be reduced to once every month.

Responsible Staff: Permittee shall take immediate action(s) to: stop, contain, and clean up the unauthorized discharges, or otherwise stop the noncompliance; correct the problem(s); implement appropriate Best Management Practices (BMPs), and/or conduct maintenance of existing BMPs; and achieve compliance with all applicable standards and permit conditions. In addition, if the noncompliance causes a threat to human health or the environment, the Permittee shall comply with the Noncompliance Notification requirements in Special Condition S5.F of the permit.

2.1.2 Element 2: Establish Construction Access

Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads, street sweeping, and street cleaning shall be employed to prevent sediment from entering state waters.

List and describe BMPs: Stabilized Construction Entrance (BMP C105)

Installation Schedules: Install the temporary construction entrance, according to the approved construction plans, prior to any clearing or grading activities

Inspection and Maintenance plan: Maintain until the access road is paved.

Responsible Staff: Contractor.

2.1.3 Element 3: Control Flow Rates

In order to protect the properties and waterways downstream of the project site, stormwater discharges from the site will be controlled. In general, discharge rates of stormwater from the site will be controlled where increases in impervious area or soil compaction during construction could lead to downstream erosion, or where necessary to meet local agency stormwater discharge requirements (e.g. discharge to combined sewer systems).

Will you construct stormwater retention and/or detention facilities?

☐ Yes ☒ No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?

☐ Yes ☒ No

List and describe BMPs: Temporary Sediment Pond (BMP C241)

Installation Schedules: Install temporary sediment pond, according to the approved construction plans, prior to any construction activities.

Inspection and Maintenance plan: Maintain until all construction activities are completed.

Responsible Staff: Contractor

2.1.4 Element 4: Install Sediment Controls

Whenever possible, sediment laden water shall be discharged into onsite, relatively level, vegetated areas .

In some cases, sediment discharge in concentrated runoff can be controlled using permanent stormwater BMPs (e.g., infiltration swales, ponds, trenches). Sediment loads can limit the effectiveness of some permanent stormwater BMPs, such as those used for infiltration or bio-filtration; however, those BMPs designed to remove solids by settling (wet ponds or detention ponds) can be used during the construction phase. When permanent stormwater BMPs will be used to control sediment discharge during construction, the structure will be protected from excessive sedimentation with adequate erosion and sediment control BMPs. Any accumulated sediment shall be removed after construction is complete and the permanent stormwater BMP will be re-stabilized with vegetation per applicable design requirements once the remainder of the site has been stabilized.

The following BMP will be implemented as end-of-pipe sediment controls as required to meet permitted turbidity limits in the site discharge(s). Prior to the implementation of these technologies, sediment sources and erosion control and soil stabilization BMP efforts will be maximized to reduce the need for end-of-pipe sedimentation controls. In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or using mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site and to minimize wash-off of sediments from adjacent streets in runoff.

List and describe BMPs:

- Silt Fence (BMP C233)
- Storm Drain Inlet Protection (BMP C220)

Installation Schedules: Install silt fencing, according to the approved plans, prior to any clearing or grading activities. Install catch basin filters, according to the approved construction plans, as catch basins are installed and become operable.

Inspection and Maintenance plan: Maintain Silt Fence and Storm Drain Inlet Protection until all construction activities are completed.

Responsible Staff: Contractor.

2.1.5 Element 5: Stabilize Soils

The project site is located west of the Cascade Mountain Crest. As such, no soils shall remain exposed and unworked for more than 7 days during the dry season (May 1 to September 30) and 2 days during the wet season (October 1 to April 30). Regardless of the time of year, all soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on weather forecasts.

In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

West of the Cascade Mountains Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Soils must be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Anticipated project dates: Start date: March 1, 2017 End date: Jan 10,2017

Will you construct during the wet season?
☒ Yes ☐ No

List and describe BMPs:
Exposed and un-worked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that shall be used on this project include:

- Temporary and Permanent Seeding (BMP C120)

Installation Schedules:
Apply temporary hydro-seed to exposed and un-worked soils, according to the approved construction plans, as needed to prevent erosion during site grading.
Inspection and Maintenance plan:
Apply permanent hydro-seed to areas at final grade as site grading is completed.

- Mulching (BMP C121)

Installation Schedules:
Apply mulching to exposed and un-worked soils, according to the approved construction plans, as needed to prevent erosion during site grading.
Inspection and Maintenance plan:
Maintain until site grading is completed and permanent hydro-seed is applied.

- Plastic Covering (BMP C123)

Installation Schedules:
Cover stockpiles with plastic sheeting, according to the approved construction plans, as needed to prevent erosion during site grading.

Inspection and Maintenance plan:
Maintain until stockpiles are removed from site.

- Dust Control (BMP C140)

Installation Schedules and Inspection and Maintenance plan:

 Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
 Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
 Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
 Sprinkle the site with water until surface is wet. Repeat as needed. To prevent carryout of mud onto street, refer to Stabilized Construction Entrance (BMP C105).
 Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
 Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliatives such as calcium chloride or PAM.
 PAM (BMP C126) added to water at a rate of 0.5 lbs. per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may actually reduce the quantity of water needed for dust control. Use of PAM could be a cost-effective dust control method.

Techniques that can be used for unpaved roads and lots include:

 Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
 Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
 Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
 Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
 Encourage the use of alternate, paved routes, if available.
 Restrict use of paved roadways by tracked vehicles and heavy trucks to prevent damage to road surface and base.
 Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
 Pave unpaved permanent roads and other trafficked areas.
 Use vacuum street sweepers.
 Remove mud and other dirt promptly so it does not dry and then turn into dust.
 Limit dust-causing work on windy days.

 Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP.

- Early application of gravel base on areas to be paved

Place gravel base on roadways, according to the approved construction plans, after roadways are graded to sub-grade. Maintain until roads are paved.

Responsible Staff: Contractor.

2.1.6 Element 6: Protect Slopes

All cut and fill slopes will be designed, constructed, and protected in a manner than minimizes erosion. The following specific BMPs will be used to protect slopes for this project:

Will steep slopes be present at the site during construction?
☐ Yes ☒ No

List and describe BMPs: Temporary and Permanent Seeding (BMP C120)

Installation Schedules: Apply temporary hydro-seed to cut and fill slopes, according to the approved construction plans, as needed to minimize erosion during site grading.
Inspection and Maintenance plan: Apply permanent hydro-seed to cut and fill slopes at final grade as site grading is completed.
Responsible Staff: Contractor

2.1.7 Element 7: Protect Drain Inlets

All storm drain inlets and culverts made operable during construction shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site.
List and describe BMPs:

- Catch Basin Filters

Installation Schedules: Install catch basin filters, according to the approved construction plans, as catch basins become operable.
Inspection and Maintenance plan: Maintain until all construction activities are completed.
Responsible Staff: Contractor

2.1.8 Element 8: Stabilize Channels and Outlets

No site runoff is to be conveyed into channels, or discharged to a stream or some other natural drainage point.— The onsite flowrates will be minimal therefore no BMP's are proposed Stabilize Channels and Outlets.

If any BMP's are provideded, the project site is located west of the Cascade Mountain Crest. As such, all temporary on-site conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the expected peak 10 minute velocity of flow from a Type 1A, 10-year, 24-hour recurrence interval storm for the developed condition. Alternatively, the 10-year, 1-hour peak flow rate indicated by an approved continuous runoff simulation model, increased by a factor of 1.6, shall be used. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches shall be provided at the outlets of all conveyance systems.

Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches, will be installed at the outlets of all conveyance systems.

2.1.9 Element 9: Control Pollutants

The following pollutants are anticipated to be present on-site:

Table 2 – Pollutants

Pollutant (List pollutants and source, if applicable)
Petroleum products
Solid waste

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

Vehicles, construction equipment, and/or petroleum product storage/dispensing:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.
- On-site permanent fueling tanks and petroleum product storage containers shall include secondary containment.
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.
- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.
- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Chemical storage:

- Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Volume IV of the Ecology stormwater manual. In Western WA, all chemicals shall have cover, containment, and protection provided on site, per BMP C153 for Material Delivery, Storage and Containment in SWMMWW 2005

Excavation and tunneling spoils dewatering waste:

- Dewatering BMPs and BMPs specific to the excavation and tunneling (including handling of contaminated soils) are discussed under Element 10.

Demolition:

- Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures (BMP C140).
- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).

 Process water and slurry resulting from saw-cutting and surfacing operations will be prevented from entering the waters of the State by implementing Saw-cutting and Surfacing Pollution Prevention measures (BMP C152).

Sanitary wastewater:

 Portable sanitation facilities will be firmly secured, regularly maintained, and emptied when necessary.

Solid Waste:

 Solid waste will be stored in secure, clearly marked containers.

Other:

 Other BMPs will be administered as necessary to address any additional pollutant sources on site.

A SPCC plan is required for this site.

As per the Federal regulations of the Clean Water Act (CWA) and according to Final Rule 40 CFR Part 112, as stated in the National Register, a Spill Prevention, Control, and Countermeasure (SPCC) Plan is required for construction activities. A SPCC Plan has been prepared to address an approach to prevent, respond to, and report spills or releases to the environment that could result from construction activities. This Plan must:

 Be well thought out in accordance with good engineering;

List and describe BMPs: BMP C151, BMP C152, BMP C153, BMP C140 and BMP C220.

Installation Schedules:

Inspection and Maintenance plan: All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris.

Achieve three objectives - prevent spills, contain a spill that occurs, and clean up the spill;

 Identify the name, location, owner, and type of facility;
 Include the date of initial operation and oil spill history;
 Name the designated person responsible;
 Show evidence of approval and certification by the person in authority; and
 Contain a facility analysis.

Responsible Staff: Contractor.

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?

☐ Yes☒ No

Will wheel wash or tire bath system BMPs be used during construction?

☐ Yes☒ No

Will pH-modifying sources be present on-site?

☐ Yes☒ No

Table 3 – pH-Modifying Sources

☒	None
☐	Bulk cement
☐	Cement kiln dust
☐	Fly ash
☐	Other cementitious materials
☐	New concrete washing or curing waters
☐	Waste streams generated from concrete grinding and sawing
☐	Exposed aggregate processes
☐	Dewatering concrete vaults
☐	Concrete pumping and mixer washout waters
☐	Recycled concrete
☐	Recycled concrete stockpiles
☐	Other (i.e., calcium lignosulfate) [please describe:]

Stormwater runoff will be monitored for pH starting on the first day of any activity that includes more than 40 yards of poured or recycled concrete, or after the application of "Engineered Soils" such as, Portland cement treated base, cement kiln dust, or fly ash. This does not include fertilizers. For concrete work, pH monitoring will start the first day concrete is poured and continue until 3 weeks after the last pour. For engineered soils, the pH monitoring period begins when engineered soils are first exposed to precipitation and continue until the area is fully stabilized.

Stormwater samples will be collected daily from all points of discharge from the site and measured for pH using a calibrated pH meter, pH test kit, or wide range pH indicator paper. If the measured pH is 8.5 or greater, the following steps will be conducted:

1. Prevent the high pH water from entering storm drains or surface water.

2. Adjust or neutralize the high pH water if necessary using appropriate technology such as CO_2 sparging (liquid or dry ice).

3. Contact Ecology if chemical treatment other than CO_2 sparging is planned.

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed. Excess concrete must be returned to the plant for recycling if there are no concrete washout areas with appropriate BMPs installed.

Will uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters?

☐ Yes ☒ No

2.1.10 Element 10: Control Dewatering

No dewatering is proposed for the development. If dewatering is needed, Transport. off-site in a vehicle (vacuum truck for legal disposal).

Table 4 – Dewatering BMPs

☐	Infiltration
☒	Transport off-site in a vehicle (vacuum truck for legal disposal)
☐	Ecology-approved on-site chemical treatment or other suitable treatment technologies
☐	Sanitary or combined sewer discharge with local sewer district approval (last resort)
☐	Use of sedimentation bag with discharge to ditch or swale (small volumes of localized dewatering)

2.1.11 Element 11: Maintain BMPs

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.
Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the SWMMEW*).
Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.
All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.
Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.
Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

2.1.12 Element 12: Manage the Project

The project will be managed based on the following principles:

- Projects will be phased to the maximum extent practicable and seasonal work limitations will be taken into account.
- Inspection and monitoring:
    - Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
    - Site inspections and monitoring will be conducted in accordance with Special Condition S4 of the CSWGP. Sampling locations are indicated on the Site Map. Sampling station(s) are located in accordance with applicable requirements of the CSWGP.
- Maintain an updated SWPPP.
    - The SWPPP will be updated, maintained, and implemented in accordance with Special Conditions S3, S4, and S9 of the CSWGP.

As site work progresses the SWPPP will be modified routinely to reflect changing site conditions. The SWPPP will be reviewed monthly to ensure the content is current.

Table 5 – Management

☒	Design the project to fit the existing topography, soils, and drainage patterns
☒	Emphasize erosion control rather than sediment control
☒	Minimize the extent and duration of the area exposed
☒	Keep runoff velocities low
☒	Retain sediment on-site
☒	Thoroughly monitor site and maintain all ESC measures
☒	Schedule major earthwork during the dry season
☐	Other (please describe)

Table 6 – BMP Implementation Schedule

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
Mark Clearing Limits	High Visibility Plastic or Metal Fence (BMP C103)	01/01/2024	Wet
Implement Element #12 BMPs and manage site to minimize soil disturbance during the wet season	Scheduling (BMP C162) CESC Lead (BMP C160)	1/01/2024	Wet
Mobilize and store all ESC and soil stabilization products	Silt Fence (BMP C233) Storm Drain Inlet Protection (BMP C220) Plastic Covering (BMP C123) Surface roughening (BMP C130)	1/01/2024	Wet
Install ESC measures	Silt Fence (BMP C233) Storm Drain Inlet Protection (BMP C220)	1/01/2024	Wet
Install stabilized construction entrance	Stabilized Construction Entrance (BMP C105)	1/01/2024	Wet
Begin clearing and grubbing	Dust Control (BMP C140)	1/15/2024	Wet
Site grading begins	Dust Control (BMP C140)	2/01/2024	Wet
Install Temporary Sediment Pond	Temporary Sediment Pond (BMP C241)	2/01/2024	Wet
Grade road and stabilize with gravel base	Dust Control (BMP C140)	3/01/2024	Wet
Temporary erosion control measures (hydro-seeding)	Temporary Seeding (BMP C120)	4/01/2024	Wet
Soil stabilization on excavated side slopes (in idle, no work areas)	Mulching (BMP C121) Dust Control (BMP C140) Plastic Covering (BMP C123) Nets and Blankets (BMP C122)	4/05/2024	Wet
Site grading ends		7/15/2024	Dry

Begin pouring concrete curbs & sidewalks and implement	BMP C151 Concrete Handling (BMP C151) Sawcutting and Surfacing Pollution Prevention (BMP C152)	08/01/2024	Dry
Pave asphalt roads		08/05/2024	Dry
Final landscaping and planting begins		09/01/2024	Dry
Permanent erosion control measures (hydro-seeding)	Permanent Seeding (BMP C120)	09/01/2024	Dry

2.1.13 Element 13: Protect Low Impact Development (LID) BMPs

On-site stormwater management BMPs used for runoff from roofs and other hard surfaces include: full dispersion, roof downspout full infiltration or dispersion systems, perforated stubout connections, rain gardens, bioretention systems, permeable pavement, sheetflow dispersion, and concentrated flow dispersion. The areas on the site to be used for these BMPs shall be protected from siltation and compaction during construction by sequencing the construction in a fashion to install these BMPs at the latter part of the construction grading operations, by excluding equipment from the BMPS and the associated areas, and by using the erosion and sedimentation control BMPs listed below. Additional requirements for protecting these BMPs during the construction process, testing functionality, and restoring functionality are needed at the final stage of the construction process.

Relevant BMPs

BMP C102: Buffer Zone BMP
C103: High Visibility Fence BMP
C200: Interceptor Dike and Swale BMP
C201: Grass-lined Channels BMP
C207: Check Dams BMP
C208: Triangular Silt Dike BMP
C231: Brush Barrier BMP
C233: Silt Fence BMP
C234: Vegetated Strip

3 Pollution Prevention Team

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	Brian Kalab	425-303-9363
Resident Engineer	Brian Kalab / Insight Engineering	425-303-9363
Emergency Ecology Contact	Tracy Walters	425-649-7000
Emergency Permittee/ Owner Contact	Todd McFarlane	541-335-4585
Non-Emergency Owner Contact	Todd McFarlane	541-335-4585
Monitoring Personnel	TBD	425-345-9547
Ecology Regional Office	Northwest Regional Office	425-649-7000

4 Monitoring and Sampling Requirements

Monitoring includes visual inspection, sampling for water quality parameters of concern, and documentation of the inspection and sampling findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater sampling data

The site log book must be maintained on-site within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

Numeric effluent limits may be required for certain discharges to 303(d) listed waterbodies. See CSWGP Special Condition S8 and Section 5 of this template.

The receiving waterbody, Swamp Creek, is impaired for: Bacteria, Bioassessment, DO. pH and Temp. All stormwater and dewatering discharges from the site are subject to an **effluent limit** of 8.5 su for pH and/or 25 NTU for turbidity.

4.1 Site Inspection

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.
The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

4.2 Stormwater Quality Sampling

4.2.1 Turbidity Sampling

Requirements include calibrated turbidity meter or transparency tube to sample site discharges for compliance with the CSWGP. Sampling will be conducted at all discharge points at least once per calendar week.
Method for sampling turbidity:

Table 8 – Turbidity Sampling Method

☒	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
☐	Transparency Tube (option for disturbances less than 1 acre and up to 5 acres in size)

The limit for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.
If the discharge's turbidity is 26 to 249 NTU **or** the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Stop effluent discharge to receiving waterbody immediately. If discharge continues, this will be a direct violation of the SWPPP and CSWGP. Implement baker tanks to prevent discharge from entering reciving water body. Replace/repair BMP's if not functioning properly. Do not discharge runoff until the turbidity value is 25 nephelometric turbidity units (NTU) or less and a transparency less than 33 centimeters.

2. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the limit.
3. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the limit. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.
4. Document BMP implementation and maintenance in the site log book.

If the turbidity exceeds 250 NTU **or** the transparency is 6 cm or less at any time, the following steps will be conducted:

1. Telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) within 24 hours.
    - **Central Region** (Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima): (509) 575-2490 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/CRO_nerts_online.html
    - **Eastern Region** (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/ERO_nerts_online.html
    - **Northwest Region** (King, Kitsap, Island, San Juan, Skagit, Snohomish, Whatcom): (425) 649-7000 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/NWRO_nerts_online.html
    - **Southwest Region** (Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Wahkiakum,): (360) 407-6300 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/SWRO_nerts_online.html
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the limit. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period
3. Document BMP implementation and maintenance in the site log book.
4. Continue to sample discharges daily until one of the following is true:
    - Turbidity is 25 NTU (or lower).
    - Transparency is 33 cm (or greater).
    - Compliance with the water quality limit for turbidity is achieved.
        - 1 - 5 NTU over background turbidity, if background is less than 50 NTU
        - 1% - 10% over background turbidity, if background is 50 NTU or greater
    - The discharge stops or is eliminated.

4.2.2 pH Sampling

pH monitoring is required for "Significant concrete work" (i.e., greater than 1000 cubic yards poured concrete over the life of the project). The use of recycled concrete or engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD] or fly ash) also requires pH monitoring.

For significant concrete work, pH sampling will start the first day concrete is poured and continue until it is cured, typically three (3) weeks after the last pour.

For engineered soils and recycled concrete, pH sampling begins when engineered soils or recycled concrete are first exposed to precipitation and continues until the area is fully stabilized.

If the measured pH is 8.5 or greater, the following measures will be taken:

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 su using appropriate technology such as carbon dioxide (CO_2) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO_2 sparging or dry ice.

Method for sampling pH:

No pH monitering will be necessary as none of the proposed work includes pH modifying activities

5 Reporting and Record Keeping

5.1 Record Keeping

5.1.1 Site Log Book

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Sample logs

5.1.2 Records Retention

Records will be retained during the life of the project and for a minimum of three (3) years following the termination of permit coverage in accordance with Special Condition S5.C of the CSWGP.

Permit documentation to be retained on-site:

- CSWGP
- Permit Coverage Letter
- SWPPP
- Site Log Book

Permit documentation will be provided within 14 days of receipt of a written request from Ecology. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with Special Condition S5.G.2.b of the CSWGP.

5.1.3 Updating the SWPPP

The SWPPP will be modified if:

- Found ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site.
- There is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

The SWPPP will be modified within seven (7) days if inspection(s) or investigation(s) determine additional or modified BMPs are necessary for compliance. An updated timeline for BMP implementation will be prepared.

5.2 Reporting

5.2.1 Discharge Monitoring Reports

Cumulative soil disturbance is one (1) acre or larger; therefore, Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given monitoring period the DMR will be submitted as required, reporting "No Discharge". The DMR due date is fifteen (15) days following the end of each calendar month.
DMRs will be reported online through Ecology's WQWebDMR System.

5.2.2 Notification of Noncompliance

If any of the terms and conditions of the permit is not met, and the resulting noncompliance may cause a threat to human health or the environment, the following actions will be taken:

1. Ecology will be notified within 24-hours of the failure to comply by calling the applicable Regional office ERTS phone number (Regional office numbers listed below).
2. Immediate action will be taken to prevent the discharge/pollution or otherwise stop or correct the noncompliance. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Anytime turbidity sampling indicates turbidity is 250 NTUs or greater, or water transparency is 6 cm or less, the Ecology Regional office will be notified by phone within 24 hours of analysis as required by Special Condition S5.A of the CSWGP.

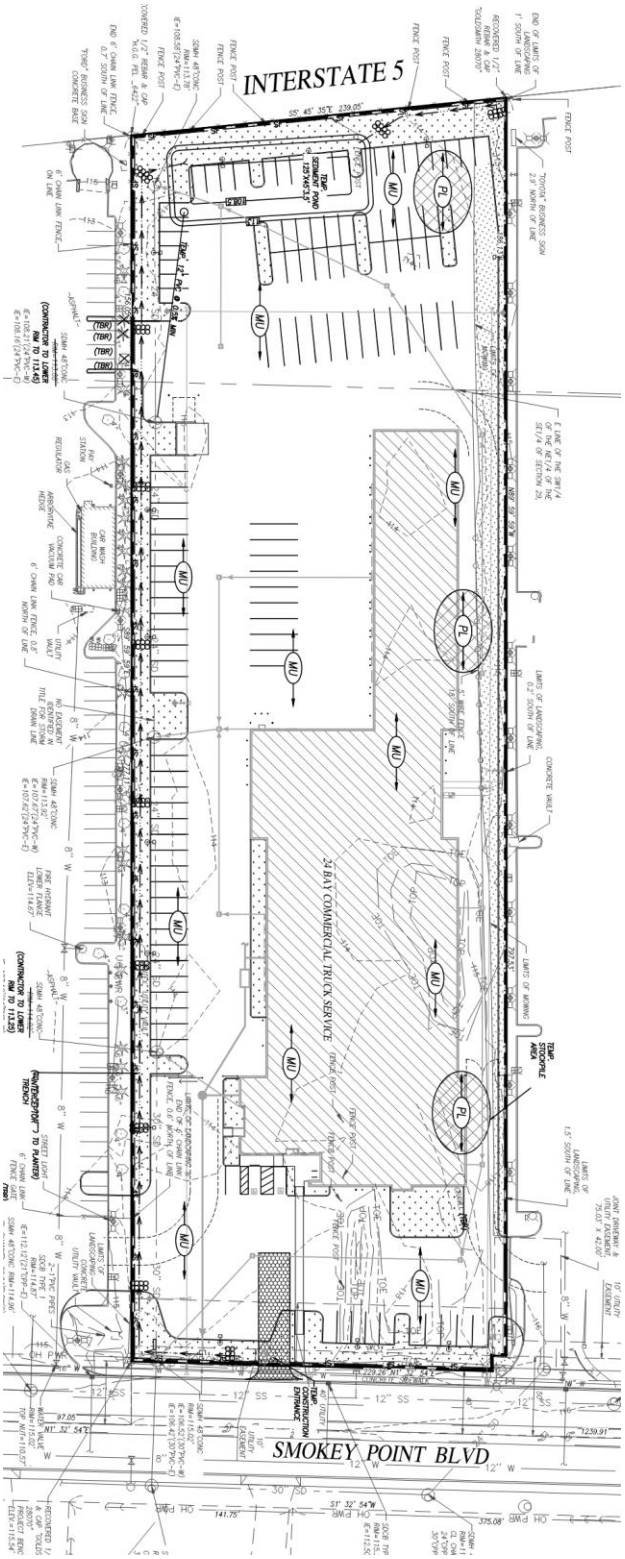
- **Central Region** at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County
- **Eastern Region** at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County
- **Northwest Region** at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County
- **Southwest Region** at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum

Include the following information:

1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results
5. Date / Time of call
6. Date / Time of sample
7. Project name

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO_2 sparging is planned for adjustment of high pH water.

A. Site Map


INTERSTATE 5
32 BAY COMMERCIAL TRUCK SERVICE
SMOKEY POINT BLVD

B. BMP Detail

Element #1 - Mark Clearing Limits

- High Visibility Plastic or Metal Fence (BMP C103)

Element #2 - Establish Construction Access

- Stabilized Construction Entrance (BMP C105)

Element #3 - Control Flow Rates

- Sediment Pond (BMP C241)

Element #4 - Install Sediment Controls

- Silt Fence (BMP C233)
- Storm Drain Inlet Protection (BMP C220)
- Interceptor Dike and Swale (BMP C200)
- Check Dams (BMP C207)

Element #5 - Stabilize Soils

- Mulching (BMP C121)
- Temporary and Permanent Seeding (BMP C120)

Element #6 - Protect Slopes

- Plastic Covering (BMP C123)

Element #8 - Stabilize Channels and Outlets

- Outlet Protection (BMP C209)
- Interceptor Dike and Swale (BMP C200)
- Channel Lining (BMP C202)

Element #9 - Control Pollutants

- Concrete Handling (BMP C151)
- Sawcutting and Surfacing Pollution Prevention (BMP C152)
- Material Delivery, Storage and Containment (BMP C153)
- Dust Control (BMP C140)
- Storm Drain Inlet Protection (BMP C220)

Element #10 - Control Dewatering

- N/A

Element #11 – Maintain BMP's

- Materials on Hand (BMP C150)
- Certified Erosion and Sediment Control Lead (BMP C160)

Element #12 – Manage the Project

- Materials on Hand (BMP C150)
- Certified Erosion and Sediment Control Lead (BMP C160)
- Scheduling (BMP C162)

Element #13 – Protect On-site Stormwater Management BMPs for Runoff from Roofs and Other Hard Surfaces

- N/A

C. Correspondence

Ecology
EPA
Local Government

D. Site Inspection Form

Construction Stormwater Site Inspection Form

Project Name _____ Permit # _____ Inspection Date _____ Time _____

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*
Print Name: _____

Approximate rainfall amount since the last inspection (in inches): _____

Approximate rainfall amount in the last 24 hours (in inches): _____

Current Weather Clear ☐ Cloudy ☐ Mist ☐ Rain ☐ Wind ☐ Fog ☐

A. Type of inspection: Weekly ☐ Post Storm Event ☐ Other ☐

B. Phase of Active Construction (*check all that apply*):

Pre Construction/installation of erosion/sediment controls	☐	Clearing/Demo/Grading	☐	Infrastructure/storm/roads	☐
Concrete pours	☐	Vertical Construction/buildings	☐	Utilities	☐
Offsite improvements	☐	Site temporary stabilized	☐	Final stabilization	☐

C. Questions:

1. Were all areas of construction and discharge points inspected? Yes ___ No ___
2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen Yes ___ No ___
3. Was a water quality sample taken during inspection? (*refer to permit conditions S4 & S5*) Yes ___ No ___
4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?* Yes ___ No ___
5. If yes to #4 was it reported to Ecology? Yes ___ No ___
6. Is pH sampling required? pH range required is 6.5 to 8.5. Yes ___ No ___

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

_____

_____

_____

_____

*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: Date: _____

Parameter	Method (circle one)	Result			Other/Note
		NTU	cm	pH	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required "details and dates.

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						
	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐
All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) _____ (Signature) _____ Date: _____

Title/Qualification of Inspector: _____

E. Construction Stormwater General Permit (CSWGP)

F. Contaminated Site Information

There is no contaminated soil onsite.

G. Engineering Calculations

TESC Pond sizing calculations

The total contributing area to the proposed sediment pond is approximately 4.29 acres. The sediment pond is sized for the developed 10-year / 24-hour design storm.

1. Discharge rate

Q 10yr/24hr = 2.65 cfs

Surface Area (SA)

SA = 2 X Q10yr/24hr / Vsed

SA = 2 X (1.91/ 0.00096)

Where Vsed is the settling velocity.

= 5520.8 Sqft

2. Sizing the De-watering Mechanism:

Principal Spillway (Riser pipe)

The diameter shall be the minimum necessary to pass the pre-developed 10-yr/24-hr design storm. Use Figure III.2.38 Riser inflow curves (DOE) to determine this diameter (h = 1 foot)

Q (10yr/24hr predev) = 0.63 cfs

Per figure III.2.38 of the DOE manual, the minimum riser diameter is 12 inches to convey this flow rate.

Emergency Overflow Spillway

The emergency overflow spillway shall convey the 100yr/24hr developed design storm.

Q 100yr/24hr = 4.62 cfs

$$\text{Length (L)} = \frac{Q\ 100yr/24hr}{3.21\ (H)^{3/2}} - 2.4\ (H)^2$$

$$= \frac{4.62}{3.21\ (0.5)^{3/2}} - 2.4\ (0.5)^2$$

Length (L) = 3.47 feet. Use the minimum length of 6.0 feet.

De-Watering Orifice:

Size the de-watering orifice (1" minimum diameter) per the following equation:

$$Ao = \frac{As\ (2H)^{1/2}}{10.6 \times 3600\ Tg^{1/2}}$$

where Ao = Orifice area in square feet
As = Pond surface area in square feet
H = Head above the Orifice (height of riser in pipe)
T = De-watering Time (T = 24 hours)
g = Acceleration due to gravity

$$Ao = \frac{5521(2*3.5)^{1/2}}{10.6 \times 3600\ (24)\ (32.2)^{1/2}}$$

Ao = 0.00281 Sqft

Convert Ao to Diameter (D) in inches

D = 24 x (Ao / 3.14)^1/2

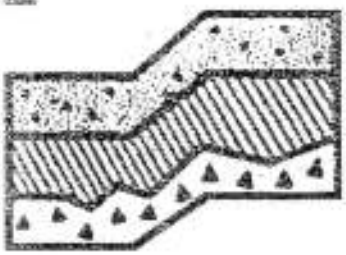
D = 0.72 inches. (Use 1" minimum) Per the DOE design standards; the perforated pipe shall be a minimum of two inches larger than the orifice sizes.
Use 3-inch diameter for the perforated pipe.

B. Geotechnical Report

GEOTECHNICAL REPORT

Pilchuck Landing
Smokey Point Boulevard
Marysville, Washington

Project No. T-5675



Terra Associates, Inc.

Prepared for:

Opus Northwest, LLC
Bellevue, Washington

March 2, 2005

TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

March 2, 2005
Project No. T-5675

Mr. Dick Wooden
Opus Northwest, LLC
915 – 118th Avenue SE, Suite 300
Bellevue, Washington 98005

Subject: Geotechnical Report
Pilchuck Landing
Smokey Point Boulevard
Marysville, Washington

Dear Mr. Wooden:

As requested, we have completed a geotechnical study for the subject project. The purpose of our study was to explore the subsurface soil and groundwater conditions and develop geotechnical engineering recommendations for project design and construction.

Our field exploration indicates that the site is generally underlain by loose to medium dense outwash soils. Groundwater was observed at depths of two to six feet below existing grade. In our opinion, the native soils on the site will be suitable for the proposed development, provided the recommendations presented in this report are incorporated into project design and construction.

We trust this information is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

David [illegible], L.E.G.
Engineering Geologist

THEODORE J. SCHEPPER
STATE OF WASHINGTON
28742
REGISTERED
PROFESSIONAL ENGINEER

3/2/05

Theodore J. Schepper, P.E.
Principal

DPL/TJS:mb

EXPIRES 6/30/05

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TABLE OF CONTENTS

Geotechnical Report
Pilchuck Landing
Smokey Point Boulevard
Marysville, Washington

1.0 PROJECT DESCRIPTION

The approximately 40-acre assemblage of parcels is located between the Interstate 5 (I-5) corridor and Smokey Point Boulevard, north of 156th Street NE, in Marysville, Washington. As we understand, the north end of the site will be developed with an automotive dealership with service bays and a motorcycle sales company who will have a test track. The remaining southern site area will be developed with retail stores, with the possibility of a large "big box" anchor store. Structures will be single-story to two-story buildings constructed with pre-cast tilt up wall panels or CMU block. We expect floors will be constructed at grade at an elevation at or near existing site grades. Dock-high access may be provided at a few locations.

The recommendations contained in the following sections of this report are based upon our understanding of these design features. If actual features vary or changes are made, we should review them in order to modify our recommendations, as required. We should review final design drawings and specifications to verify that our recommendations have been properly interpreted and incorporated into project design.

2.0 SCOPE OF WORK

Our work was completed in accordance with our authorized proposal dated January 31, 2005. On February 11, 2005, we excavated 12 test pits to depths ranging from 8 to 10 feet below existing surface grades. In addition, we subcontracted with Northwest Cone Exploration to perform 6 Cone Penetration Tests (CPTs) to a maximum depth of 40 feet. Using the information obtained from these subsurface explorations, we developed geotechnical recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions
- Seismic
- Site preparation and grading
- Excavations
- Foundations
- Slab-on-grade support
- Earth pressure parameters for retaining wall design
- Drainage
- Utilities
- Pavements

It should be noted that recommendations outlined in this report regarding drainage are associated with soil strength, design earth pressures, erosion and stability. Design and performance issues with respect to moisture as it relates to the structure environment (i.e., humidity, mildew, mold) is beyond Terra Associates' purview. A building envelope specialist or contactor should be consulted to address these issues as needed.

3.0 SITE CONDITIONS

3.1 Surface

The project site is located west of Smokey Point Boulevard, and east of I-5 in Marysville, Washington. The approximate location of the site is shown on Figure 1. We were provided with a preliminary site development plan by Opus NW, dated December 16, 2005. Figure 2 is based on this site plan.

Currently, the southern portion of the site is occupied with several structures associated with the Marysville Livestock Auction (MLA). An approximately 400-foot long, 150-wide pond is located along the west property line, west of the MLA facilities. The northern one-half of the site is primarily open agricultural fields with two single-family residential structures. The site is relatively open with few trees, with the exception of a thick grove of trees south of the residence near the northwest property corner. The site lies within the Stilliquamish River flood plain.

3.2 Soils

In general, underlying a thin sod cover, the CPT and test pit explorations indicate the site is underlain with glacial outwash sediments. The soils encountered in the test pits consisted of loose to medium dense, fine- to coarse-grained sand with varying amounts of silt and gravel. The sands were generally moist in the upper two to six feet, and wet to water-bearing below that depth. Below this upper horizon, layers of medium dense silty sand grading to dense sand are predominant to the 40-foot termination depth of the CPTs. Interbedded thin layers of silt and sandy silt were also indicated in this lower soil profile. Shallow surface fills also composed of silty sand were observed at Test Pits TP-11 and TP-12 to depths of two to three feet in the southern developed portion of the site.

The *Geologic Map of the Arlington West Quadrangle, Snohomish County, Washington*, by James P. Minard (1985), maps the soils in the vicinity of the site belonging to the Marysville Sand Member (Qvrm) of the Vashon recessional outwash. These soils are classified as well-drained sand with fine gravel. The soils we observed in the test pits, and indicated by the CPTs, are consistent with the mapped description.

The preceding discussion is intended as a general review of the soil conditions encountered. For more complete descriptions, please refer to the Test Pit and CPT Logs attached in Appendix A.

3.3 Groundwater

At the time of our exploration, the static groundwater table was indicated at a depth of about four to six feet below existing surface grades. We installed slotted, two-inch diameter PVC pipes in six of the test pits to allow for monitoring groundwater levels. Water level readings at these wells obtained on February 23, 2005, indicated a static water level at a depth of about three feet. Fluctuations in the static groundwater level will occur seasonally, and will reach maximum levels during and shortly following the wet winter months.

4.0 GEOLOGIC HAZARDS

4.1 Seismic

Based on the results of our field exploration and our knowledge of the area geology, per Chapter 16 of the 2003 International Building Code (IBC), Site Class "C" should be used in structural design.

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations. Liquefaction mainly affects geologically recent deposits of loose, fine-grained sand and silty sand underlying the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction; thus, eliminating the soil's strength.

As described earlier, our subsurface exploration indicates that the soils at the site consist of glacial recessional outwash sands. The static groundwater table is shallow, residing at a depth of about three feet below current surface elevations. CPT data indicates that the outwash sand layers below the water table exhibit relative densities in the medium dense to very dense range. Due to the dense nature of the sand formation, analysis indicates it will be resistant to liquefaction during a design magnitude earthquake. Based on analysis, in our opinion, the risk for soil liquefaction to occur at the site and its associated hazard are low.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

Based on our study, there are no geotechnical conditions that would preclude development of the site as planned. The primary geotechnical consideration for site design and building construction is the shallow groundwater table. To reduce impacts associated with the shallow water table, building grades should be designed as high as practical. At minimum, finished floor and pavement grades should be at or near existing site elevations. Below-grade structures will need to be designed to account for hydrostatic pressures, or provided with adequate drainage to prevent hydrostatic loading. Dewatering by well point or deep pump wells will be necessary to facilitate excavations for installation of below-grade structures and utilities. The need for and extent of dewatering will depend on the depth of the structure or utility and the time of year construction will occur. The groundwater table will likely recede to a depth of five to six feet below current site elevations during the normally dry summer season.

Buildings can be supported on conventional spread footings bearing on competent native soils below the surface layer of organic topsoil and sod. Alternatively, if required by desired final building elevations, structural fill placed and compacted above these native soils can be used to support the building foundations. Floor slabs and pavements can be similarly supported.

The near-surface native soils encountered at the site to a depth of about five feet contain a sufficient amount of soil fines that will make them difficult to compact as structural fill when too wet or dry. The ability to use the upper native soils from site excavations as structural fill will depend on its moisture content and the prevailing weather conditions at the time of construction. The earthwork contractor should be prepared to dry the native soils by aeration during the normally dry summer season to facilitate compaction as structural fill. Alternatively, stabilizing the moisture in the native soil with cement kiln dust (CKD), cement, or lime can be considered. In general, the native outwash below the upper five-foot soil horizon is relatively free of fines and could be used during most weather conditions as structural fill or backfill.

The following sections provide detailed recommendations regarding these issues and other geotechnical design considerations. These recommendations should be incorporated into the final design drawings and construction specifications.

5.2 Site Preparation and Grading

To prepare the site for construction, all vegetation, organic surface soils, and other deleterious materials should be stripped and removed from the site. Surface stripping depths of about 12 inches should be expected to remove the sod/organic topsoil layer in the northern open field areas. In the developed MLA portion of the site, removal of surface organic materials will be required in the livestock holding areas. Stripped vegetation debris should be removed from the site. Organic topsoil will not be suitable for use as structural fill but may be used for limited depths in non-structural areas or for landscaping purposes.

Demolition of existing structures should include removal of all foundations from below areas of new construction. Depending on final building grades, it may be possible to leave floor slabs and pavement in place provided it is fractured or broken up in place prior to filling over. Existing site utilities that are abandoned should be removed from below new foundation construction. Elsewhere, the abandoned pipes can be left in place provided they are plugged or sealed to prevent water and soil intrusion.

Once clearing and grubbing operations are complete, grading to establish desired building grades can be initiated. In order to achieve proper compaction of the building fill, the native subgrade must be in a relatively stable condition. If excessively soft and yielding subgrade is observed and it cannot be stabilized in place by aeration and compaction, stabilizing by the use of an additive, such as cement, CKD, or lime will need to be considered. Alternatively, the unstable soils can be excavated and replaced with clean granular structural fill. Typically, stabilization of soft yielding soils that, because of excess moisture cannot be stabilized in place, requires amending or otherwise removing and replacing affected soils to a depth of 12 to 18 inches.

To construct suitable support for pavements, we recommend constructing a soil cement base (SCB) using the native soils. Based on our experience, native soils should be blended with Type I Portland cement at a rate of .75 pounds per square foot of surface area per inch of depth, moisture conditioned as necessary, and then compacted as structural fill. The soil cement should be tested to determine its compressive strength. A minimum 28-day compressive strength of 200 pounds per square inch (psi) is recommended. Recommended thickness of the SCB is discussed in the pavement section.

If grading activities are planned during the wet winter months, and the on-site soils become too wet to achieve adequate compaction, the owner or contractor should be prepared to treat soils with CKD, lime, or cement, or import wet weather structural fill. For wet weather structural fill, we recommend importing a granular soil that meets the following grading requirements:

U.S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

*Based on the 3/4-inch fraction.

Prior to use, Terra Associates, Inc., should examine and test all materials to be imported to the site for use as structural fill. If the building subgrade is constructed using native soils and will be exposed during wet weather, it would be advisable to place 12 inches of this granular structural fill on the building pad to prevent deterioration of the floor subgrade.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by American Society for Testing and Materials (ASTM) Test Designation D-698 (Standard Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this same ASTM standard. In non-structural areas, or for backfill in utility trenches below a depth of 4 feet, the degree of compaction can be reduced to 90 percent.

5.3 Excavations

All excavations at the site associated with confined spaces, such as utility trenches and lower building levels, must be completed in accordance with local, state, or federal requirements. Based on current Occupational Safety and Health Administration (OSHA) regulations, soils found on the project site would be classified as Group C soils.

For properly dewatered excavations more than 4 feet but less than 20 feet in depth, the side slopes should be laid back at a minimum slope inclination of 1.5:1 (Horizontal:Vertical). If there is insufficient room to complete the excavations in this manner, or if excavations greater than 20 feet in depth are planned, using temporary shoring to support the excavations may need to be considered. Utility trench sidewalls can be supported by a properly designed and installed shoring trench box.

Groundwater should be anticipated within excavations extending to depths of three feet and greater below existing surface grades. For excavations below six feet, the volume of water and rate of flow into the excavation may be significant, and dewatering of the excavations will be necessary. Shallow excavations that do not extend more than one to two feet below the groundwater table can likely be dewatered by conventional sump pumping procedures, along with a system of collection trenches. Deeper excavation will require dewatering by well points or isolated deep-pump wells. The utility subcontractor should be prepared to implement excavation dewatering by well point or deep-pump wells, as needed. This will be an especially critical consideration for deep utility excavations that will likely be required to tie into existing utilities along Smokey Point Boulevard.

This information is provided solely for the benefit of the owner and other design consultants, and should not be construed to imply that Terra Associates, Inc., assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

5.4 Foundations

The buildings may be supported on conventional spread footing foundations bearing on competent native soils or on structural fill placed above competent native soils. Foundation subgrade should be prepared as recommended in Section 5.2 of this report. Perimeter foundations exposed to the weather should bear at a minimum depth of 1.5 feet below final exterior grades for frost protection. Interior foundations can be constructed at any convenient depth below the floor slab.

Foundations supported on undisturbed bearing surfaces composed of native soil or structural fill can be dimensioned for a net allowable bearing capacity of 2,000 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used. With structural loading as anticipated and these bearing stresses applied, estimated total foundation settlement ranges from one-half to one inch.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressures acting on the sides of the footings can also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pounds per cubic foot (pcf). We do not recommend including the upper 12 inches of soil in this computation because it can be affected by weather or disturbed by future grading activity. This value assumes the foundation will be backfilled with structural fill, as described in Section 5.2 of this report. The values recommended include a safety factor of 1.5.

5.5 Retaining Walls

The magnitude of earth pressure development on retaining walls will partly depend on the quality of backfill. We recommend placing and compacting wall backfill as structural fill. To guard against the buildup of hydrostatic pressure, wall drainage must also be installed. A typical wall drainage detail is attached as Figure 3.

With granular backfill placed and compacted as recommended and drainage properly installed, we recommend designing unrestrained retaining walls for an active earth pressure equivalent to a fluid weighing 35 pcf. For restrained conditions, an additional uniform pressure equivalent to 100 psf should be applied and included in the wall loading calculations. For below-grade walls, such as utility vaults, if it is not possible to effectively drain the walls, they should be designed to support an equivalent fluid weight of 90 pcf. When required, to account for traffic surcharge, the walls should be designed for an additional height of two feet.

Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in Section 5.5 of this report.

5.6 Slab-on-Grade Floors

Slabs-on-grade may be supported on the subgrade prepared as recommended in Section 5.2 of this report. Immediately below the floor slab, we recommend placing a four-inch thick capillary break layer composed of coarse sand or fine gravel that has less than three percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will be ineffective in assisting in uniform curing of the slab and can actually serve as a water supply for moisture transmission through the slab, and affecting floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained.

Other methods are available for preventing or reducing water vapor transmission through the slab. We recommend consulting with building envelope specialist or contractor for additional assistance regarding this issue.

5.7 Drainage

Surface

Final exterior grades should promote free and positive drainage away from the site at all times. Water must not be allowed to pond or collect adjacent to foundations or within the immediate building areas. We recommend providing a gradient of at least three percent for a minimum distance of ten feet from the building perimeters, except in paved locations. In paved locations, a minimum gradient of two percent should be provided, unless provisions are included for collection and disposal of surface water adjacent to the structure.

Subsurface

In our opinion, with pavement surfaces extending up to the building perimeter and surface drainage controlled by positive sloping away from the building, or by storm sewer installations, perimeter foundation drains would not be required.

5.8 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Associates (APWA) specifications. As a minimum, trench backfill should be placed and compacted as structural fill as described in Section 5.2 of this report. At the time of our study, the soil's moisture content was above optimum; therefore, drying back or other means to condition the material will probably be necessary to facilitate proper compaction. If utility construction takes place during the winter, it may be necessary to import suitable wet weather fill for utility trench backfilling. Also, due to the high groundwater table, any trench excavation deeper than four feet will likely require dewatering.

Hydrostatic uplift forces will need to be considered for below-grade structures, such as utility vaults or buried tanks. For design, the groundwater table should be assumed equivalent to existing surface grade. Resistance to uplift will be provided by the weight of the structure itself and the weight of the backfill soil. For backfill that is compacted to structural fill requirements, a soil unit weight of 115 pcf can be used.

5.9 Pavements

In order to prepare a stable subgrade and pavement base, we recommend using a soil cement application as discussed in Section 5.2 of this report. The cement should be blended uniformly with the native soil, with the mixture also moisture conditioned as necessary. The soil cement moisture should be within –1 to +2 percent of optimum, as determined by ASTM Test Designation D-698 (Standard Proctor) prior to compaction. Once blended and conditioned, the soil cement should be compacted to a minimum of 95 percent of its maximum dry density, as determined by this ASTM standard. The soil cement should achieve a minimum 28-day compressive strength of 200 pounds per square inch (psi).

Initial compaction of the soil cement should be accomplished with a sheep's foot compactor. Once compacted, rough grading can be completed with final compaction achieved using a steel-drum roller. Compaction and rough grading should be completed within a three-hour time period following application and blending of the cement with the soil.

After grading and compaction, traffic on the soil cement base should be kept at a minimum for at least three days to allow the base to cure and gain its initial compressive strength. Pavement construction should then be completed shortly following this initial curing period. During this time period, and up to when pavement surfaces are constructed, the SCB must be kept moist and not allowed to dry excessively. If needed, maintaining a moist surface by watering with a water truck is recommended. If the soil cement base will not be paved over following initial curing, and traffic will traverse the base, we recommend placing a two-inch thick layer of crushed rock over the SCB to reduce surface degradation.

Quality control during construction of the soil cement base should include verifications of the following:

- Cement application rate
- Thickness
- Moisture and compaction
- Compressive strength

A minimum of three test specimens from the same soil cement sample should be prepared for compressive strength testing for each day's construction.

We expect traffic at the facility will consist of cars and light trucks, along with occasional heavy traffic in the form of tractor-trailer rigs. For design considerations, we have assumed traffic in parking and in car/light truck access pavement areas can be represented by an 18-kip Equivalent Single Axle Loading (ESAL) of 50,000 over a 20-year design life. For heavy traffic pavement areas, we have assumed and ESAL of 300,000 would be representative of the expected loading. These ESALs represent loading equivalent to 3 and 18, loaded (80,000 pound GVW) tractor-trailer rigs traversing the pavement daily in each area, respectively.

Based on these traffic loading assumptions, we recommend the following pavement sections be constructed:

Light traffic and parking:

- Three inches of asphalt concrete (AC) over eight inches of SCB

Heavy traffic:

- Three inches of AC over 12 inches of SCB

Asphalt concrete should meet the requirements for ½-inch HMA mix, as outlined in Washington State Department of Transportation's (WSDOT) standard specifications. Asphalt-treated base and crushed rock base should also meet WSDOT requirements.

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability. For optimum pavement performance, we recommend surface drainage gradients of at least two percent. Some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

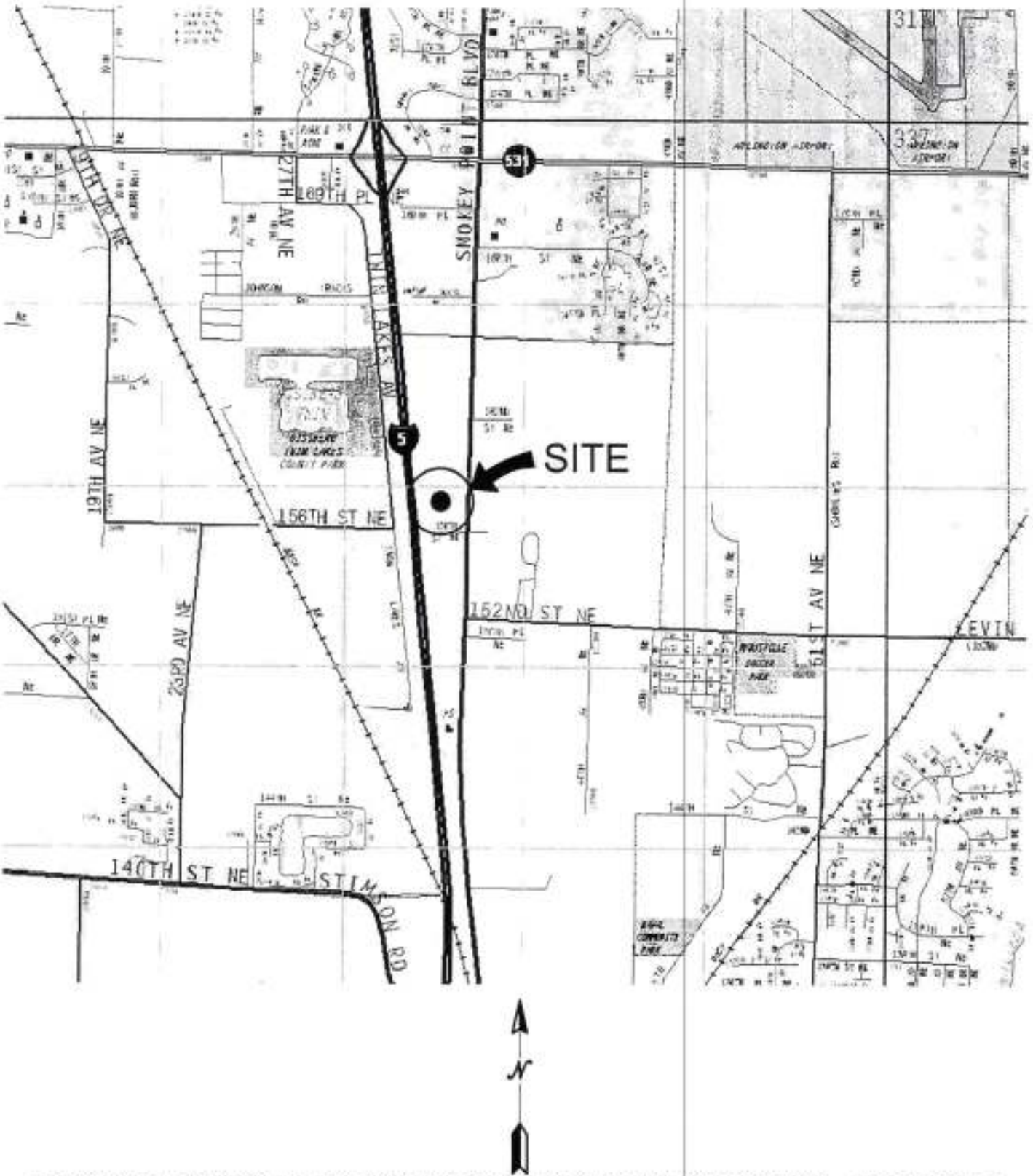
6.0 ADDITIONAL SERVICES

Terra Associates, Inc., should review final designs and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and implemented into project design. We should also provide geotechnical services during construction in order to observe compliance with the design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

7.0 LIMITATIONS

This report is the property of Terra Associates, Inc., and was prepared in accordance with generally accepted geotechnical engineering practices. This report is intended for specific application to the Pilchuck Landing project in Marysville, Washington, and for the exclusive use of Opus NW, LLC and their authorized representatives. No other warranty, expressed or implied, is made.

The analyses and recommendations presented in this report are based upon data obtained from the test pits excavated on-site. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc., should be requested to reevaluate the recommendations in this report prior to proceeding with construction.



REFERENCE: THOMAS GUIDE, CD-ROM, KING/PIERCE/SNOHOMISH COUNTIES, 2004 NOT TO SCALE

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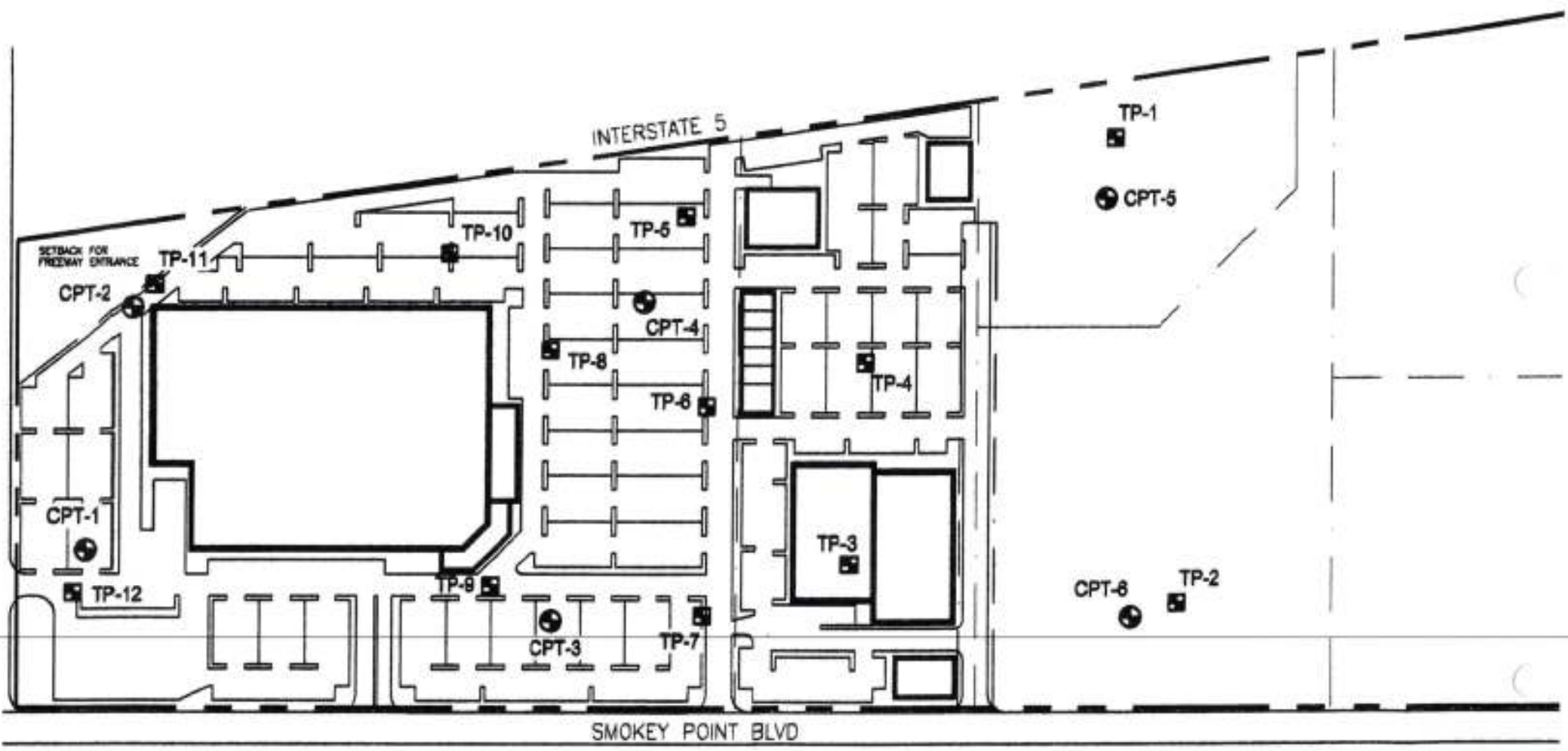
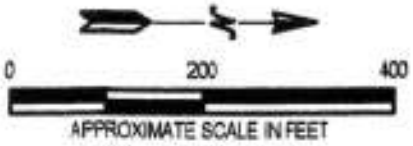
VICINITY MAP
PILCHUCK LANDING
MARYSVILLE, WASHINGTON

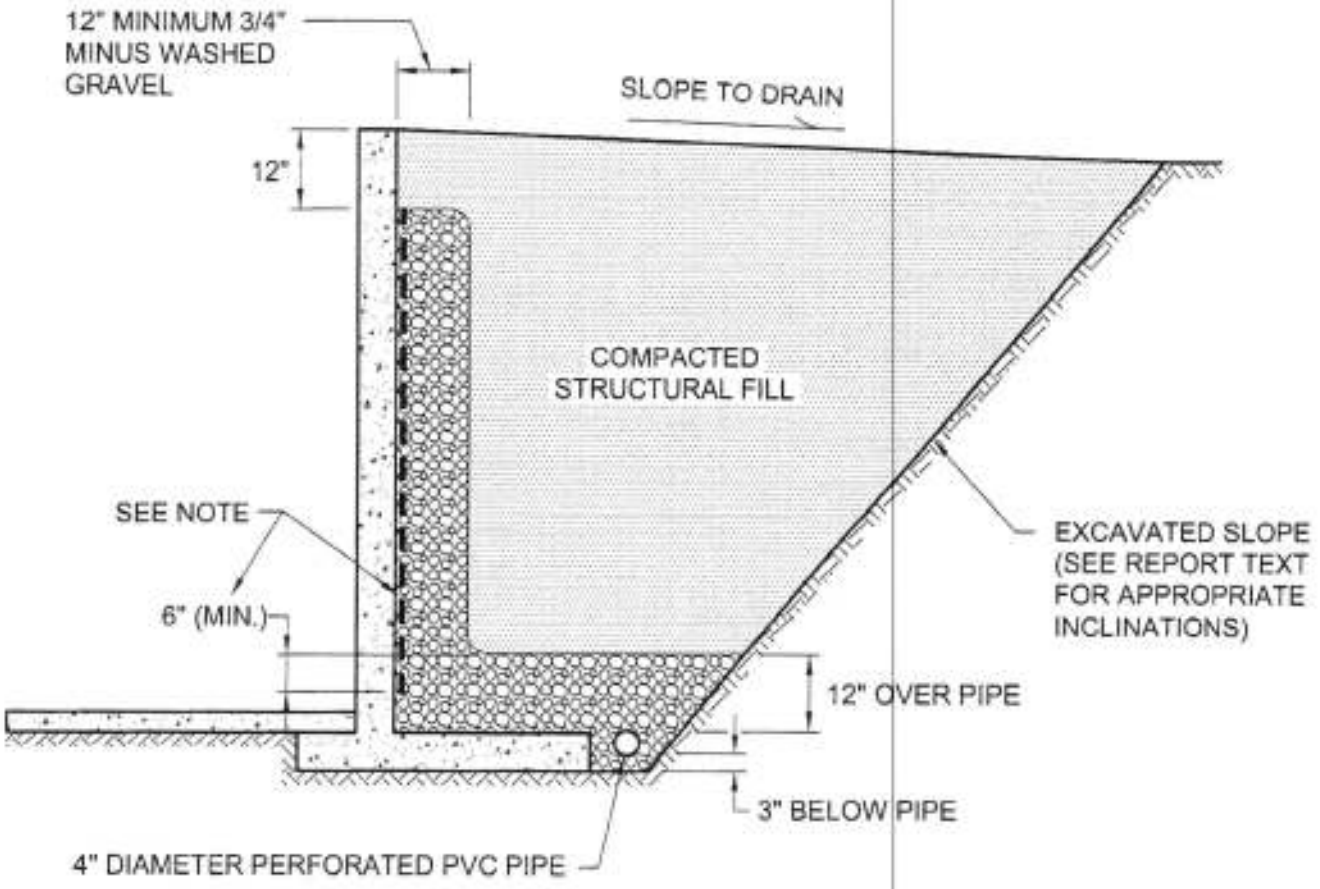
Proj. No. T-5675	Date MAR 2005	Figure 1





LEGEND:

■ TP-1 APPROXIMATE LOCATION OF TEST PIT



NOT TO SCALE

NOTE:

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.

Terra Associates, Inc. Consultants in Geotechnical Engineering Geology and Environmental Earth Sciences	TYPICAL WALL DRAINAGE DETAIL PILCHUCK LANDING MARYSVILLE, WASHINGTON	
	Proj. No. T-5675	Date MAR 2005	Figure 3

APPENDIX A
FIELD EXPLORATION

Pilchuck Landing
Marysville, Washington

On February 11, 2005, we performed our field exploration using a rubber-tired backhoe. We explored subsurface soil conditions at the site by excavating 12 test pits to a maximum depth of 10 feet below existing surface grades. On February 16, 2005, we also explored subsurface conditions at the site by performing six CPTs. Northwest Cone Exploration (NWC) under subcontract with Terra Associates, Inc. performed the CPTs at locations selected by Terra Associates, Inc. The CPTs were advanced to depths of 40 feet below the surface. The CPT and test pit locations were determined in the field by pacing measurements from existing site features. The approximate CPT and test pit locations are shown on Figure 2.

In the CPT, an instrumented approximately 1 ½-inch diameter cone is pushed into the ground at a constant rate. During advancement, continuous measurements are made of the resistance to penetration of the cone and the friction of the outer surface of a sleeve. The cone is also equipped with a porous filter and a pressure transducer for measuring groundwater or pore water pressure generated. Measurements of tip and sleeve frictional resistance, pore pressure, and interpreted soil conditions are summarized in graphical form on the attached CPT logs.

An engineering geologist from our office observed the test pit excavations and classified the soil conditions encountered, maintained a log of each test pit, obtained representative soil samples, and observed pertinent site features. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1. The test pit logs are presented on Figures A-2 through A-7.

Representative soil samples obtained from the test pits were placed in closed containers and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the Test Pit Logs. Grain size analyses were performed on six of the samples, the results of which are shown on Figures A-8 through A-10.

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS: More than 50% material larger than No. 200 sieve size	GRAVELS: More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS: More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands or gravelly sands, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS: More than 50% material smaller than No. 200 sieve size	SILTS AND CLAYS: Liquid limit is less than 50%		ML	Inorganic silts, rock flour, clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, (lean clay).
			OL	Organic silts and organic clays of low plasticity.
	SILTS AND CLAYS: Liquid limit is greater than 50%		MH	Inorganic silts, elastic.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat.

DEFINITION OF TERMS AND SYMBOLS

COHESIONLESS

Density	Standard Penetration Resistance in Blows/Foot
Very loose	0-4
Loose	4-10
Medium dense	10-30
Dense	30-50
Very dense	>50

COHESIVE

Consistency	Standard Penetration Resistance in Blows/Foot
Very soft	0-2
Soft	2-4
Medium stiff	4-8
Stiff	8-16
Very stiff	16-32
Hard	>32

I	2" OUTSIDE DIAMETER SPLIT SPOON SAMPLER
I	2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
▼	WATER LEVEL (DATE)
Tr	TORVANE READINGS, tsf
Pp	PENETROMETER READING, tsf
DD	DRY DENSITY, pounds per cubic foot
LL	LIQUID LIMIT, percent
PI	PLASTIC INDEX
N	STANDARD PENETRATION, blows per foot

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UNIFIED SOIL CLASSIFICATION SYSTEM
PILCHUCK LANDING
MARYSVILLE, WASHINGTON

Proj. No. T-5675 | Date MAR 2005 | Figure A-1

Test Pit No. TP-1

Logged by: DPL

Approximate Elev.

Date: 2/11/05

Depth (ft.)	Soil Description	Moisture Content (%)	
0	(6 inches TOPSOIL/SOD) Reddish-brown silty SAND, fine grained, loose to medium dense, moist to wet. (SM)	23.5	
	Grayish-brown to gray silty SAND to SAND with silt, fine grained, medium dense, moist. (SM/SP)	23.0	
5		21.8	▼
	Gray SAND, fine to coarse grained, medium dense, wet. (SP)	19.4	
10	Test pit terminated at 9 feet. Moderate groundwater seepage observed at 6 feet. Test pit sidewalls easily caved. 2-inch slotted pvc standpipe installed.		
15			

Test Pit No. TP-2

Logged by: DPL

Approximate Elev.

Date: 2/11/05

Depth (ft.)	Soil Description	Moisture Content (%)	
0	(12 inches TOPSOIL/SOD)		
	Reddish-brown silty SAND, fine grained, medium dense, moist. (SM)	18.4 21.8	
5	Grayish-brown to gray SAND with silt to clean SAND, fine grained, medium dense, moist to wet. (SP)	25.3	▼
		23.6 24.3	
10	Test pit terminated at 10 feet. Moderate groundwater seepage observed at 6.5 feet. Test pit sidewalls easily caved.		
15			

Test Pit No. TP-3

Logged by: DPL

Approximate Elev.

Date: 2/11/05

Depth (ft.)	Soil Description	Moisture Content (%)
0	(12 inches TOPSOIL/SOD)	
	Reddish-brown silty SAND, fine grained, medium dense, moist. (SM)	25.6
	Grayish-brown to gray SAND with silt, fine grained, medium dense, moist. (SM/SP)	25.3 20.7
5		
	Gray SAND, fine to coarse grained, trace gravel, medium desne, wet. (SP)	23.4 21.3
10	Test pit terminated at 10 feet. Moderate groundwater seepage observed at 6 feet. Test pit sidewalls easily caved.	
15		

▼

Test Pit No. TP-4

Logged by: DPL

Approximate Elev.

Date: 2/11/05

Depth (ft.)	Soil Description	Moisture Content (%)
0	(12 inches TOPSOIL/SOD)	
	Reddish-brown silty SAND, fine grained, medium dense, moist to wet. (SM)	22.4
5	Gray SAND with some silt, fine grained, medium dense, wet. (SP)	23.1
	Gray SAND with gravel, fine to coarse grained, medium dense, wet. (SP)	14.5
10	Test pit terminated at 10 feet. Moderate groundwater seepage observed at 6 feet. Test pit sidewalls easily caved. 2-inch slotted pvc standpipe installed.	
15		

▼

Test Pit No. TP-5

Logged by: DPL

Date: 2/11/05

Approximate Elev.

Depth (ft.)	Soil Description	Moisture Content (%)
0	(12 inches TOPSOIL/SOD)	
	Reddish-brown silty SAND, fine grained, medium dense, wet. (SM)	
	Grayish-brown sandy clayey SILT, medium stiff, wet. (ML)	27.4
	Reddish-brown sandy clayey SILT, soft, wet. (ML)	43.7
5	Gray SAND, fine grained, medium dense, wet. (SP)	26.3
	Gray SAND with gravel, fine to coarse grained, medium dense, wet. (SP)	13.7
10	Test pit terminated at 8 feet. Moderate groundwater seepage observed at 4.5 feet. Test pit sidewalls easily caved.	
15		

▼

Test Pit No. TP-6

Logged by: DPL

Date: 2/11/05

Approximate Elev.

Depth (ft.)	Soil Description	Moisture Content (%)
0	(12 inches TOPSOIL/SOD)	
	Reddish-brown silty SAND, fine grained, medium dense, moist to wet. (SM)	29.1
5	Gray SAND, fine grained, medium dense, moist. (SP)	21.8
	Gray SAND with some gravel, fine to coarse grained, medium dense, wet. (SP)	19.9
10	Test pit terminated at 10 feet. Moderate to heavy groundwater seepage observed at 6 feet. Test pit sidewalls easily caved.	
15		

▼

Test Pit No. TP-7

Logged by: DPL

Date: 2/11/05

Approximate Elev.

Depth (ft.)	Soil Description	Moisture Content (%)
0	(12 inches TOPSOIL/SOD)	
	Reddish-brown silty SAND, fine grained, medium dense, moist. (SM)	15.2
	Gray SAND, fine grained, medium dense, moist. (SP)	21.5
5		25.6 ▼
	Trace coarse sand grains below 8 feet.	24.7
10	Test pit terminated at 10 feet. Moderate groundwater seepage observed at 6.5 feet. Test pit sidewalls easily caved. 2-inch slottted pvc standpipe installed.	
15		

Test Pit No. TP-8

Logged by: DPL

Date: 2/11/05

Approximate Elev.

Depth (ft.)	Soil Description	Moisture Content (%)
0	(12 inches TOPSOIL/SOD)	
	Reddish-brown silty SAND, fine grained, medium dense, moist. (SM)	20.1
	Grayish-brown to gray SAND with silt to clean SAND, fine grained, medium dense, moist to wet. (SP)	20.4
5		15.9 ▼
	Trace gravel and coarse sand grairs below 6 feet.	19.2
10	Test pit terminated at 9 feet. Moderate groundwater seepage observed at 5 feet. Test pit sidewalls easily caved. 2-inch slotted pvc standpipe installed.	
15		

Test Pit No. TP-9

Logged by: DPL

Approximate Elev.

Date: 2/11/05

Depth (ft.)	Soil Description	Moisture Content (%)
0	(12 inches TOPSOIL/SOD)	
	Brown to reddish-brown silty SAND, fine grained, medium dense, moist to wet. (SM)	19.8 28.2
5	Gray SAND, fine grained, medium dense, trace gravel below 7 feet, moist to wet. (SP)	20.1 23.9
10	Test pit terminated at 10 feet. Moderate groundwater seepage observed at 5.5 feet. Test pit sidwalls easily caved.	
15		

Test Pit No. TP-10

Logged by: DPL

Approximate Elev.

Date: 2/11/05

Depth (ft.)	Soil Description	Moisture Content (%)
0	(12 inches TOPSOIL/SOD)	
	Reddish-brown silty SAND, fine grained, medium dense, wet. (SM)	
	Grayish-brown to gray silty SAND to SAND with silt, fine grained, medium dense, moist. (SM)	17.1
5	Gray SAND, fine grained, medium dense, trace gravel, fine to coarse grained below 8 feet, moist to wet. (SP)	20.9 23.7 20.2
10	Test pit terminated at 10 feet. Moderate groundwater seepage observed at 4.5 feet. Test pit sidewalls easily caved. 2-inch slotted pvc standpipe installed.	
15		

Test Pit No. TP-11

Logged by: DPL

Approximate Elev.

Date: 2/11/05

Depth (ft.)	Soil Description	Moisture Content (%)
0	FILL: brown to dark brown silty sand with some gravel, loose, wet. (6 inches TOPSOIL layer at 1.5 to 2 feet)	
	Bluish-gray silty SAND, fine grained, medium dense, moist. (SM)	22.7
	Brown silty SAND, fine grained, medium dense, wet. (SM)	
5		29.8
	Gray SAND, fine to coarse grained, trace gravel, medium dense, wet. (SP)	22.5
		14.6
10	Test pit terminated at 10 feet. Moderate groundwater seepage observed at 6.5 feet. Test pit sidewalls easily caved. 2-inch slotted pvc standpipe installed.	
15		

▼

Test Pit No. TP-12

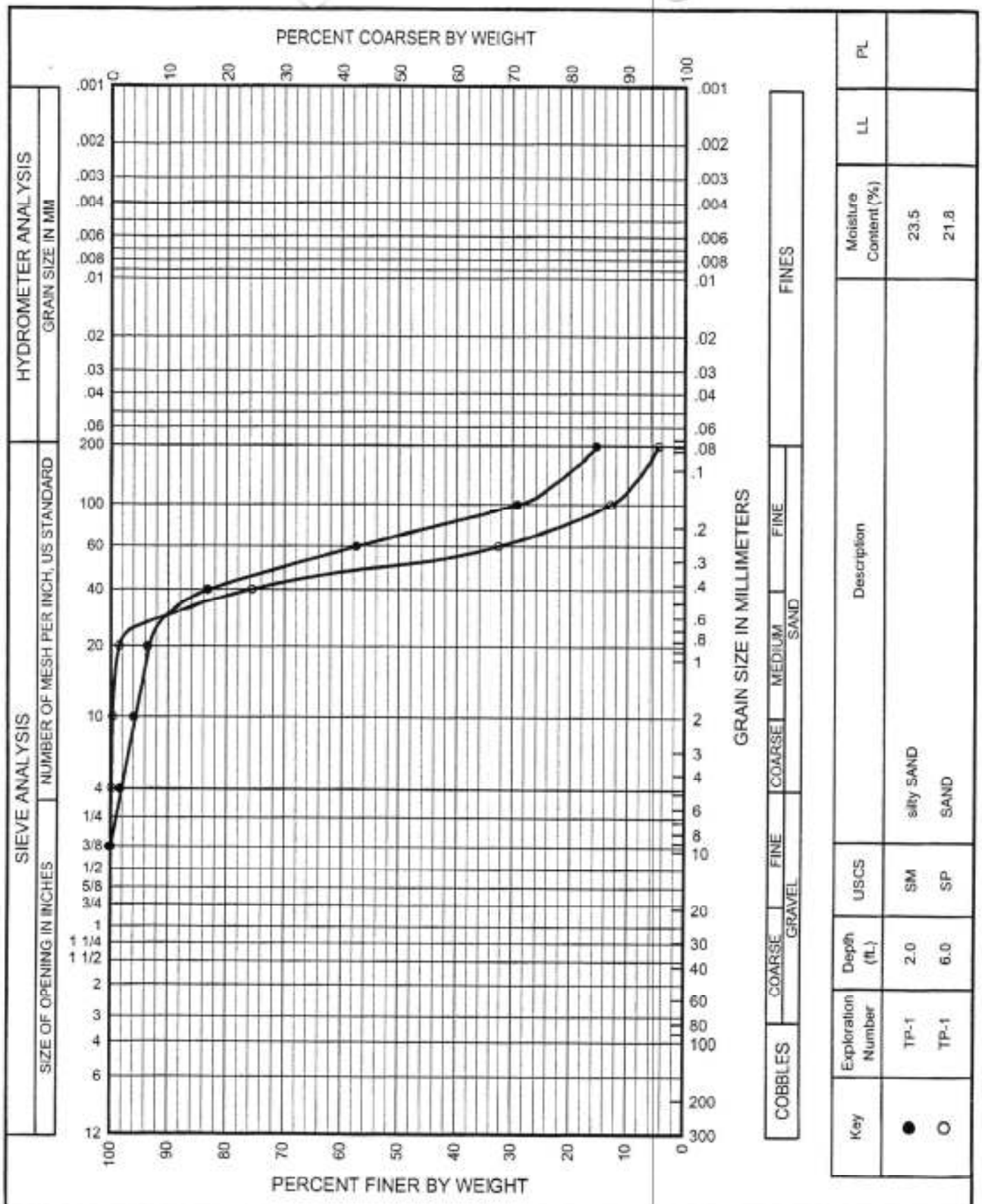
Logged by: DPL

Approximate Elev.

Date: 2/11/05

Depth (ft.)	Soil Description	Moisture Content (%)
0	FILL: gray silty sandy gravel, fine grained, medium dense, moist.	
	FILL: brown to tan brown silty sand, fine grained, medium dense, moist.	15.9
	Reddish-brown silty SAND, fine grained, iron stained, medium dense, wet. (SP)	43.4
5	Gray SAND, fine to coarse grained, medium dense, moist to wet. (SP)	15.9
10	Test pit terminated at 8 feet. Heavy groundwater seepage observed at 4 feet. Test pit sidewalls easily caved.	
15		

▼



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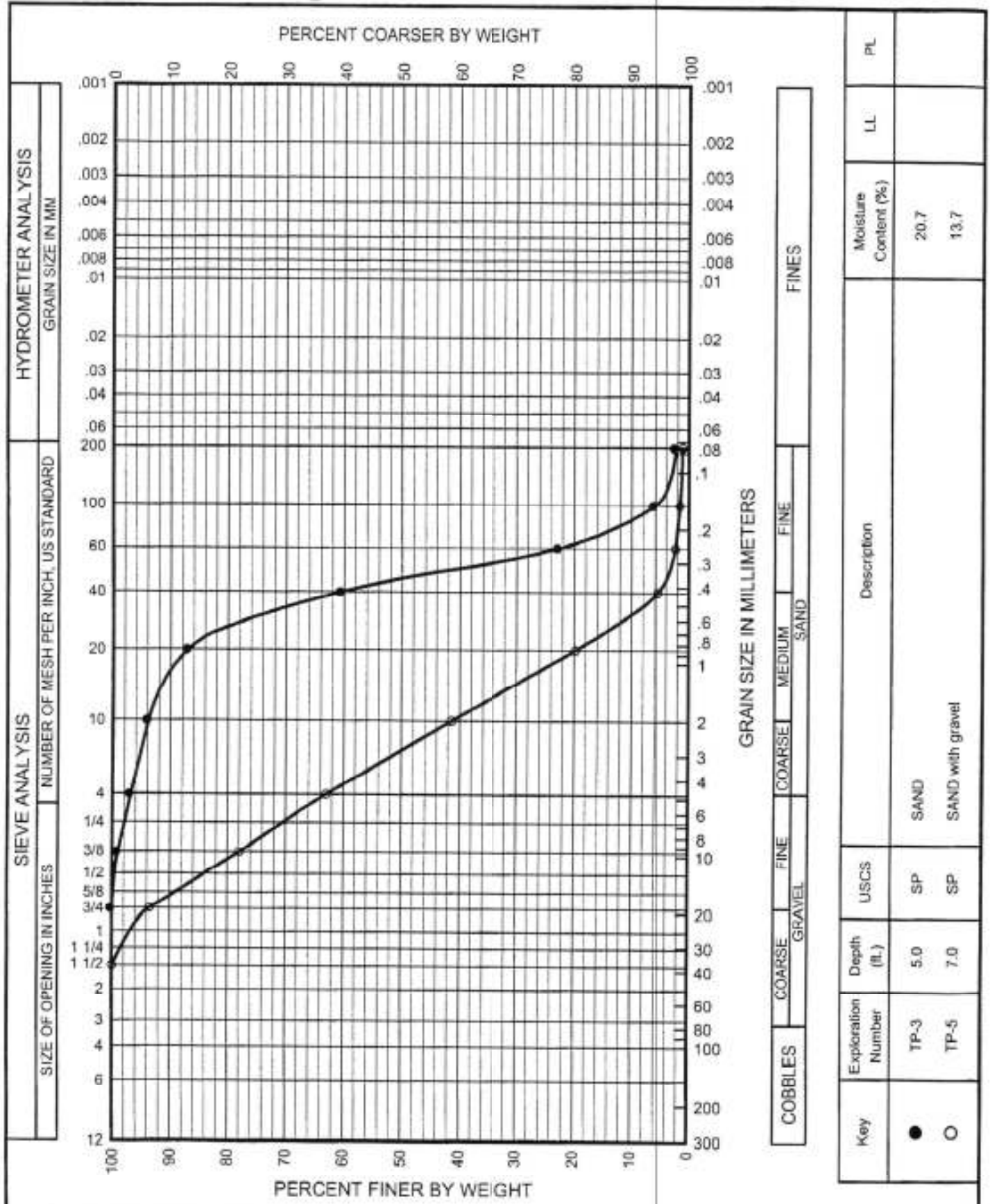
Geology and
Environmental Earth Sciences

GRAIN SIZE ANALYSIS
PILCHUCK LANDING
MARYSVILLE, WASHINGTON

Proj. No. T-5675 | Date MAR 2005 | Figure A-8



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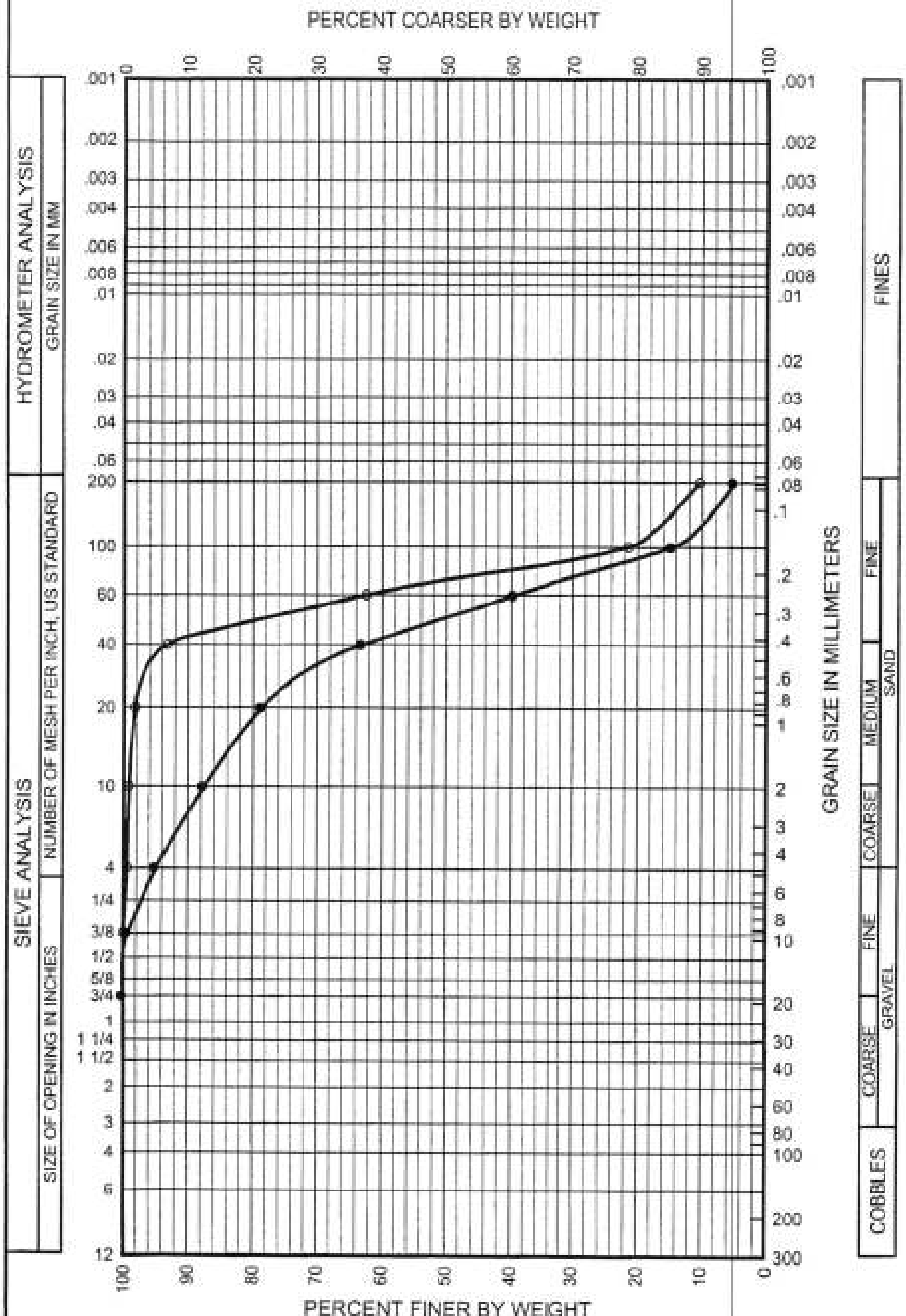
GRAIN SIZE ANALYSIS
PILCHUCK LANDING
MARYSVILLE, WASHINGTON

Proj. No. T-5675	Date MAR 2005	Figure A-9



Key	Exploration Number	Depth (ft.)	USCS	Description	Moisture Content (%)	LL	PL
●	TP-9	5.5	SP	SAND with gravel	20.1		
○	TP-11	5.0	SP-SM	SAND with silt	29.8		

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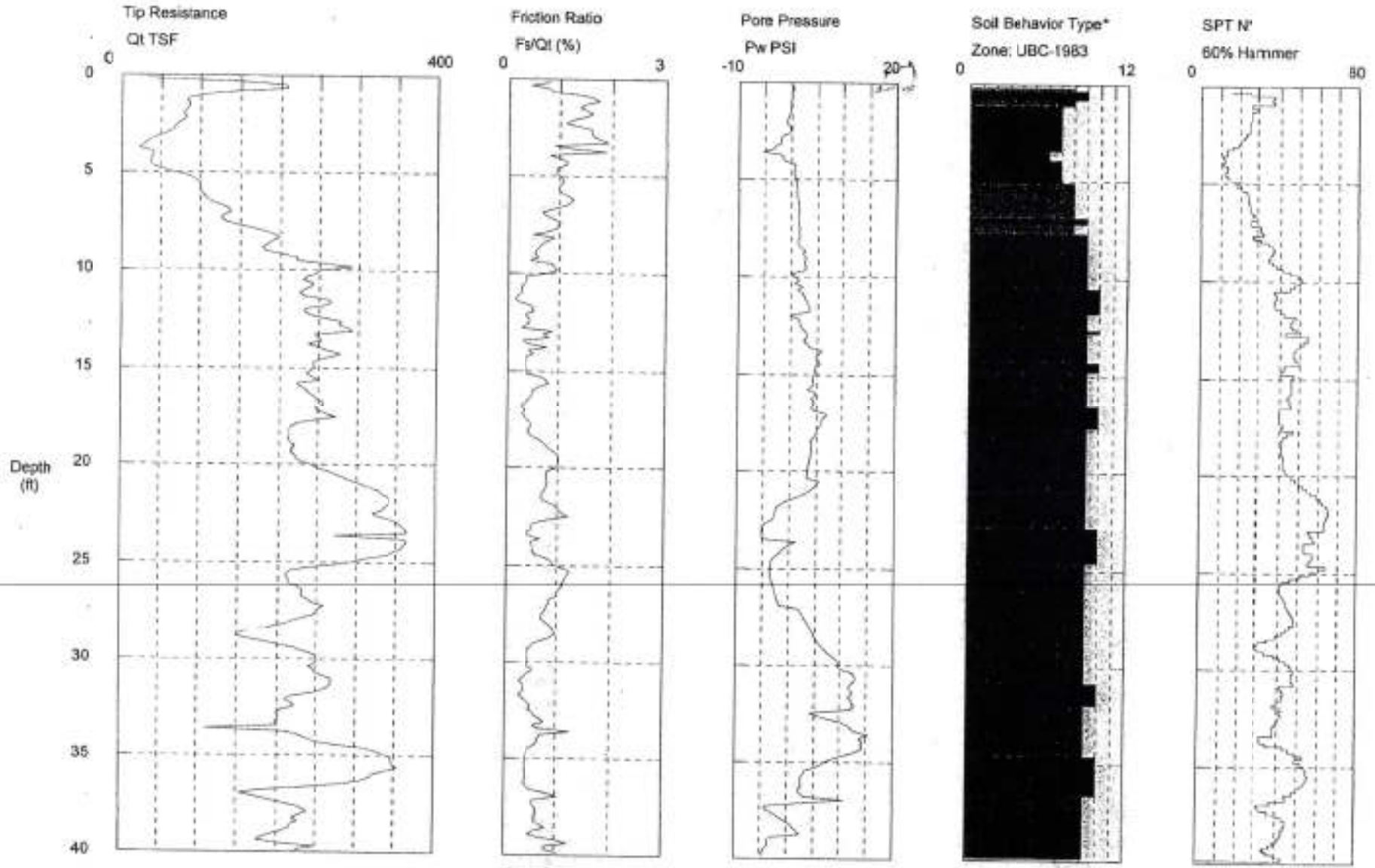
GRAIN SIZE ANALYSIS
PILCHUCK LANDING
MARYSVILLE, WASHINGTON

Proj. No. T-5675	Date MAR 2005	Figure A-10

Terra Associates

Operator: Brown
Sounding: CPT2005-01
Cone Used: DSG0851

CPT Date/Time: 2/16/2005 2:38:52 PM
Location: Pichuck Landing
Job Number: T-5675



Maximum Depth = 40.19 feet

Depth Increment = 0.164 feet

1 sensitive fine grained
2 organic material
3 clay

4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt

7 silty sand to sandy silt
8 sand to silty sand
9 sand

10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

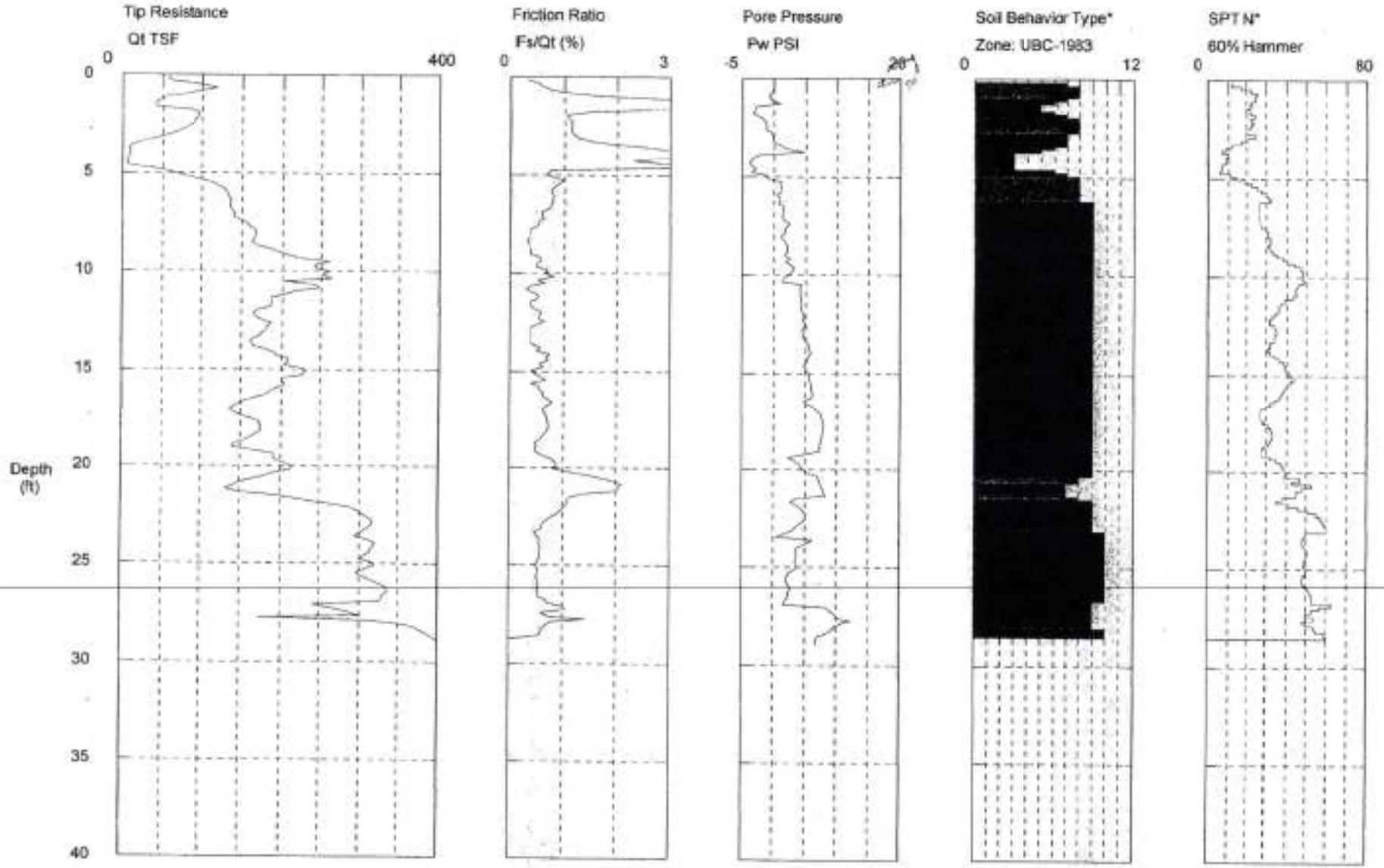
*Soil behavior type and SPT based on data from UBC-1983

Northwest Cone Exploration

Terra Associates

Operator: Brown
Sounding: CPT-02
Cone Used: DSG0851

CPT Date/Time: 2/16/2005 3:15:44 PM
Location: Pilchuck Landing
Job Number: T-5675



Maximum Depth = 28.90 feet

Depth Increment = 0.164 feet

- 1 sensitive fine grained
- 2 organic material
- 3 clay
- 4 silty clay to clay
- 5 clayey silt to silty clay
- 6 sandy silt to clayey silt
- 7 silty sand to sandy silt
- 8 sand to silty sand
- 9 sand
- 10 gravelly sand to sand
- 11 very stiff fine grained (*)
- 12 sand to clayey sand (*)

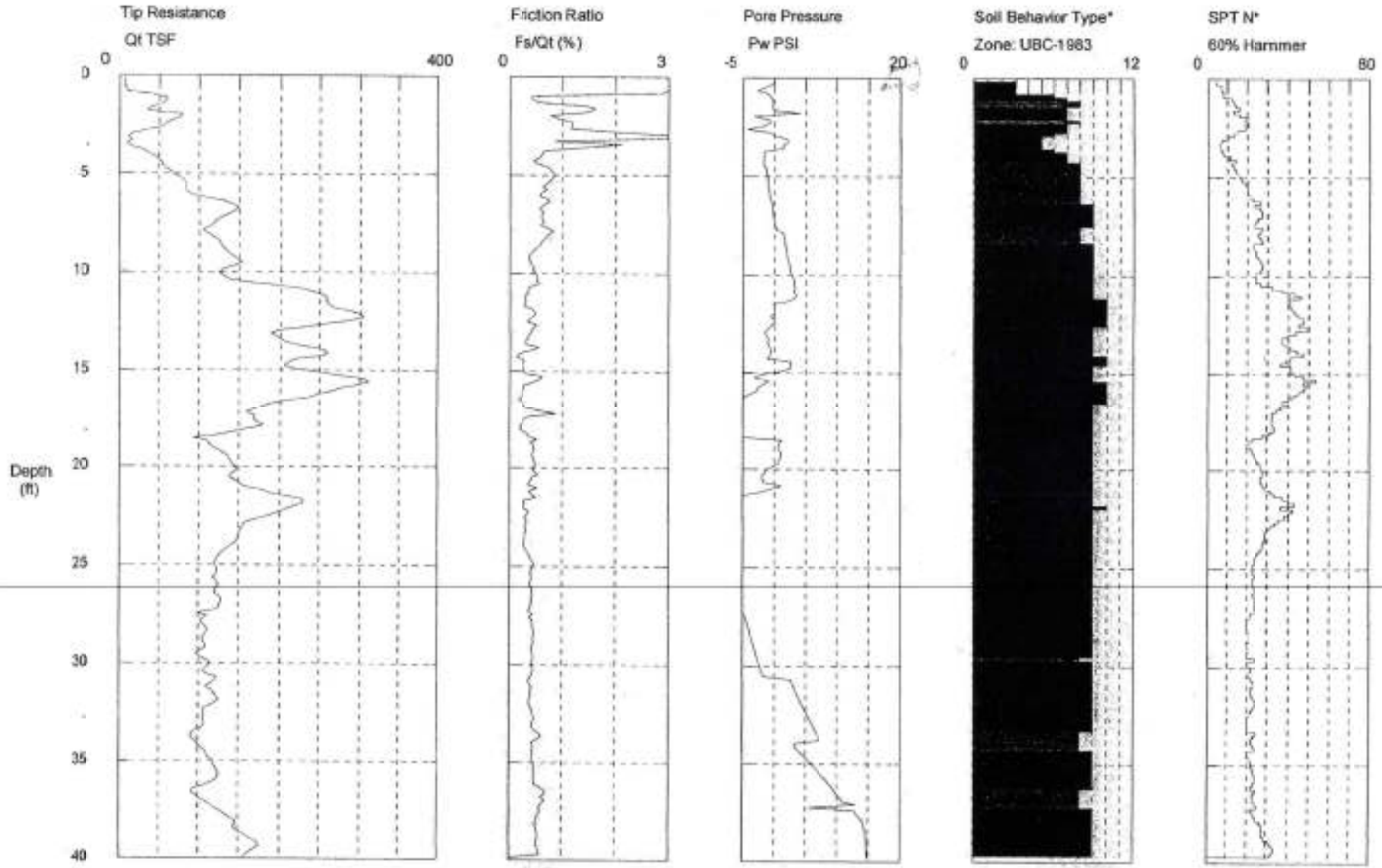
Instrument refused at 29 feet due to tip resistance
Northwest Cone Exploration

*Soil behavior type and SPT based on data from UBC-1983

Terra Associates

Operator: Brown
Sounding: CPT-03
Cone Used: DSG0708

CPT Date/Time: 2/18/2005 1:55:40 PM
Location: Pilchuck Landing
Job Number: T-5675



Maximum Depth = 40.03 feet

Depth Increment = 0.164 feet

- 1 sensitive fine grained
- 2 organic material
- 3 clay
- 4 silty clay to clay
- 5 clayey silt to silty clay
- 6 sandy silt to clayey silt
- 7 silty sand to sandy silt
- 8 sand to silty sand
- 9 sand
- 10 gravelly sand to sand
- 11 very stiff fine grained (*)
- 12 sand to clayey sand (*)

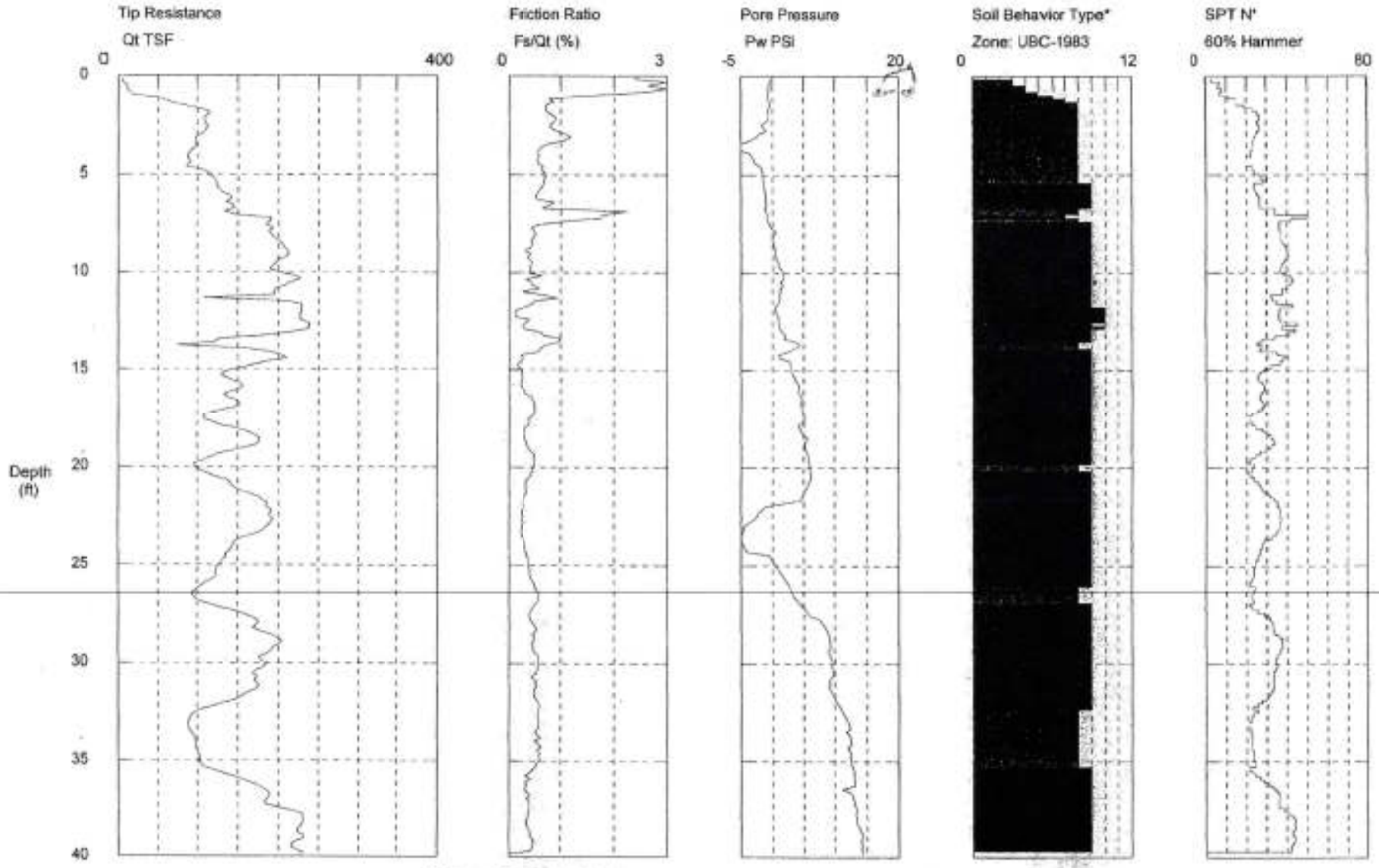
*Soil behavior type and SPT based on data from UBC-1983

Northwest Cone Exploration

Terra Associates

Operator: Brown
Sounding: CPT-04
Cone Used: DSG0708

CPT Date/Time: 2/18/2005 1:25:45 PM
Location: Pichuck Landing
Job Number: T-5675



Maximum Depth = 40.03 feet

Depth Increment = 0.164 feet

- 1 sensitive fine grained
- 2 organic material
- 3 clay
- 4 silty clay to clay
- 5 clayey silt to silty clay
- 6 sandy silt to clayey silt
- 7 silty sand to sandy silt
- 8 sand to silty sand
- 9 sand
- 10 gravelly sand to sand
- 11 very stiff fine grained (*)
- 12 sand to clayey sand (*)

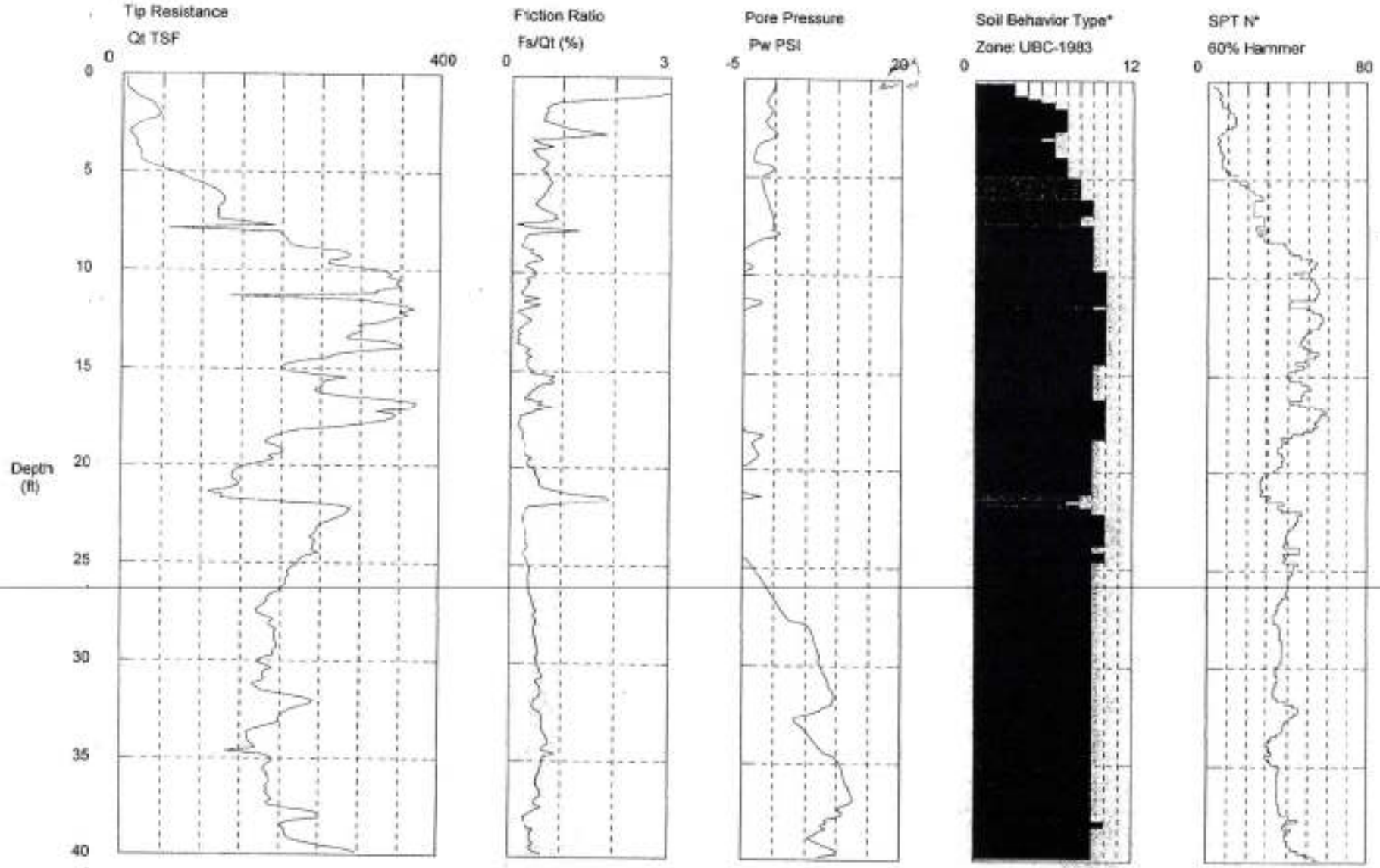
*Soil behavior type and SPT based on data from UBC-1983

Northwest Cone Exploration

Terra Associates

Operator: Brown
Sounding: CPT-05
Cone Used: DSG0706

CPT Date/Time: 2/18/2005 12:34:53 PM
Location: Pilchuck Landing
Job Number: T-5675



Maximum Depth = 41.17 feet

Depth Increment = 0.164 feet

- 1 sensitive fine grained
- 2 organic material
- 3 clay
- 4 silty clay to clay
- 5 clayey silt to silty clay
- 6 sandy silt to clayey silt
- 7 silty sand to sandy silt
- 8 sand to silty sand
- 9 sand
- 10 gravelly sand to sand
- 11 very stiff fine grained (*)
- 12 sand to clayey sand (*)

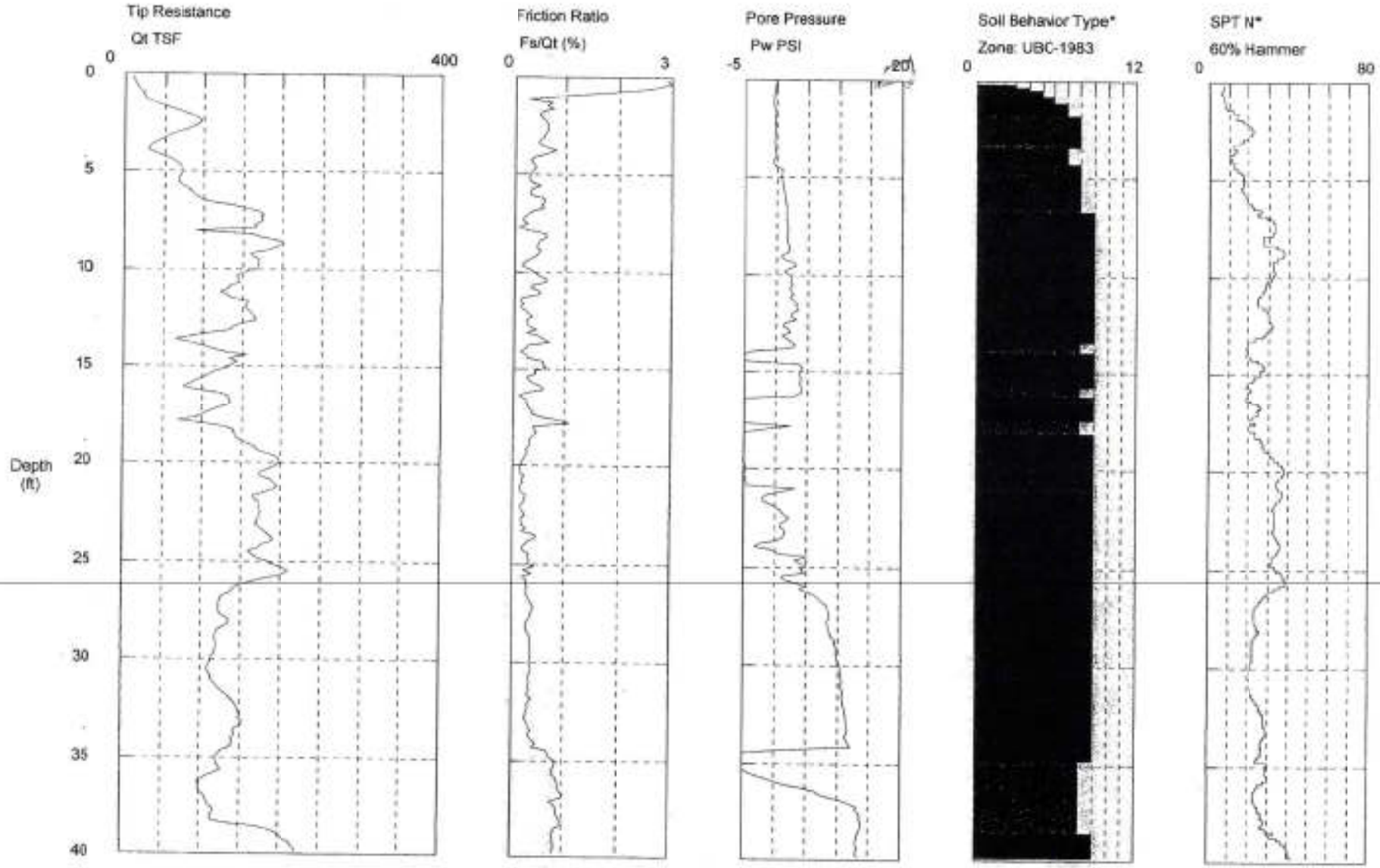
*Soil behavior type and SPT based on data from UBC-1983

Northwest Cone Exploration

Terra Associates

Operator: Brown
Sounding: CPT-06
Cone Used: DSG0708

CPT Date/Time: 2/18/2005 11:57:42 AM
Location: Pilchuck Landing
Job Number: T-5675



Maximum Depth = 40.35 feet

Depth Increment = 0.164 feet

1 sensitive fine grained
2 organic material
3 clay

4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt

7 silty sand to sandy silt
8 sand to silty sand
9 sand

10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*Soil behavior type and SPT based on data from UBC-1983

Northwest Cone Exploration

6.0 Other Permits

A right-of-way permit will be required for the city of Marysville.