civil & structural
engineering & planning

TECHNICAL INFORMATION REPORT

Guadagno Landslide Repair

14282 Olympic Drive SW
Vashon, WA 98070

06/15/2022

CG Project No. 21076.20

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Overview

This Technical Information Report is for the Guadagno landslide repair project. The project is the installation of a retaining wall on a 19,104 sf (0.44 ac) lot. The property is rectangular in shape and currently contains an existing single-family residence, garage, two decks, associated walkways and driveways, and several walls and rockeries. Site pervious areas generally consist of landscaping and evergreen trees.

The proposed development consists of clearing and grading the area of work where the landslide occurred and the construction of a new retaining wall with associated drainage reconfiguration, and the addition of two wooden staircases leading to the northernmost existing deck on site to replace in like kind the stairs that were demolished by the recent landslide. Minimal new impervious surfaces will be added on site. Stormwater will be managed on-site using a drain diffuser tee that will collect runoff that will be re-established from the existing roof drains, other existing drains on site, and the footing drains of the proposed wall.

This report is based on the TIR specifications as detailed in Section 2.3.1.1 in the 2021 King County Surface Water Design Manual (herein referred to as the SWDM).

Address: 14282 Olympic Drive SW, Vashon, WA 98070
Tax Parcel Number: 888800-0055
Zoning: RA2.5
Drainage Basin: West Vashon
Watershed: Central Puget Sound

Predeveloped Condition

The existing site contains a partially developed parcel totaling 0.439 acres. There is an existing one-story building in the southern portion of the site with a deck, garage, and associated walkways and driveways. The site contains a steep slope hazard area, flood hazard area in the northern portion of the site, and the entire site is contained within a landslide hazard area. The site has recently experienced two landslides, necessitating the construction of a retaining wall. Site topography slopes downward from south to north at an average slope of about 15% to 23% before increasing to about 68% in the steep slope area. The slope lessens downhill to about 33% below the existing lower deck and to a flat area of approximately 10 feet behind the existing bulkhead. The existing storm drainage pipes that drained above the existing bulkhead

were disconnected due to the landslide. Currently there is a 4" ADS line that drains onto the slope causing erosion that will need to be temporarily connected during construction until the new drainage system shown on sheet C2.1 of the Grading and Drainage Plan is installed.

There is a septic field on site and an existing water meter that connects to the existing residence. The property is bordered by single-family lots to the east and west, Olympic Dr SW to the south, and the Puget Sound to the north. (see Figures I-1 and I-2 for vicinity map and aerial image). See civil sheet C2.1 for a plan view of the site in its existing condition and proposed TESC measures.

According to the geotechnical report by Nelson Geotechnical Associates (NGA), two borings were bored to a depth of 31.5' and three hand augers were dug 3' to 6' below the existing ground surface. From their explorations, they interpreted the site to be underlain by 2' to 3' of undocumented fill, with 10' to 15' of Pre-Fraser fine-grained deposits underneath the fill. Groundwater seepage was encountered at about 2' to 8' below ground surface in the various borings and hand augers. See Section VI for the full geotechnical report.

The project's clearing limits were considered as this project's land-disturbing activity area. The total land-disturbing activity area for the project is slightly below 7,000 sf (0.16 ac).

Developed Condition

The site's proposed development on-site consists of the construction of a retaining wall within the steep slope area, as well as the construction of two wooden staircases that will lead to an existing deck on the northern portion of the site. The existing staircases were destroyed by the landslide. Proposed impervious surfaces total less than 2,000 sf, but the site contains a steep slope hazard area, flood hazard area, and is within a landslide hazard area. Therefore, the project will undergo Targeted Drainage Review per the requirements of Section 1.1.2.2 of the SWDM. The project must comply with, at minimum, Core Requirement #5, and Special Requirements #1-4.

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Attachment I-1. Technical Information Report (TIR) worksheet.

See attached pages.

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TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner: Anne & Phillip Guadagno
Phone: 206.259.0941
Address: 14282 Olympic Dr SW, Vashon Island, WA 98070

Project Engineer: Greg Guillen
Company: CG Engineering
Phone: 425-778-8500

Part 2 PROJECT LOCATION AND DESCRIPTION

Project Name: Guadagno Landslide Repair
DLS-Permitting
Permit #: TBD
Location Township: 23N
Range: 2E
Section: 13
Site Address: 14282 Olympic Dr SW, Vashon Island, WA 98070

Part 3 TYPE OF PERMIT APPLICATION

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

Part 4 OTHER REVIEWS AND PERMITS[1]

- ☐ DFW HPA
- ☐ COE CWA 404
- ☐ ECY Dam Safety
- ☐ FEMA Floodplain
- ☐ COE Wetlands
- ☐ Other _____
- ☐ Shoreline Management
- ☒ Structural Rockery/Vault/ Wall
- ☐ ESA Section 7

Part 5 PLAN AND REPORT INFORMATION

Technical Information Report

Type of Drainage Review (check one):
- ☐ Full
- ☒ Targeted
- ☐ Simplified
- ☐ Large Project
- ☐ Directed

Date (include revision dates): _____
Date of Final: _____

Site Improvement Plan (Engr. Plans)

Plan Type (check one): N/A
- ☐ Full
- ☐ Modified
- ☐ Simplified

Date (include revision dates): _____
Date of Final: _____

Part 6 SWDM ADJUSTMENT APPROVALS

Type (circle one): Standard / Experimental / Blanket

Description: (include conditions in TIR Section 2)

_____

_____

_____

Approved Adjustment No. _____ Date of Approval: _____

[1] DFW: WA State Dept. of Fish and Wildlife. HPA: hydraulic project approval. COE: (Army) Corps of Engineers. CWA: Clean Water Act. ECY: WA State Dept. of Ecology. FEMA: Federal Emergency Management Agency. ESA: Endangered Species Act.

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 7 MONITORING REQUIREMENTS

Monitoring Required: Yes (No)

Start Date: _____

Completion Date: _____

Describe: _____

Re: KCSWDM Adjustment No. _____

Part 8 SITE COMMUNITY AND DRAINAGE BASIN

Community Plan : _____

Special District Overlays: _____

Drainage Basin: West Vashon

Stormwater Requirements: Core Requirement 5, Special Requirements 1-4 at minimum

Part 9 ONSITE AND ADJACENT SENSITIVE AREAS

- ☐ River/Stream _____
- ☐ Lake _____
- ☐ Wetlands _____
- ☐ Closed Depression _____
- ☐ Floodplain _____
- ☐ Other _____

- ☐ Steep Slope _____
- ☐ Erosion Hazard _____
- ☐ Landslide Hazard _____
- ☐ Coal Mine Hazard _____
- ☐ Seismic Hazard _____
- ☐ Habitat Protection _____
- ☐ _____

Part 10 SOILS

Soil Type	Slopes	Erosion Potential
Alderwood gravelly sandy loam	8-30%	Moderate

- ☒ High Groundwater Table (within 5 feet)
- ☐ Other _____
- ☐ Sole Source Aquifer
- ☐ Seeps/Springs

☐ Additional Sheets Attached

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 11 DRAINAGE DESIGN LIMITATIONS N/A

REFERENCE	LIMITATION / SITE CONSTRAINT
☐ Core 2 – Offsite Analysis	
☐ Sensitive/Critical Areas	
☐ SEPA	
☐ LID Infeasibility	
☐ Other	
☐	

☐ Additional Sheets Attached

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

Threshold Discharge Area: (name or description) Northern portion of site

Core Requirements (all 8 apply):

Discharge at Natural Location	Number of Natural Discharge Locations: 1
Offsite Analysis	Level: 1 / 2 / 3 N/A dated:
Flow Control (include facility summary sheet)	Level: 1 / 2 / 3 or Exemption Number Flow Control BMPs N/A
Conveyance System	Spill containment located at: N/A
Erosion and Sediment Control / Construction Stormwater Pollution Prevention	CSWPP/CESCL/ESC Site Supervisor: TBD Contact Phone: TBD After Hours Phone:
Maintenance and Operation	Responsibility (circle one): Private / Public N/A If Private, Maintenance Log Required: Yes / No
Financial Guarantees and Liability	Provided: Yes / (No)
Water Quality (include facility summary sheet)	Type (circle one): Basic / Sens. Lake / Enhanced Basic / Bog or Exemption No. N/A Landscape Management Plan: Yes / No
For Entire Project: % of Target Impervious that had a feasible FCBMP implemented N/A	Total Replaced Impervious surfaces on the site 0 sf Total New Pervious Surfaces on the site 0 sf Repl. Imp. on site mitigated w/flow control facility 0 sf Repl. Imp. on site mitigated w/water quality facility 0 sf Repl. Imp. on site mitigated with FCBMP 0 sf

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

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

Special Requirements (as applicable):

Area Specific Drainage Requirements	Type: CDA / SDO / MDP / BP / LMP / Shared Fac. / (None) Name: _____
Floodplain/Floodway Delineation	Type (circle one): Major / (Minor) / Exemption / None 100-year Base Flood Elevation (or range): 18 ft Datum: NAVD88
Flood Protection Facilities	Describe: N/A
Source Control (commercial / industrial land use)	Describe land use: Single-family Describe any structural controls: N/A
Oil Control	High-use Site: Yes / (No) Treatment BMP: _____ Maintenance Agreement: Yes / No with whom? _____

Other Drainage Structures

Describe: Driveway trench drain, catch basins, conveyance pipes

Part 13 EROSION AND SEDIMENT CONTROL REQUIREMENTS

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION

- [X] Clearing Limits
- [X] Cover Measures
- [X] Perimeter Protection
- [ ] Traffic Area Stabilization
- [X] Sediment Retention
- [ ] Surface Water Collection
- [ ] Dewatering Control
- [X] Dust Control
- [ ] Flow Control
- [ ] Protection of Flow Control BMP Facilities (existing and proposed)
- [X] Maintain BMPs / Manage Project

MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION

- [X] Stabilize exposed surfaces
- [X] Remove and restore Temporary ESC Facilities
- [X] Clean and remove all silt and debris, ensure operation of Permanent Facilities, restore operation of Flow Control BMP Facilities as necessary
- [ ] Flag limits of SAO and open space preservation areas
- [ ] Other _____

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

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

Flow Control	Type/Description		Water Quality	Type/Description
☐ Detention			☐ Vegetated Flowpath	
☐ Infiltration			☐ Wetpool	
☐ Regional Facility			☐ Filtration	
☐ Shared Facility			☐ Oil Control	
☐ Flow Control BMPs			☐ Spill Control	
☐ Other	N/A		☐ Flow Control BMPs	
			☐ Other	N/A

Part 15 EASEMENTS/TRACTS

- ☐ Drainage Easement
- ☐ Covenant
- ☐ Native Growth Protection Covenant
- ☐ Tract
- ☐ Other N/A

Part 16 STRUCTURAL ANALYSIS

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

Part 17 SIGNATURE OF PROFESSIONAL ENGINEER

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

Greg Guiller 06/16/2022

Signed/Date

Figure I-1: Vicinity map (from Google Maps)

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Figure I-2: Aerial image (from King County iMap)

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Attachment I-2. Soils.
Predominant underlying soils were determined using the USDA Natural Resources Conservation Service Web Soil Survey tool. The site contains the following: Alderwood gravelly sandy loam at 8 to 30 percent slopes and Coastal beaches.

See attached pages.

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for King County Area, Washington

June 15, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:784 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 17, Aug 23, 2021

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

Date(s) aerial images were photographed: Aug 5, 2020—Aug 10, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	0.2	25.0%
AgD	Alderwood gravelly sandy loam, 15 to 30 percent slopes	0.4	62.5%
Cb	Coastal beaches	0.1	12.5%
Totals for Area of Interest		**0.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The

delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

King County Area, Washington

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

Map Unit Setting

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

Map Unit Composition

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

Description of Alderwood

Setting

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

Typical profile

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

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)

Other vegetative classification: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)
Hydric soil rating: No

Minor Components

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

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

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

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

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

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

Map Unit Composition
Alderwood and similar soils: 85 percent

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

Description of Alderwood

Setting

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

Typical profile

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

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)
Other vegetative classification: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)
Hydric soil rating: No

Minor Components

Everett

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

Indianola

Percent of map unit: 5 percent

Landform: Eskers, kames, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Shalcar

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

Norma

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

Cb—Coastal beaches

Map Unit Composition

Beaches: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Beaches

Setting

Landform: Beaches

Typical profile

H1 - 0 to 60 inches: Error

Properties and qualities

Slope: 1 to 5 percent
Depth to water table: About 0 inches
Frequency of flooding: Very frequent

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Tidal marsh

Percent of map unit: 5 percent
Landform: Alluvial cones

Hydric soil rating: Yes

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TIR Section II – Conditions and Requirements Summary

TIR Section II Summary

Narrative
Core Requirements
Special Requirements

The project will comply with the 2021 King County SWDM. Per the drainage review flow chart (Figure II-1) and Chapter 1.1.2 from the SWDM, the project is being submitted for Targeted Drainage Review because it is a project that is adding less than 2,000 sf of impervious area, but contains a steep slope hazard area, flood hazard area, and is within a landslide hazard area. The project was determined to be a Category 1 project and thus must address Core Requirement #5 and Special Requirements #1-4. The drainage system will include replacement of the entire drainage system that was damaged by the recent landslide. The installation of new conveyance pipes will route existing drainage to a dispersal tee, so Core Requirement #4 is also proposed to be met. Therefore, the following conditions are required as specified by the King County SWDM.

Core Requirements

Core Requirement #1: Discharge at the Natural Location: The overall topography of the subject property descends from south to north. This drainage pattern will be maintained by routing stormwater from the southern portion of the site into the northern portion of the site using conveyance pipes. A proposed dispersal tee will discharge runoff into the Puget Sound.

Core Requirement #2: Offsite Analysis: Not applicable.

Core Requirement #3: Flow Control: Not applicable.

Core Requirement #4: Conveyance System: New pipe systems are proposed and were designed to meet the 25-year peak flow capacity. See Section V.

Core Requirement #5: Erosion & Sediment Control: A Construction Stormwater Pollution Prevention Plan (CSWPPP) and narrative has been prepared. See Section VIII.

Core Requirement #6: Maintenance & Operations: Not applicable.

Core Requirement #7: Financial Guarantees & Liabilities: Not applicable.

Core Requirement #8: Water Quality: Not applicable.

Core Requirement #9: Flow Control BMPs: Not Applicable.

Special Requirements

Special Requirement #1: Other Adopted Requirements: Not applicable.

Special Requirement #2: Flood Hazard Area Delineation: FEMA 100-year flood plain shown on site plan per King County iMap.

Special Requirement #3: Flood Protection Facilities: Not applicable.

Special Requirement #4: Source Control: Not applicable.

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FIGURE 1.1.2.A FLOW CHART FOR DETERMINING TYPE OF DRAINAGE REVIEW REQUIRED

Is the project a ***single family residential*** or ***agricultural project*** that results in ≥2,000 sf of ***new*** plus ***replaced impervious surface*** or ≥7,000 sf of ***land disturbing activity***, results in less than 5,000 square feet of new plus replaced pollution generating impervious surface, results in less than ¾ acre of pollution generating pervious surfaces AND meets one of the following criteria?

- The project meets the Basic Exemption from flow control in Core Requirement #3. *Note the Basic Exemption thresholds are applied by project site.*
- *For projects inside the Urban Growth Area on predominately till soils:*
  The project results in no more than 7,947 square feet of target impervious surfaces* as defined in Section 1.1.2.1 AND proposed pervious area is equal to or less than 14,941 – 1.88 x (total target impervious surfaces)
- *For projects inside the Urban Growth Area on predominately outwash soils:*
  The project results in no more than 6,872 square feet of target impervious surfaces* as defined in Section 1.1.2.1 AND proposed pervious area is equal to or less than 20,343 – 2.96 x (total target impervious surfaces)
- *For outside the Urban Growth Area on predominately till soils:*
  The project results in no more than 5,074 square feet of target impervious surfaces* as defined in Section 1.1.2.1 AND proposed pervious area is equal to or less than 11,570 – 2.28 x (total target impervious surfaces)
- *For outside the Urban Growth Area on predominately outwash soils:*
  The project results in no more than 4,000 square feet of target impervious surfaces* as defined in Section 1.1.2.1 AND proposed pervious area is equal to or less than 10,720 – 2.68 x (total target impervious surfaces)
- *Is an agricultural project that qualifies for the "Impervious Surface Percentage Exemption For Agricultural Projects" detailed in Core Requirement 3*

No

Yes → SIMPLIFIED DRAINAGE REVIEW
Section 1.1.2.1
Note: The project may also be subject to Targeted Drainage Review as determined below.

Is the project a ***single family residential*** or ***agricultural project*** that results in ≥2,000 sf of ***new*** plus ***replaced impervious surface*** or ≥7,000 sf of ***land disturbing activity AND*** *is not subject to Large Project Drainage Review as defined in Section 1.1.2.5*?

Yes → DIRECTED DRAINAGE REVIEW
Section 1.1.2.3

No

Does the project result in ≥2,000 sf of ***new*** plus ***replaced impervious surface*** or ≥7,000 sf of ***land disturbing activity***?

No

Does the project have the characteristics of one or more of the following categories of projects (see more detailed threshold language on p. 1-15)?

1. Projects containing or adjacent to a ***flood***, ***erosion***, or ***steep slope hazard area***; or projects within a ***Critical Drainage Area*** or Landslide Hazard Drainage Area.
2. Projects proposing to ***construct or modify*** a drainage pipe/ditch that is 12" or larger or receives runoff from a 12" or larger drainage pipe/ditch.
3. ***Redevelopment projects*** proposing ≥$100,000 in improvements to an existing ***high-use site***.

Yes

No → Reassess whether drainage review is required per Section 1.1.1 (p. 1-9).

Yes → TARGETED DRAINAGE REVIEW
Section 1.1.2.2

Yes

Is the project an Urban Planned Development (UPD), OR does it result in ≥50 acres of ***new impervious surface*** within a subbasin or multiple subbasins that are hydraulically connected, OR does it have a ***project site*** ≥50 acres within a ***critical aquifer recharge area***?

No → FULL DRAINAGE REVIEW
Section 1.1.2.4

Yes → LARGE PROJECT DRAINAGE REVIEW
Section 1.1.2.5

Figure II-1: Drainage review flow chart from 2021 SWDM

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TIR Section III – Off-Site Analysis

TIR Section III Summary

Narrative

Not applicable per Section II.

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TIR Section IV – Flow Control, Low Impact Development (LID) and Water Quality Facility Analysis and Design

TIR Section IV Summary:

Narrative

Not applicable per Section II.

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TIR Section V – Conveyance System Analysis and Design

TIR Section V Summary:

Narrative

Per Core Requirement #4, new pipe systems shall be designed with sufficient capacity to convey and contain the 25-year peak flow. Conveyance capacity shall be demonstrated using the methods in Chapter 4 of the KCSWDM.

Verification of capacity and performance must be provided for each element of the conveyance system. The analysis must show design velocities and flows for all drainage facilities within the development, as well as those off-site that are affected by the development.

The conveyance system will consist of a 6" HDPE pipe that will route existing drainage and the proposed wall footing drain to a dispersal tee to the north. The pipe is sloped at an average of 35.6%.

See Figures V-1 and V-2 on the following pages for calculations for the on-site conveyance pipes. Figure V-1 shows an image of the spreadsheet used for the Rational Method to calculate the 25-year flow rate for runoff from the roof. Q_{25} = 0.34 cfs. Figure V-2 shows an image of the spreadsheet used to develop a conveyance capacity table using Manning's Equation. From the table, the capacity of a 6" HDPE pipe sloping at 10% (the highest value on the table) is 1.78 cfs. This is greater than the 25-year peak flow calculated via the rational method, 0.34 cfs. Therefore, the conveyance pipes are expected to be sufficient.

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Rational Method - Developed Conditions
for: Guadagno Landslide Repair

$Q = C_{avg}iA$

Tc = 6.30 (assumed, since all pipe flow)

	Area (ac)	C
Dense Forest		0.10
Light Forest		0.15
Pasture	0.21	0.20
Lawns		0.25
Gravel		0.80
Pavement & Roofs	0.088	0.90
Open Water		1.00
Other		0.00

C_{avg}= 0.41

Total Area (A) = 0.30 **acres**

i = (Pr)(ir) Pr= total precipitation at the project site for 24-hr duration storm
ir= unit peak rainfall intensity factor

ir= (ar)(Tc)^(-br) ar, br= coefficients from Table 3.2.1.B of KCSWDM

$(ir)_2$=	0.54	i_2=	1.09	Q_2=	0.13
$(ir)_{10}$=	0.75	i_{10}=	2.25	Q_{10}=	0.27
$(ir)_{25}$=	0.80	i_{25}=	2.81	Q_{25}=	0.34
$(ir)_{100}$=	0.82	i_{100}=	3.68	Q_{100}=	0.45

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020	Rational Method	By	SBG	Date	6/15/2022
	Developed Conditions	Chkd		Date	
		Scale	N.T.S.	Sheet No.	
	Guadagno Landslide Repair	Job No.	21076.20		

Figure V-I: Rational Method calculations

Rational Method - Developed Conditions
for: Guadagno Landslide Repair

n= 0.013

Conveyance Capacity					
	4-inch	6-inch	8-inch	10-inch	12-inch
Slope (ft/ft)					
0.005	0.13	0.40	0.87	1.55	2.52
0.010	0.19	0.56	1.23	2.20	3.57
0.015	0.23	0.69	1.50	2.69	4.37
0.020	0.27	0.79	1.74	3.11	5.05
0.025	0.30	0.89	1.94	3.47	5.65
0.030	0.33	0.97	2.13	3.81	6.18
0.035	0.36	1.05	2.30	4.11	6.68
0.040	0.38	1.12	2.46	4.39	7.14
0.045	0.40	1.19	2.60	4.66	7.57
0.050	0.43	1.26	2.75	4.91	7.98
0.055	0.45	1.32	2.88	5.15	8.37
0.060	0.47	1.38	3.01	5.38	8.75
0.065	0.49	1.43	3.13	5.60	9.10
0.070	0.50	1.49	3.25	5.81	9.45
0.075	0.52	1.54	3.36	6.02	9.78
0.080	0.54	1.59	3.47	6.21	10.10
0.085	0.56	1.64	3.58	6.40	10.41
0.090	0.57	1.68	3.68	6.59	10.71
0.095	0.59	1.73	3.78	6.77	11.01
0.100	0.60	1.78	3.88	6.95	11.29

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020	Rational Method		By SBG	Date 6/15/2022
	Developed Conditions		Chkd	Date
			Scale N.T.S.	Sheet No.
	Guadagno Landslide Repair		Job No. 21076.20	

Figure V-2: Conveyance capacity values based on Manning's Equation

TIR Section VI – Special Reports and Studies

TIR Section VI Summary:

Narrative

The following reports are provided in this section:

1. Geotechnical Engineering Evaluation by Nelson Geotechnical Associates, Inc., dated May 13, 2021.
2. Critical Area Determination by Raedeke Associates, Inc., dated June 13, 2022.

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May 13, 2021

Mr. Phil Guadagno
VIA Email: phguadagno@gmail.com

Geotechnical Engineering Evaluation
Guadagno Slope Stabilization
14282 Olympic Drive SW
King County, Washington
NGA File No. 1245721

Dear Mr. Guadagno:

We are pleased to submit the attached report titled "**Geotechnical Engineering Evaluation – Guadagno Slope Stabilization – 14282 Olympic Drive SW – King County, Washington**." This report summarizes the existing surface and subsurface conditions within the site and provides recommendations for landslide mitigation. Our services were completed in general accordance with the proposal signed by you on March 1, 2021.

The subject site consists of a narrow coastal bluff lot overlooking Colvos Passage along the northwestern portion of Vashon Island. The site is currently occupied by a garage structure and single-family residence within the very southern and south-central portions of the site, respectively. Topography within the site generally slopes gently northward towards a steep north-facing bluff, which descends towards the beach and provides an estimated vertical relief of 40-feet. A wooden deck and staircase structure is situated on the bluff and provides access to the beach and existing boathouse structure along the northern portion of the property. We understand indications of slope movement have been observed; tension cracks, ground surface offset, and contortion of the existing staircase and landings has been reported.

We explored the subsurface soil conditions within the site with two geotechnical borings extending to approximate depths of 31.5 feet below grade, respectively. The bluff slope and landslide-affected steep slope areas were also mapped, and surficial soil conditions explored with hand tools. Our explorations indicated the site is underlain by a layer of generally soft and wet silt to silty fine sand soils with competent sand and gravel at depth. Based on our observations and explorations it appears that the upper silt-rich and relatively weaker soil layer has mobilized in an earthflow downslope movement, which has resulted in deformation of the upper to mid slope area as well as soils underlying and around existing deck/staircase foundations.

In our opinion, the slope, in its current state should be considered unstable and will likely continue to deform. Although, an earthflow of this nature is generally considered a slow process the slide could quickly evolve into a more rapid and catastrophic event, especially in the event of prolonged heavy rainfall or seismic conditions. Left unchecked, the slide will continue to move until it reaches a more stable configuration.

Considering these risks, we recommend stabilization measures be promptly taken to reduce further landslide activity on this slope and to protect life, access, and infrastructure. In the attached report, we provide recommendations for permanent stabilization of the bluff slope with a 'light-duty' timber-lagged wall laterally restrained with grouted tie-back anchors, as well as recommendations for drainage and long-term slope maintenance considerations.

We appreciate the opportunity to provide service to you on this project. Please contact us if you have any questions regarding this report or require further information.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Khaled M. Shawish, PE
Principal

TABLE OF CONTENTS

LIST OF FIGURES

Geotechnical Engineering Evaluation
Guadagno Slope Stabilization
14282 Olympic Drive SW
King County, Washington

INTRODUCTION

This report presents the results and stabilization recommendations of our geotechnical engineering investigation and evaluation of the recent landslide activity which has occurred at 14282 Olympic Drive SW in the Vashon Island area of King County, Washington, as shown on the Vicinity Map in Figure 1. The parcel number for the subject property is 8888000055.

The property is located in the Colvos neighborhood of Vashon Island, and is bordered to the east and west by existing residences, to the south by Olympic Drive SW, and to the north by the Puget Sound. Ongoing landslide activity has been observed along and adjacent to the steep north-facing bluff slope within the northern portion of the property. We anticipate the upper soft silt-rich soils interpreted to mantle the site and bluff slope have mobilized in an earthflow soil creep due to likely increased natural moisture content as a result of precipitation and/or inadequate surface water management.

We were requested to complete an evaluation of the landslide and provide stabilization options for the hillside to protect existing infrastructure against future slope instability. The existing site features mapped are shown on the Site Plan in Figure 2.

SCOPE

The purpose of this study is to explore and characterize the site subsurface conditions and provide our opinions and recommendations regarding the existing slope stability and proposed retaining wall.

Specifically, our scope of services includes the following:

1. Reviewing available soil and geologic maps of the area as well as other relevant geotechnical information, as provided.

2. Exploring the subsurface soil and groundwater conditions within the affected areas with up to three, 20-foot-deep geotechnical boreholes using a limited-access drill rig. Drilling services were subcontracted by NGA.

3. Mapping the conditions on the site slopes using shallow, hand-tool explorations where necessary to construct geological cross sections and quantitatively evaluate slope stability.

4. Providing our opinions regarding the potential causes and mechanisms of the landslides.

5. Providing preliminary recommendations for repairing the affected areas and/or reducing the severity of the instability.

6. Providing general recommendations for improving drainage and erosion control.

7. Consulting with contractors and with civil and structural engineers to discuss potential stabilization measures for the slide area.

8. Documenting the results of our findings, conclusions, and recommendations in a preliminary written geotechnical report.

SITE CONDITIONS

Surface Conditions

The site consists of a narrow rectangular-shaped parcel covering approximately 0.47 acres with roughly 50-feet of Puget Sound beach frontage. The site is currently occupied by a garage and single-family residence within the southern and south-central portions of the site, respectively. Topography within the site generally slopes gently from south to north towards a steep bluff slope along the northern portion of the site. The north-facing bluff descends from the gently sloping backyard area at gradients in the range of 32 to 40 degrees (62.5 to 83.9 percent) towards the beach and Puget Sound as shown on Cross Section A-A' in Figure 3. The overall vertical relief of the bluff slope is approximately 40-feet. Access from the backyard to the beach and lower boat house structure is provided by an existing wooden staircase along the face of the slope, which leads down to a mid and lower wooden landing. The toe of the slope is faced by an existing approximately 8-foot-tall riprap bulkhead. The subject bluff slope is generally vegetated with light underbrush, scattered shrubs, grass, and few smaller coniferous and deciduous trees. A system of short timber landscape walls was observed along the slope surface adjacent to the staircase, forming short-terraced benches. Numerous corrugated pipes were observed along the face of the slope and appeared to discharge along the beach as well as an approximately 12-inch diameter concrete drainpipe daylighting from the top of slope near the western property line. We also observed and were informed that a french drain was installed parallel with and just south of the top of slope, which reportedly consisted of an approximately 2- to 3-foot-deep trench filled with drain rock and a perforated drainage pipe; the discharge location, if any, was unknown. Tension cracking was observed along the top of slope forming an arcuate head scarp with as much as approximately 12-inches of down set material near the crown of the slide. Further downslope very wet saturated soils were observed and the deck/stair foundations were being contorted by apparent soil creep.

Subsurface Conditions

Geology: The geologic units for this area are shown on the Geologic Map of the Vashon 7.5' Quadrangle and Selected Areas, King County, Washington, by Booth, D.B., Troost, K.G., and Tabor, R.W. (USGS, 2015). The geologic map indicates the site is covered by landslide deposits (Qls) with Vashon till and advance outwash soils occupying the uplands areas south of the site, as well as pre-Fraser older glacial and nonglacial sediments mapped along the bluff line. Landslide deposits are described as a mixture of broken to internally coherent surficial deposits derived from upslope. Till is described as a compact and non-sorted diamict of silt, sand, gravel, and cobbles. The advance outwash deposits are described as clean, mostly gray sand with pebbles and cobbles. The pre-Fraser glacial and nonglacial sediments (Pleistocene) are described as massive to laminated silt and clay, and variably oxidized bedded sand and gravel. Fine- and coarse-grained facies of the pre-Fraser glacial deposition are mapped in the vicinity of the site and are described as predominantly silt and clay and predominantly sand and gravel, respectively. Our explorations generally encountered silt underlain by sand and gravel soils consistent with the geologic mapping in this area.

Explorations: The subsurface conditions within the site were explored on March 29, 2021 by monitoring the drilling of two geotechnical boreholes along with performing three shallow hand tool explorations within the steep bluff slope. The approximate locations of our explorations are shown on the Schematic Site Plan in Figure 2.

A geologist from Nelson Geotechnical Associates, Inc. (NGA) was present during the explorations, examined the soils and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the explorations. A Standard Penetration Test (SPT) was performed on each of the samples during drilling to document soil density at depth. The SPT consists of driving a 2-inch outer-diameter, split-spoon sampler 18 inches using a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the final 12 inches is referred to as the “N” value and is presented on the boring logs. The N value is used to evaluate the strength and density of the deposit.

The soils were visually classified in general accordance with the Unified Soil Classification System presented in Figure 4. The logs of our explorations are attached to this letter and presented as Figures 5 through 7. We present a brief summary of the subsurface conditions in the following paragraphs. For a detailed description of the subsurface conditions, the exploration logs should be reviewed.

Undocumented fill: At the surface of each exploration approximately 2- to 3-feet of very loose to loose, dark brown to brown, organic-rich silty sand with varying amounts of gravel and roots were encountered, which we interpreted as topsoil and/or undocumented fill. These soils were typically moist to wet.

Pre-Fraser fine-grained deposits: Underlying surficial fill and topsoil in each exploration we encountered soft to medium stiff silt to silty fine sand which we interpreted as pre-Fraser glacial deposits. These soils were generally encountered in a wet condition. The fine-grained silt deposit varied in thickness from approximately 10- to 15-feet thick.

Pre-Fraser Coarse-grained deposits: In each exploration compact sand and gravel in a moist to locally wet condition was encountered to the extents explored. These soils were interpreted to match the description of pre-Fraser coarse-grained deposits.

Hydrogeologic Conditions

Wet conditions were encountered throughout each exploration, particularly in the upper fine-grained deposits, which we interpreted as perched water captured within sandier zones or preferential flow paths in an otherwise generally impermeable deposit. Perched water occurs when surface water infiltrates through less dense, more permeable soils, such as topsoil and the native sand deposits, and accumulates on top of a less permeable soil, such as the dense/hard glacial drift soils. Perched water typically does not represent a regional groundwater "table" within the upper soil horizons. Perched water tends to vary spatially and is dependent upon the amount of rainfall. We would expect the amount of groundwater to slightly decrease during drier times of the year and increase during wetter periods.

SENSITIVE AREA EVALUATION

Seismic Hazard

The 2018 International Building Code (IBC) seismic design section provides a basis for seismic design of structures. Since medium dense or better native glacial soils were generally encountered underlying the site at depth, the site conditions best fit the IBC description for Site Class D. Table 1 below provides seismic design parameters for the site that are in conformance with the 2018 IBC, which specifies a design earthquake having a two percent probability of occurrence in 50 years (return interval of 2,475 years), and the 2008 USGS seismic hazard maps.

Table 1 – 2018 IBC Seismic Design Parameters

Site Class	Spectral Acceleration at 0.2 sec. (g) S_S	Spectral Acceleration at 1.0 sec. (g) S_1	Site Coefficients		Design Spectral Response Parameters	
			F_a	F_v	S_{DS}	S_{D1}
D	1.558	0.586	1.000	1.500	1.039	0.586

The spectral response accelerations were obtained from the USGS Earthquake Hazards Program Interpolated Probabilistic Ground Motion website (2008 data) for the project latitude and longitude.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the groundwater table. It is our opinion that the competent native glacial soils interpreted to underlie the site at depth have a low potential for liquefaction or amplification of ground motion.

The competent glacial soils interpreted to form the core of the site slope are considered stable with respect to deep-seated slope failures. However, the loose surficial soils and undocumented fill on and near the sloping portions of the site have the potential for shallow sloughing failures during seismic events. Such events should not affect the proposed retaining wall, slope stabilization measures and existing residence provide the design recommendations in this report are incorporated into the overall site stabilization.

Landslide Hazard/Slope Stability

The criteria used for evaluation of landslide hazards include soil type, slope gradient, and groundwater conditions. The ground surface within the site generally slopes down gently to moderately from the south to the north with a steeper north-facing bluff slope below and north of the existing residence. The steep north-facing slope descends from the northern backyard area down to the toe of the steep slope behind the shoreline bulkhead at gradients in the range of 32 to 40 degrees (62.5 to 83.9 percent), as shown on Cross-Sections A-A' in Figure 3. The overall height of the steep north-facing slope below the residence is in the range of approximately 35- to 40-feet.

Our explorations and observations indicate that the core of the steep slope consists primarily of competent native glacial soils at depth. Relatively shallow failures as well as surficial erosion are natural processes and should be expected on these slopes especially within the loose surficial soils and the undocumented fill soils on the slopes.

It is our opinion that while there is on-going potential for sloughing, soil creep, and shallow failures within the loose surficial and undocumented fill soils on the steep slope as has been observed throughout the years, there is not a significant potential for deep-seated rotational slope failures under current site conditions. Investigating and improving the existing residence drainage systems, as well as proper site grading and the construction of the proposed retaining walls as recommended in this report should help improve current stability conditions within the site.

Slope Stability Analysis

The site slope within the proposed development area was analyzed for stability along Cross Sections A-A' for the existing conditions and the recommended retaining wall support within the site slopes using the computer program Slope/W, by Geo-Slope International. Slope/W is a two-dimensional, limit equilibrium slope stability program that generates random potential failure surfaces or specific failure surfaces and determines their corresponding factors of safety with respect to failure. By generating a large number of random surfaces, a critical failure surface with the minimum factor of safety can be identified.

The slope stability analyses were performed using information gathered from the field explorations and soil properties were assigned to the soil layers to reasonably reflect their engineering characteristics. Stability analyses were performed localized to the areas along the cross section. Stability analyses were performed for static conditions for the existing and proposed conditions and for seismic conditions for the proposed conditions. A peak ground acceleration of 0.25g was used in the seismic analyses. The soil parameters used in our analyses, along with the results of the analyses, are presented in Figures 8 through 10.

Our slope stability analyses indicated the loose surficial soils within the steep slope are marginally stable under the current static conditions with critical slip surface resulting in a factor of safety of less than 1.4 with respect to a sizeable deep-seated landslide. We also modeled the placement of two, tiered up to four-foot-tall retaining walls resisting approximately 3,200 pounds per linear foot of wall to support the yard and upper slope area. The critical slip surfaces for this case achieved factors of safety greater than or equal to 1.5 and 1.1 for the static and seismic cases, respectively indicating relatively stable conditions.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on our explorations and observations of the current conditions in the vicinity of the top of slope area, it is our opinion that the proposed installation of a pin pile retaining wall within the steep slope area below the residence is feasible from a geotechnical standpoint. Due to the presence of soft/loose undocumented fill and fine-grained native deposits soils along the top of the steep slope area, it is also our opinion that these soils may experience continued soil creep, settlement and/or shallow failures potentially impacting the top of slope area and further disturbance of existing infrastructure on slope especially during a seismic event if the proposed retaining wall is not constructed to support and stabilize the steep slope area.

Additionally, it is imperative that the existing residence and yard drainage systems are investigated and improved, as needed, such that all stormwater is accounted for and is tightlined to the base of the steep slopes or an approved point of discharge. In our opinion, construction of the proposed retaining wall should aid in stabilizing the top of slope area and limit potential impacts associated with potential slope movements on the yard area and residence structure.

Due to site constraints, and based on our explorations and site observations, we recommend the use of a "light" retaining wall to protect and support the top of the slope area, along with erosion control and drainage systems to be utilized below the new retaining wall. We have provided recommendations for design and installation of a new pipe pile wall with timber lagging along the top of the steep slope. To minimize the overall height of the retaining walls within the steep slope areas, we recommend two individual tiered retaining walls up to four feet in overall height. We recommend that all lateral loads on the walls be restrained by grouted tie-back anchors. We have also provided recommendations for improvements on the slope below the wall to lessen the potential for future sliding on the slope within the vicinity of the retaining wall. Detailed recommendations regarding the proposed retaining wall design and installation have been included in the following subsections of this report.

It is also our opinion that any existing deck or structure foundation within the steep slope could be supported or underpinned with driven 2-inch pin piles as recommended in this report.

The surficial soils encountered on this site are considered moisture-sensitive and may disturb easily when wet. To lessen the potential impacts of construction and to reduce cost overruns and delays, we recommend that construction take place during the drier summer months if possible. If construction takes place during the rainy months, additional expenses and delays should be expected. These extra expenses could include additional erosion control and temporary drainage measures to protect the proposed development area including placement of a blanket of rock spalls to protect exposed subgrades, and the need for importing all-weather materials for structural fill.

All construction operations and drainage improvements planned as part of this project should be planned and completed in a manner that enhances the stability of the steep slope, not reduces it. Any excavation spoils generated during site improvements should not be stockpiled on site but rather promptly hauled away. Also, all current and future runoff generated within the site should be collected and routed to a permanent discharge location at the bottom of the slope, or to an approved drainage system. Under no circumstances should water be allowed to concentrate or flow uncontrollably over the site slopes. The vegetation cover on the slope should be evaluated for compatibility with desired slope stability conditions, and a vegetation management plan should be devised to enhance slope stability.

The slopes should be protected from erosion. We recommend that all disturbed areas be replanted with vegetation to re-establish vegetation cover as soon as possible. Specific recommendations for erosion control are presented in the **Erosion Control and Slope Protection Measures** subsection of this report. The slopes should be monitored on an ongoing basis, especially during the wet season, for any signs of instability, and corrective actions promptly taken should any signs of instability be observed. Lawn clipping and any other household trash or debris should never be allowed to reach the slopes. Any future plans for structures near the slope or modifications to the slope should be specifically evaluated by NGA and approved by King County.

Erosion Control and Slope Protection Measures

The erosion hazard for the on-site soils is interpreted to be slight to moderate but the actual hazard will be dependent on how the site is graded and how water is allowed to concentrate. Best Management Practices (BMPs) should be used to control erosion. Areas disturbed during construction should be protected from erosion. Erosion control measures may include diverting surface water away from the stripped or disturbed areas. Silt fences and/or straw bales should be erected to prevent muddy water from leaving the site or flowing over the slopes or to neighboring properties. Stockpiles should not be allowed on site. Disturbed areas should be planted as soon as practical and the vegetation should be

maintained until it is established. The erosion potential for areas not stripped of vegetation should be low.

Protection of the slope areas should be performed as required by King County. Specifically, we recommend that the slope not be disturbed or modified through placement of any fill or removal of the existing vegetation. Trees should not be cut down or removed from the slopes unless a mitigation plan is developed, such as the replacement of vegetation for erosion protection. Vegetation should not be removed from the slopes. Replacement of vegetation should be performed in accordance with recommendations of a geotechnical professional. Any proposed development within the steep slope area should be the subject of a specific geotechnical evaluation.

The clearing of vegetation within the area of the proposed retaining wall should not affect slope stability, provided any disturbed areas outside the retaining wall area are revegetated as soon as practical and protected from erosion. In areas that are disturbed during or after construction, planting, hydro seeding, and/or straw mulching are effective ways to minimize erosion and allow vegetation to be re-established rapidly.

Site Preparation and Grading

Plans for site grading should be devised such that cuts and fills are kept to a minimum if possible. Site preparation should consist of excavating the retaining wall areas to planned configuration. If significant surface water flow is encountered during construction, this flow should be diverted around areas to be developed and the exposed subgrade maintained in a semi-dry condition. In wet conditions, the exposed subgrade should not be compacted, as compaction of a wet subgrade may result in further disturbance of the soils. A layer of crushed rock may be placed over the prepared areas to protect them from further disturbance.

The site soils are considered moisture sensitive and will disturb easily when wet. We recommend that earthwork construction take place during periods of extended dry weather and suspended during periods of precipitation if possible. If work is to take place during periods of wet weather, care should be taken during site preparation not to disturb the site soils. This can be accomplished by utilizing large excavators equipped with smooth buckets and wide tracks to complete earthwork and diverting surface and groundwater flow away from the prepared subgrades. Also, construction traffic should not be allowed on the exposed subgrade. A blanket of rock spalls should be used in construction access areas if wet conditions are prevalent. The thickness of this rock spall layer should be based on subgrade

performance at the time of construction. For planning purposes, we recommend a minimum one-foot thick layer of rock spalls.

Temporary and Permanent Slopes

Temporary cut slope stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open and the presence of surface or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations since they are continuously at the job site, able to observe the nature and condition of the cut slopes, and able to monitor the subsurface materials and groundwater conditions encountered.

The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor.

For planning purposes, we recommend that temporary cuts in the on-site material be no steeper than two units horizontal to one unit vertical (2H:1V). If the groundwater seepage is encountered, we would expect that significantly flatter inclinations would be necessary. We should be retained to specifically review proposed geometry for significant cuts planned on this site. We recommend that cut slopes be protected from erosion. Erosion control measures may include covering cut slopes with plastic sheeting and diverting surface water runoff away from the top of cut slopes. We do not recommend vertical slopes for cuts deeper than four feet if worker access is necessary. We recommend that cut slope heights and inclinations conform to appropriate OSHA/WISHA regulations.

Permanent cut and fill slopes should be no steeper than 2H:1V. However, flatter inclinations may be required in areas where loose soils are encountered. Permanent slopes should be covered with erosion control matting and vegetated. The vegetative cover should be maintained until established. We should specifically review all plans for grading on this project.

Retaining Wall Design and Construction

The proposed new retaining wall should consist of 3-inch square driven steel tubing or 2-inch pin piles bridged using pressure-treated timber lagging. The new retaining walls should generally be located along the top and middle of the steep slope, as shown on the Slope Stability Analysis. The final location, extent and heights of the wall should be determined by your structural engineer based on a topographic survey. In our slope stability analyses, we modeled the slope stability conditions for the proposed retaining wall alignment utilizing two, tiered, approximately four-foot-tall retaining walls with the upper wall situated along the top of slope and the lower wall approximately 10-feet laterally downslope. The wall design parameters provided in this report are specific to a two tiered, maximum four-foot-tall wall alignment at the two specific locations. If the wall layout and design vary from this proposed layout, NGA should be retained to re-evaluate the proposed wall layout and confirm design assumptions prior to finalizing the wall design. A schematic detail of the proposed retaining wall system is shown on the Schematic Pin Pile Retaining Wall Detail in Figure 10. The retaining wall should be designed by an experienced structural engineer licensed in the State of Washington.

We recommend that the 3-inch square tubing or 2-inch pin piles be galvanized extra strong (Schedule 80) steel pipe sections driven into place using a hand-held, 140-pound jackhammer or larger. The piles should be spaced at a maximum distance of four feet and should be embedded a minimum of 5 feet into the competent native glacial soils. Based on our explorations, we anticipate minimum embedment depths of the piles to range from 10 to 20 feet below the existing ground surface. Piles that do not meet this minimum embedment criterion should be rejected, and replacement piles should be driven after consulting with the structural engineer on the new pile locations. Our explorations encountered loose undocumented fills underlain by native glacial deposits at depth within the proposed retaining wall location. If large particles or debris are present within the fill, there is a possibility that this material may obstruct some piles at shallow depths. There should be contingencies in the budget and design for additional/relocated piles to replace piles that may be obstructed by debris in the fill. In addition to the minimum recommended embedment into the native material, the piles should be driven to a refusal criterion of less than one inch of movement during 60 seconds of continuous driving. The wall lagging should be embedded a minimum of 12 inches into the finished slope face. Metal plates should be welded to the back of the pin piles to allow a connection for the timber lagging.

We recommend that the voids behind the wall be backfilled with 2-inch clean crushed rock up to the top of the retaining wall. The crushed rock backfill behind the wall should be slope back from the top of the wall to a maximum inclination of 2H:1V. For the 2-inch crushed rock, the shoring wall should be designed to resist a lateral load resulting from a fluid with a unit weight of 400 pounds per cubic foot (pcf). This recommended load accounts for the up to 2H:1V slope above the proposed walls and seismic loading. These loads should be applied across the pile spacing above the excavation line. We recommend that all lateral pressures be transferred to tieback anchors. We should be retained to review final plans, observe test pile installation prior to finalizing design, monitor installation of the piles, and evaluate pile refusal.

Tiebacks

General: These systems should consist of drilled, grouted tieback anchors. We recommend that five percent of the anchors, but no less than two anchors, be treated as performance anchors and be tested to a minimum of 200 percent of the design loads. The soil creep characteristics would be evaluated during these tests. We recommend that the foundation embedment of the residence and utilities within the yard area be verified by the contractor and measurements made in the field at the time of tieback installation to ensure tiebacks do not encounter the existing residence, or underground utilities.

No-Load Zone: The anchor portion of all tiebacks must be located a sufficient distance behind the wall face to develop resistance within a stable soil mass. We recommend the anchorage be obtained behind an assumed no-load zone. The no-load zone is defined by a line extending horizontally from the base of the wall back towards the cut excavation a distance of six feet. The line should then extend up from the base elevation at an angle from the horizontal of 60 degrees. We expect that some loose soils may exist beyond the no-load zone. We therefore recommend that the bonded portion of the tiebacks, be placed a minimum of 15 feet beyond the face of the wall. All anchors should be installed at an approximate inclination of 15 to 20 degrees below horizontal. We recommend that we monitor soil conditions during anchor installation in order to evaluate adequate penetration into competent soils.

Soil Design Values: The tiebacks will likely terminate in coarse-grained glacial soils below the walls. For use in design of the anchors, we estimate an allowable grout to soil adhesion of 1,500 pounds per square foot (psf) can be used for grouted anchors. We recommend that we review anchor design and proposed installation methods. We should also observe anchor installation and testing.

Tieback Installation and Testing: The contractor should be responsible for using equipment suited for the site conditions. We do not recommend the use of open-hole methods for the purpose of installing the tiebacks due to the potential for soil caving. Secondary grouting to increase soil adhesion may be used; however, if secondary grouting is used, the anchors should be tested using the methods outlined for the performance testing.

Two anchors should be performance tested to 200 percent of the anchor design capacity. The performance test should consist of cyclic loading in increments of 25 percent of the design load, as outlined in the Federal Highways Administration (FHA) report No. FHWA/RD-82/047. The test location should be determined in the field, based on soil conditions observed during anchor installation. All other tiebacks should be proof-tested to at least 130 percent of design capacity.

Pin Piles

Vertical loads from nearby deck foundations that are to remain should be supported on 2-inch diameter driven steel pipe piles. The piles should consist of 2-inch diameter galvanized extra strong (Schedule 80) steel pipe sections driven into place using a hand-held, 140-pound jackhammer. For 2-inch diameter pipe piles driven to refusal using a hand-held, 140-pound jackhammer, we recommend a design axial compression capacity of two tons for each pile. The piles should be embedded a minimum of 10 feet into competent material after advancing through the fill. Piles that do not meet this minimum embedment criterion should be rejected, and replacement piles should be driven after consulting with the structural engineer on the new pile locations. Due to the relatively small slenderness ratio of pin piles, maintaining pin pile confinement and lateral support is essential to preventing pile buckling. Vertically driven pin piles do not provide meaningful lateral capacity. All lateral loads should be picked up by the tieback anchors.

Structural Fill

General: Fill placed beneath foundations, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be suitably prepared as described in the **Site Preparation and Grading** subsection of this report prior to beginning fill placement.

Materials: Structural fill should consist of a good quality, granular soil, free of organics and other deleterious material, and be well graded to a maximum size of about three inches. All-weather structural fill should contain no more than five-percent fines (soil finer than U.S. No. 200 sieve, based on that fraction passing the U.S. 3/4-inch sieve). The use of on-site soils as structural fill is not recommended. We should be retained to evaluate proposed structural fill material prior to placement.

Fill Placement: Following subgrade preparation, placement of structural fill may proceed. All fill placements should be accomplished in uniform lifts up to eight inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill underlying building areas and pavement subgrade should be compacted to a minimum of 95 percent of its maximum dry density. Maximum dry density, in this report, refers to that density as determined by the ASTM D-1557 Compaction Test procedure. The moisture content of the soils to be compacted should be within about two percent of optimum so that a readily compactable condition exists. It may be necessary to over-excavate and remove wet soils in cases where drying to a compactable condition is not feasible. All compaction should be accomplished by equipment of a type and size sufficient to attain the desired degree of compaction.

Wall Drainage and Slope Improvements

We recommend that after the pin piles are installed, a 4-inch perforated PVC pipe be placed behind the base of the wall and extended through the face of the retaining wall to aid in drainage through the wall. The pipe should be surrounded by a minimum of one foot of drain rock and the drain rock entirely wrapped in a heavy-duty filter fabric prior to the placement of the crushed rock backfill. The drain should be tightlined into the existing drain system or independently down to the base of the slope and adequately anchored to the slope. If tightlined to the base of the slope, we recommend utilizing a 4-inch HDPE pipe terminating at a dispersion tee placed on a splash pad consisting of 2- to 4-inch quarry spalls. The backfill should be carefully placed as to not disturb or damage the tieback anchoring system. We should be retained to evaluate the crushed rock placement during construction.

The areas along the top of the slope below the proposed wall should be improved, as needed by gently re-grading the over-steepened/loosened areas, removing the vegetative cover, compacting the exposed surface to a non-yielding condition, placing suitable erosion control systems on the prepared areas, and re-vegetating with deep-rooted drought-resistant plants. The actual improvement methods for these areas will be highly depended on the conditions encountered during construction. We should work with your contractor to determine the best course of action at the time of construction.

We recommend that the exposed soil be covered with heavy duty jute netting. The jute netting should be staked at the top of the slope with 2- to 3-foot-long metal rebar that has a metal "T" welded to the end. The mat should be staked to the surface every five feet. After the matting is placed, we recommended that deep-rooted vegetation be planted on the slope and grass seed be placed to re-establish vegetation growth. The vegetation should be maintained until established. We recommend a mixture of 25% each of the following vegetation: Snowberry (Symphoricarpos albus), Nootka rose (Rosa nutkana), Ocean Spray (Holodiscus discolor), and Oregon-grape (Manhonia nervosa). We should be retained to review and comment on the slope vegetation plan and observe the slope repairs.

We also recommend that all residence downspouts and yard drains be investigated to understand where they are directed. At a minimum, we recommend that all residence downspouts and yard drains along with the proposed retaining wall drain be tightlined and directed to discharge to an approved location.

USE OF THIS REPORT

NGA has prepared this report for **Mr. Phil Guadagno** and his agents, for use in the planning and design of the retaining wall and slope stabilization measures on this site only. This report is a specific evaluation of the steep slope stabilization within the southern portion of the site and should not be considered an evaluation of the entire site or the existing residence. There is potential for failures to continue to occur on the slope near and below the wall. This potential can be reduced by maintaining the drainage systems and refraining from casting any material what so ever over the slope. Irrigation systems near the new wall should be avoided. The scope of our work does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractors' methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. There are possible variations in subsurface conditions between the explored and unexplored areas and also with time. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions. A contingency for unanticipated conditions should be included in the budget and schedule.

All people who own or occupy homes on hillsides should realize that landslide movements are always a possibility. The homeowner should periodically inspect the slope, especially after a winter storm. If distress is evident, a geotechnical engineer should be contacted for advice on remedial/preventative measures. The probability that landsliding will occur is substantially reduced by the proper maintenance of drainage control measures at the site (the runoff from the roofs should be led to an approved discharge point). Therefore, the homeowner should take responsibility for performing such

maintenance. Consequently, we recommend that a copy of our letter be provided to any future homeowners of the property if the home is sold.

We recommend that NGA be retained to review project plans prior to construction and to monitor wall repairs. These additional services are intended to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not construction activities comply with specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

Within the limitations of scope, schedule and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this letter was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

o-o-o

It has been a pleasure to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Alex B. Rinaldi, LG
Project Geologist

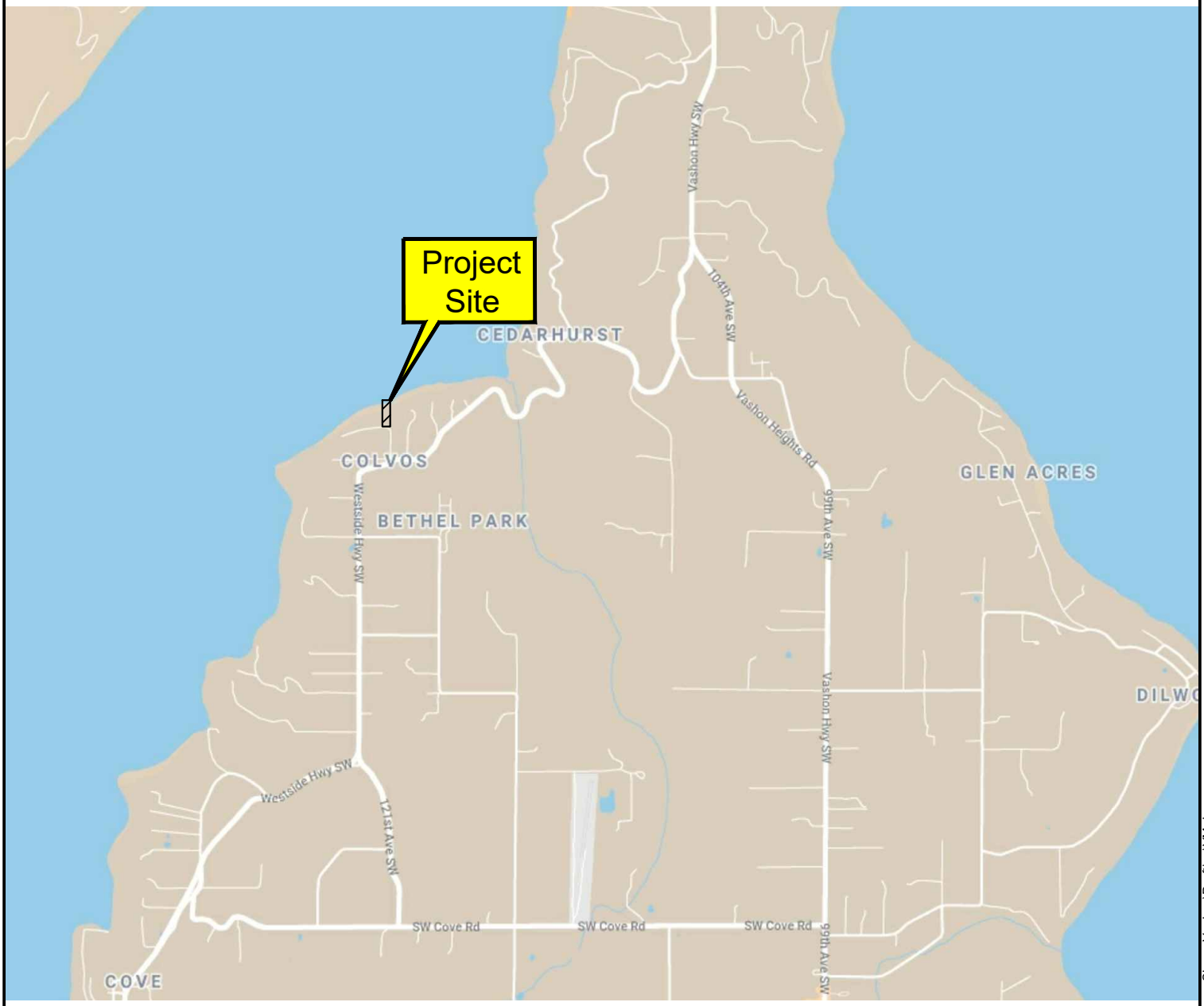
Khaled M. Shawish, PE
Principal

ABR:KMS:dy

Eleven Figures Attached

VICINITY MAP

Not to Scale



Vashon, WA

Project Number 1245721	Guadagno Property Stabilization Vicinity Map	NELSON GEOTECHNICAL ASSOCIATES, INC	No.	Date	Revision	By	CK
Figure 1			1	4/20/21	Original	DPN	ABR

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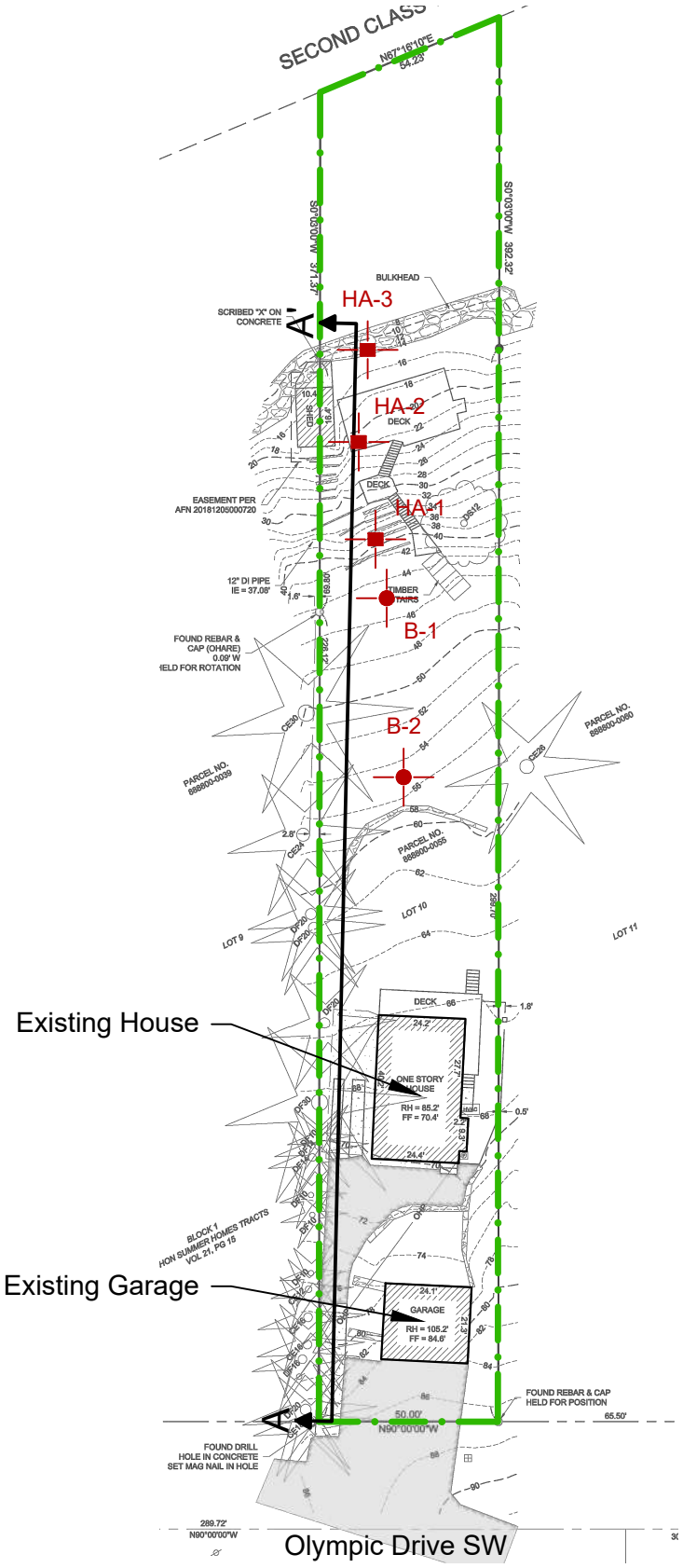

N

LEGEND

- Property line
- B-1 — Number and approximate location of boring
- HA-1 — Number and approximate location of hand auger
- A A' — Approximate location of cross-section

0 50 100

Scale: 1 inch = 50 feet

Reference: Site Plan based on a plan dated March 12, 2021 titled "Topographic Survey - Phil Guadagno," prepared by Site Surveying.

Project Number 1245721	Guadagno Property Stabilization Site Plan	NELSON GEOTECHNICAL ASSOCIATES, INC	
Figure 2			

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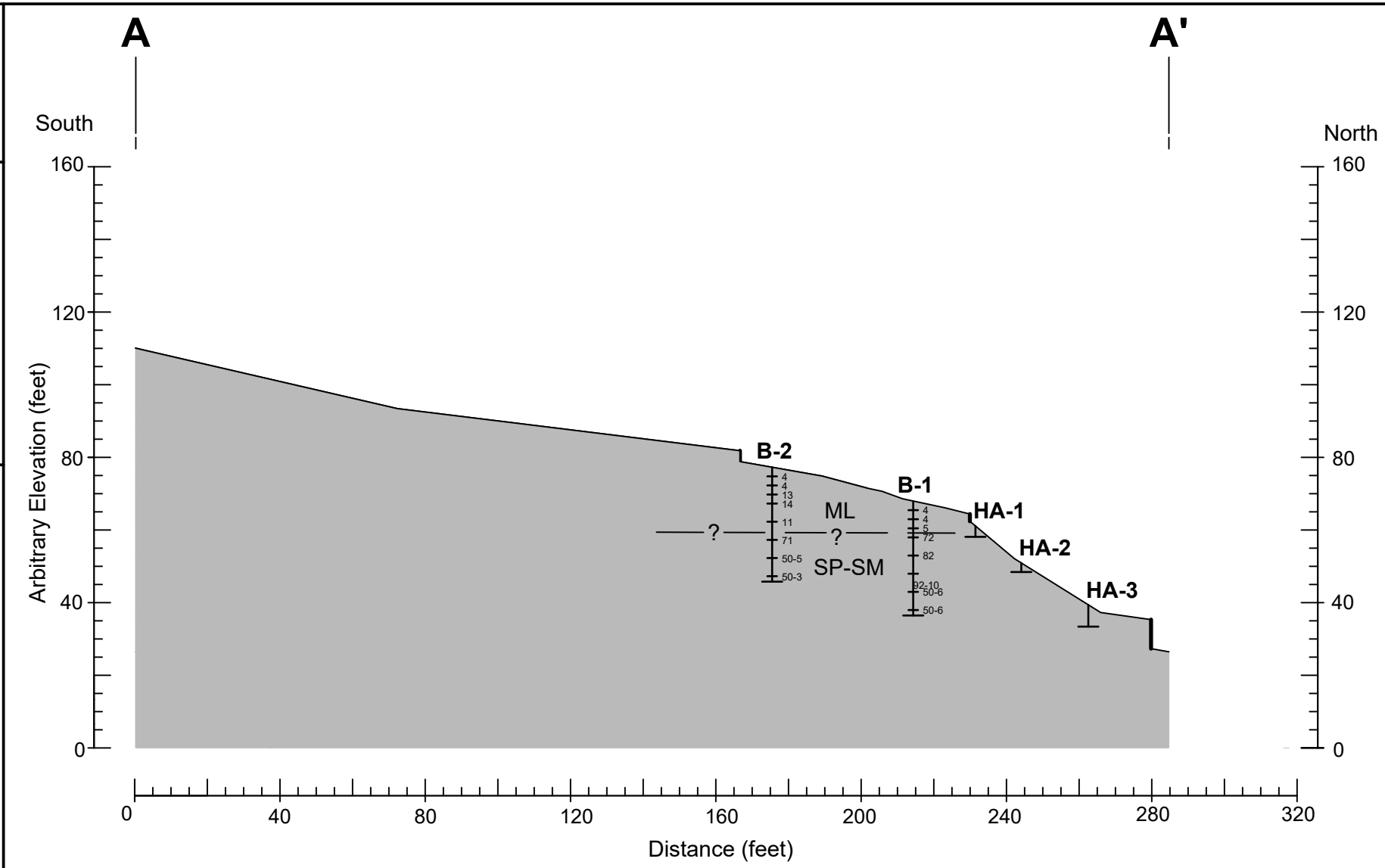
Project Number
1245721

Figure 3

Guadagno Property
Stabilization
Cross-Section A-A'



Exploration

Boring / Hand Auger Designation → **B-1/HA-1**

23 ← SPT N-value

Groundwater Level During Exploration →

Geologic Contact (approximate) → ? — ?

NOTES:
1) Stratigraphic conditions are interpolated between the explorations. Actual conditions may vary.
2) Elevations are arbitrary.

Reference: Cross Section is based on field measurements using a hand-held clinometer and 100-ft tape measure.

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UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE - GRAINED SOILS MORE THAN 50 % RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE - GRAINED SOILS MORE THAN 50 % PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.
2) Soil classification using laboratory tests is based on ASTM D 2488-93.
3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water.

Wet - Visible free water or saturated, usually soil is obtained from below water table

Project Number 1245721	Guadagno Property Stabilization Soil Classification Chart	NELSON GEOTECHNICAL ASSOCIATES, INC
Figure 4		

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BORING LOG

B-1

Approximate Ground Surface Elevation: 44 ft

Soil Profile: Description	Graphic Log	Group Symbol	Sample Data: Blow Count	Sample Location (depth in feet)
Topsoil				
Gray-brown to gray silt with fine sand and trace roots (soft to medium stiff, moist)			4	
-becomes gray		ML	4	
-becomes moist to wet			5	
Gray, fine to medium sand with silt and trace gravel (very dense, moist to wet)			72	
-with gravel		SP-SM	82	
			92-10	
			50-6	

Penetration Resistance (Blows/foot - ●)
10 20 30 40 50 50+
Moisture Content (Percent - ■)
10 20 30 40 50 50+

Laboratory Testing

Piezometer Installation - Ground Water Data (Depth in Feet)

5 10 15 20 25

Logged by: ABR on 03/29/2021

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- ✱ Liquid Limit
- \+ Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M	Moisture Content
A	Atterberg Limits
G	Grain-size Analysis
DS	Direct Shear
PP	Pocket Penetrometer Readings, tons/ft
P	Sample Pushed
T	Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Project Number	Guadagno Property Stabilization Boring Log
1245721	
Figure 5	
Page 1 of 2	

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BORING LOG

B-1 (cont.)

Logged by: ABR on 03/29/2021

Soil Profile			Sample Data		Penetration Resistance (Blows/foot - ●) 10 20 30 40 50 50+ / Moisture Content (Percent - ■) 10 20 30 40 50 50+	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Description	Graphic Log	Group Symbol	Blow Count	Sample Location (depth in feet)			
-becomes gravelly		SP-SM	50-6		●		
Boring terminated at 31.5 feet below existing grade on 03/29/2021. Groundwater seepage was encountered at 8.0 feet during drilling.							

35 40 45 50 55

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- ✱ Liquid Limit
- \+ Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M	Moisture Content
A	Atterberg Limits
G	Grain-size Analysis
DS	Direct Shear
PP	Pocket Penetrometer Readings, tons/ft
P	Sample Pushed
T	Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

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BORING LOG

B-2

Approximate Ground Surface Elevation: 56 ft

Soil Profile: Description	Graphic Log	Group Symbol	Sample Data: Blow Count	Sample Location (depth in feet)	Penetration Resistance (Blows/foot - ●) / Moisture Content (Percent - ■)	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Topsoil							
Gray-brown to gray silt with fine sand and trace roots (soft to medium stiff, moist to wet)			4				
-becomes gray, no roots			4				
-becomes gray to gray-blue, stiff, with trace sand			13				
-becomes gray-blue, with fine sand		ML	14				
-becomes moist			11				
Gray to light brown, fine to medium sand with silt and gravel (very dense, moist)			71				
-becomes gray		SP-SM	50-5				

Penetration Resistance (Blows/foot - ●) / Moisture Content (Percent - ■): 10 20 30 40 50 50+

Depth scale: 5, 10, 15, 20, 25

Logged by: ABR on 03/29/2021

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LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- ✱ Liquid Limit
- \+ Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M	Moisture Content
A	Atterberg Limits
G	Grain-size Analysis
DS	Direct Shear
PP	Pocket Penetrometer Readings, tons/ft
P	Sample Pushed
T	Triaxial

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BORING LOG

B-2 (cont.)

Logged by: ABR on 03/29/2021

Soil Profile			Sample Data		Penetration Resistance (Blows/foot - ●) 10 20 30 40 50 50+ / Moisture Content (Percent - ■) 10 20 30 40 50 50+	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Description	Graphic Log	Group Symbol	Blow Count	Sample Location (depth in feet)			
-becomes gray-brown		SP-SM	50-3		●		
Boring terminated at 31.5 feet below existing grade on 03/29/2021. Groundwater seepage was not encountered during drilling.							

35 40 45 50 55

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- ✱ Liquid Limit
- \+ Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M	Moisture Content
A	Atterberg Limits
G	Grain-size Analysis
DS	Direct Shear
PP	Pocket Penetrometer Readings, tons/ft
P	Sample Pushed
T	Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

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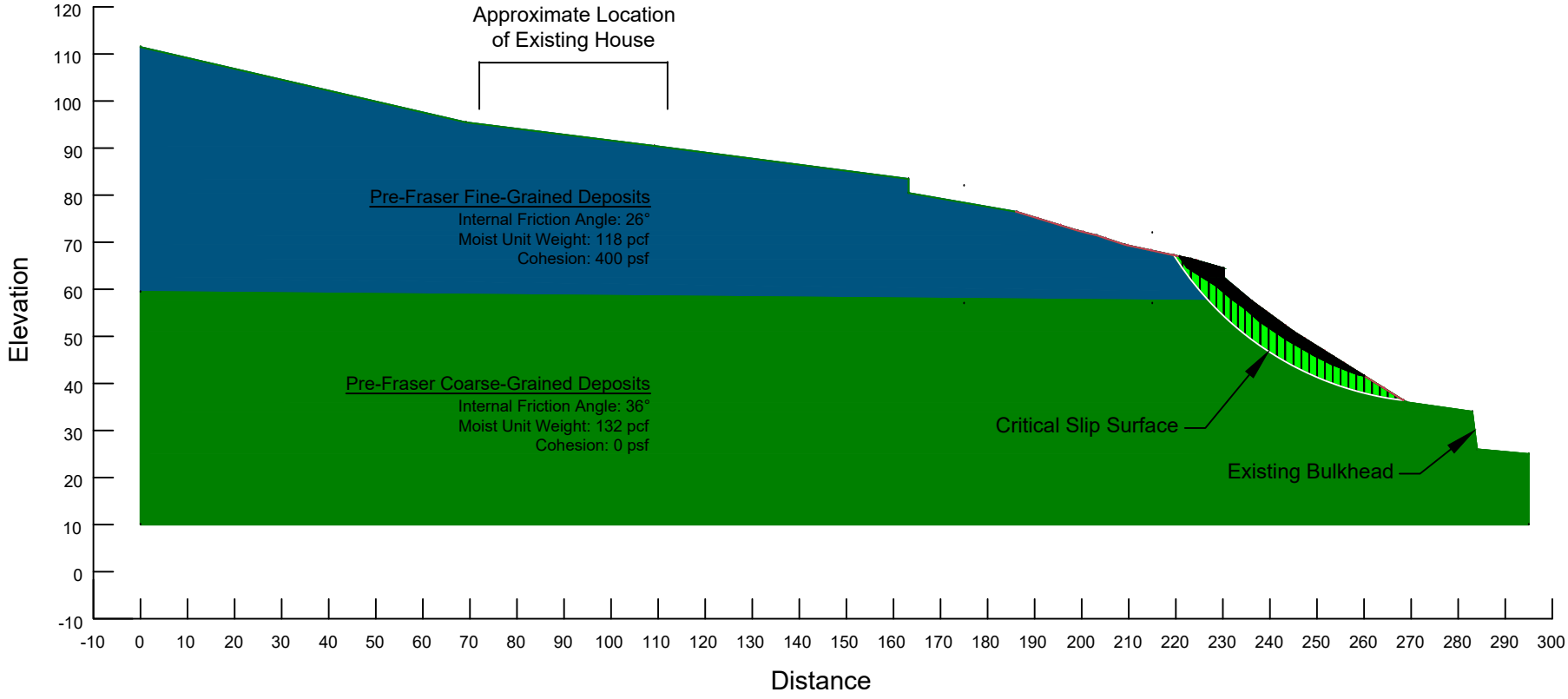
LOG OF EXPLORATION

DEPTH (FEET)	USCS	SOIL DESCRIPTION
HAND AUGER ONE		
0.0 – 1.5		GRASS UNDERLAIN BY DARK BROWN TOPSOIL (LOOSE, MOIST) (**UNDOCUMENTED FILL**)
1.5 – 2.5	ML	BROWN TO GRAY-BROWN SILT WITH FINE SAND, WEATHERING, AND TRACE ROOTS (SOFT, WET)
2.5– 3.0	SP-SM	GRAY FINE SAND WITH SILT, AND TRACE GRAVEL (MEDIUM DENSE TO DENSE, MOIST TO WET)
		SAMPLES WERE NOT COLLECTED GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 3.0 FEET CAVING WAS NOT ENCOUNTERED HAND AUGER TERMINATED AT 3.0 FEET ON 03/29/21
HAND AUGER TWO		
0.0 – 2.0	ML	BROWN TO GRRAY-BROWN SILT WITH SAND AND TRACE ROOTS (SOFT, WET)
2.0– 2.5	SP-SM	GRAY, FINE TO MEDIUM SAND WITH SILT AND TRACE GRAVEL (MEDIUM DENSE TO DENSE, MOIST)
		SAMPLES WERE NOT COLLECTED GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 2.0 FEET CAVING WAS NOT ENCOUNTERED HAND AUGER WAS COMPLETED AT 2.5 FEET ON 03/29/21
HAND AUGER THREE		
0.0 – 5.5		GRAY TO GRAY BROWN SILT WITH FINE SAND, ROOTS, AND WEATHERING (SOFT, MOIST TO WET)
5.5 – 6.0	SP-SM	GRAY FINE TO MEDIUM SAND WITH SILT AND GRAVEL (MEDIUM DENSE TO DENSE, MOIST)
		SAMPLES WERE NOT COLLECTED GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 5.0 FEET CAVING WAS NOT ENCOUNTERED HAND AUGER WAS COMPLETED AT 6.0 FEET ON 03/29/21

Slope Stability Analysis- Cross Section A-A' Existing Static Conditions

Morgenstern-Price most critical surface with minimum FOS = 1.41



NOTES: Not to scale
Elevations are Approximate

Project Number 1245721

Figure 8

Guadagno Property Stabilization
Cross Section A-A' Existing Static Slope Stability Analysis

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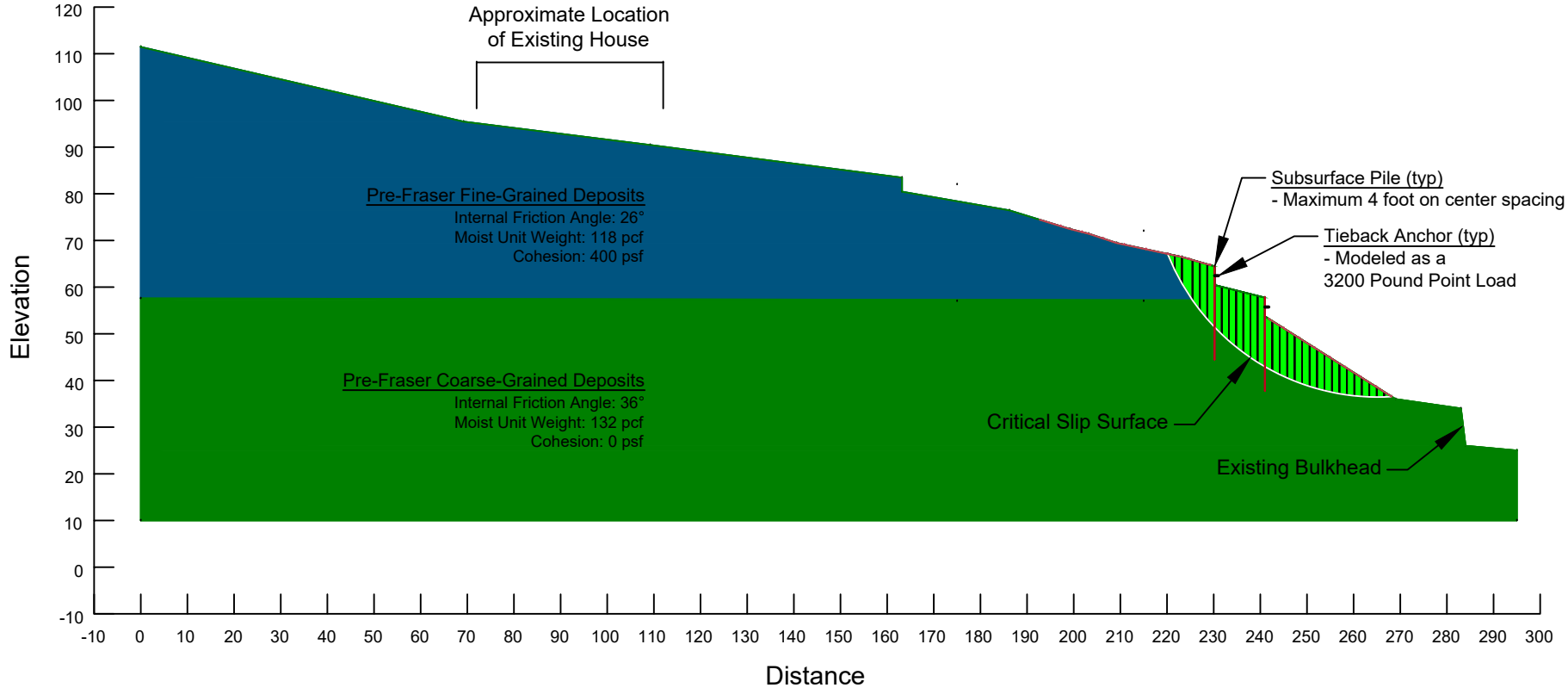
Slope Stability Analysis- Cross Section A-A' Proposed Static Conditions

Morgenstern-Price most critical surface with minimum FOS = 1.79



NOTES: Not to scale
Elevations are Approximate

Project Number 1245721

Figure 9

Guadagno Property Stabilization
Cross Section A-A' Proposed Static Slope Stability Analysis

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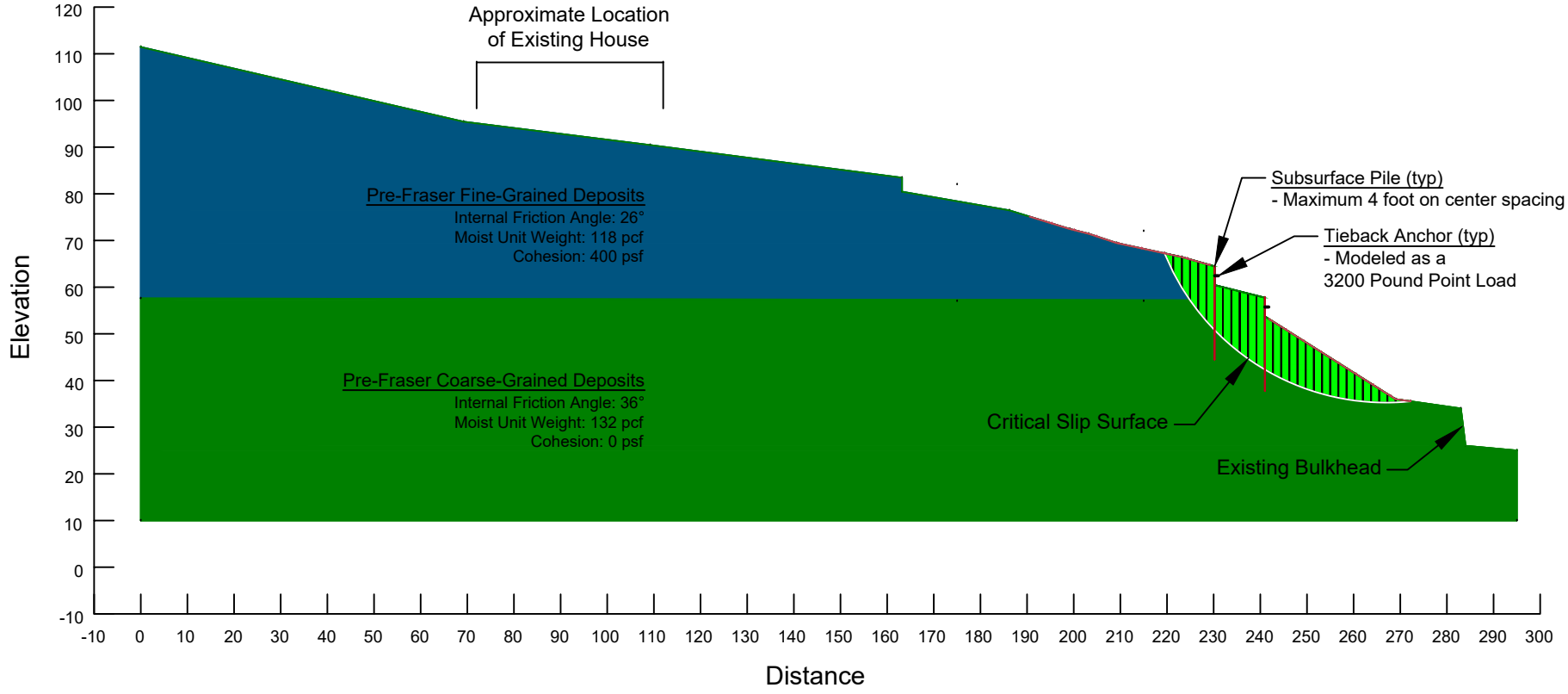
Slope Stability Analysis- Cross Section A-A' Proposed Seismic Conditions

Morgenstern-Price most critical surface with minimum FOS = 1.10
with a seismic coefficient of ground acceleration = 0.25g



NOTES: Not to scale
Elevations are Approximate

Project Number 1245721

Figure 10

Guadagno Property Stabilization
Cross Section A-A' Proposed Seismic Slope Stability Analysis

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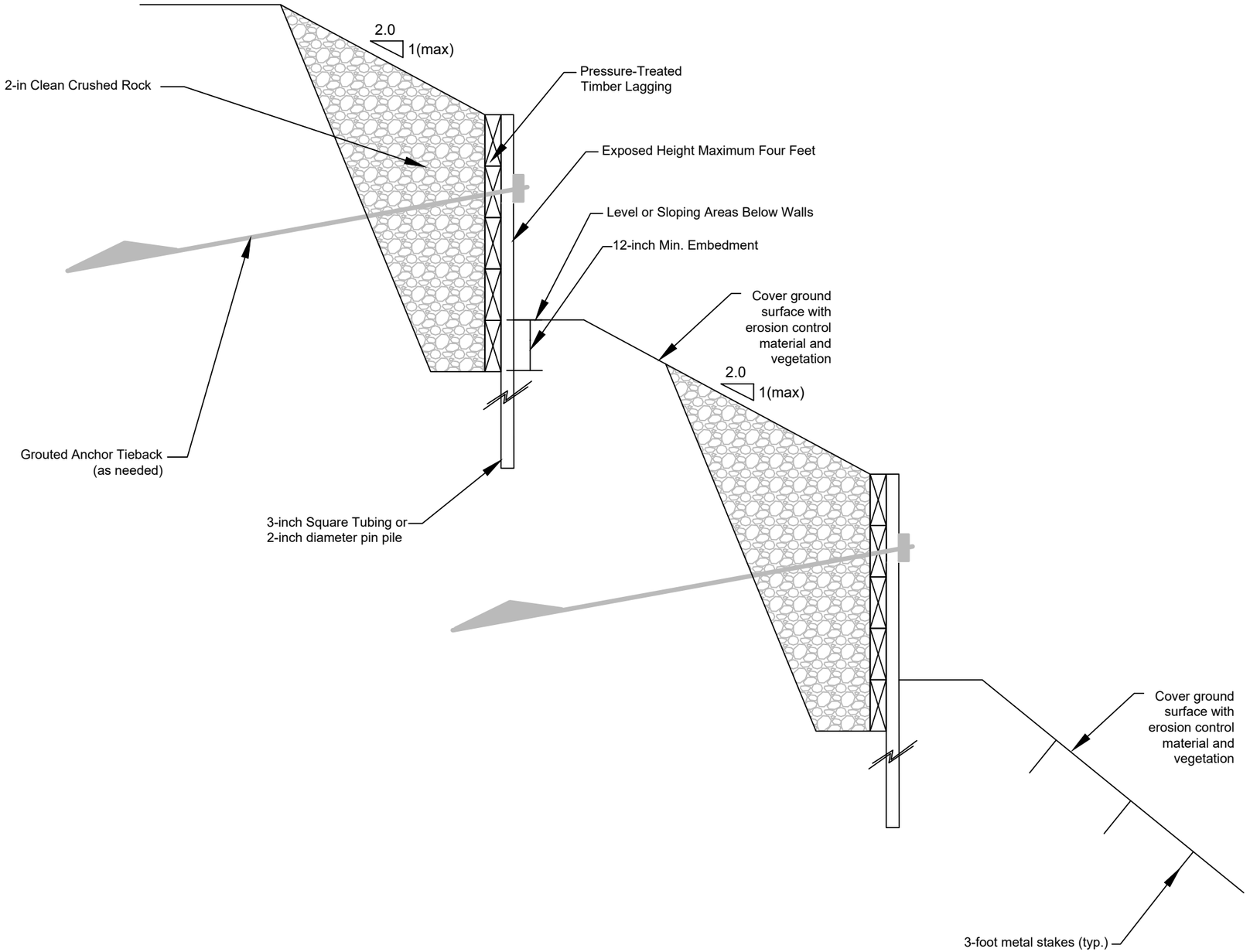
Schematic Tiered Pin Pile Wall Detail

Not to Scale



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Guadagno Property
Stabilization
Schematic Tiered
Pin Pile Wall Detail

Project Number
1245721

Figure 11

CRITICAL AREA DETERMINATION

Guadagno Property
King County, Washington

June 13, 2022

RAEDEKE ASSOCIATES, INC.

Raedeke Associates, Inc.

Wetland & Aquatic Sciences
Wildlife Ecology
Landscape Architecture

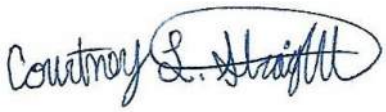
Report To:	Phil & Ann Guadagno 14282 Olympic Drive SW Vashon Island, WA 98070
Title:	Critical Area Determination Guadagno Property King County, Washington
Project Number:	2022-043-001
Prepared by:	RAEDEKE ASSOCIATES, INC. 2111 N. Northgate Way Ste. 219 Seattle, Washington, 98133 (206) 525-8122
Date:	June 13, 2022

Raedeke Associates, Inc.

Wetland & Aquatic Sciences
Wildlife Ecology
Landscape Architecture

Project Manager:	Kolten T. Kosters, M.S., PWS Wetland Scientist
Project Personnel:	Courtney Straight, BS, WPIT Wetland and Wildlife Biologist
	Annamaria Clark, BS, PWS Wetland Biologist
	Richard W. Lundquist, M.S. President/Wildlife Biologist

Submitted by:



Signature

Courtney Straight
Printed Name

June 13, 2022
Date

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LIST OF FIGURES

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1.0 INTRODUCTION

1.1 PURPOSE

Raedeke Associates, Inc. was retained by Phil and Anne Guadagno to provide a critical area determination for the slope restoration and reconstruction of a deck on the property located along Olympic Drive SW in unincorporated King County on Vashon Island, Washington. As part of this project, we conducted a site visit to identify and delineate any wetlands, streams, or shorelines on or in the immediate vicinity of the project site. During our site visit, we collected information sufficient to characterize the existing site conditions as well as onsite wetlands. We delineated the Ordinary High Water Mark (OHWM) of the shoreline. We did not locate any wetlands on or adjacent to the site during our investigation.

This report presents the findings of our background information review and our April 22, 2022, site investigation of the project site.

1.2 PROJECT LOCATION

The Guadagno King County project site includes one 0.47-acre parcel located at 14282 Olympic Drive SW in unincorporated King County on Vashon Island, Washington (Figure 1). The project site is identified as King County Tax Parcel No. 888000055, which places the project site in a portion of Section 13, Township 23 North, Range 2 East, W.M. Parcel maps retrieved on-line from King County iMap depict the property boundaries.

The Guadagno King County project site is bordered to the north by the Puget Sound, and to the east, south, and west by single-family homes. The property is accessed from Olympic Drive SW to the south.

2.0 METHODS

2.1 DEFINITIONS AND METHODOLOGIES

Wetlands and streams are protected by federal law as well as by state and local regulations. Federal law (Section 404 of the Clean Water Act) prohibits the discharge of dredged or fill material into "Waters of the United States", including certain wetlands, without a permit from the U.S. Army Corps of Engineers (COE 2021, 2022). The COE makes the final determination as to whether an area meets the definition of a wetland and whether the wetland is under their jurisdiction.

The COE wetland definition was used to determine if any portions of the project area could be classified as wetland. A wetland is defined as an area "inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (Federal Register 1986:41251).

We based our investigation upon the guidelines of the U. S. Army Corps of Engineers (COE) Wetlands Delineation Manual (Environmental Laboratory 1987) and subsequent amendments and clarifications provided by the COE (1991a, 1991b, 1992, 1994), as updated for this area by the regional supplement to the COE wetland delineation manual for the Western Mountains, Valleys, and Coast Region (COE 2010). The COE wetlands manual is required by state law (WAC 173-22-035, as revised) for all local jurisdictions.

Hydrophytic vegetation is defined as "macrophytic plant life growing in water, soil or substrate that is at least periodically deficient in oxygen as a result of excessive water content" (Environmental Laboratory 1987). The U.S. Army Corps of Engineers National Wetland Plant List wetland indicator status (WIS) ratings were used to make this determination (COE 2020). The WIS ratings "reflect the range of estimated probabilities (expressed as a frequency of occurrence) of a species occurring in wetland versus non-wetland across the entire distribution of the species" (Reed 1988:8). Plants are rated, from highest to lowest probability of occurrence in wetlands, as obligate (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), and upland (UPL), respectively. In general, hydrophytic vegetation is present when the majority of the dominant species are rated OBL, FACW, and FAC.

A hydric soil is defined as "a soil that is formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (Federal Register 1995: 35681). The morphological characteristics of the soils in the study area were examined to determine whether any could be classified as hydric.

According to the 1987 methodology, wetland hydrology could be present if the soils were saturated (sufficient to produce anaerobic conditions) within the majority of the rooting zone (usually the upper 12 inches) for at least 5% of the growing season, which in this

area is usually at least 2 weeks (COE 1991a). It should be noted, however, that areas having saturation to the surface between 5% and 12% of the growing season may or may not be wetland (COE 1991b). Depending on soil type and drainage characteristics, saturation to the surface would occur if water tables were shallower than about 12 inches below the soil surface during this time period. Positive indicators of wetland hydrology include direct observation of inundation or soil saturation, as well as indirect evidence such as driftlines, watermarks, surface encrustations, and drainage patterns (Environmental Laboratory 1987). Hydrology was further investigated by noting drainage patterns and surface water connections between wetlands and streams within and adjacent to the project area.

2.2 BACKGROUND RESEARCH

Prior to conducting our site visit, we reviewed existing background maps and information for the project site from the U.S.D.A. Natural Resource Conservation Service (NRCS 2022) Web Soil Survey, the U.S. Fish and Wildlife Service (USFWS 2022) National Wetland Inventory (NWI), and King County (2022b) iMap. We also reviewed the Washington Department of Fish Wildlife (2022) Priority Species database (PHS) in order to determine if any endangered or sensitive wildlife was present on or within the immediate vicinity of the project site. In addition, we reviewed current and historical aerial photographs (Google Earth 2022) to assist in the definition of existing plant communities, drainage patterns, and land use.

2.3 FIELD SAMPLING PROCEDURES

We conducted a site visit on April 22, 2022, to identify and delineate wetland and shoreline boundaries within the project site. During our site visit, we also collected information sufficient to describe the general site conditions.

Vegetation, soils, and hydrology were examined in representative portions of the study area according to the procedures described in the Regional Supplement (COE 2010). Plant communities were inventoried, classified, and described during our field investigation. We estimated the percent coverage of each species. Plant identifications were made according to standard taxonomic procedures described in Hitchcock and Cronquist (2018), with nomenclature as updated by the U.S. Army Corps of Engineers National Wetland Plant List (COE 2020). Wetland classification follows the USFWS wetland classification system (Cowardin et al. 1992). We determined the presence of a hydrophytic vegetation community using the procedure described in the Regional Supplement (COE 2010), which requires the use of the dominance test, unless positive indicators of hydric soils and wetland hydrology are also present, in which case the prevalence index or the use of other indicators of a hydrophytic vegetation community as described in the Regional Supplement (COE 2010) may also be required.

We excavated pits to at least 18 inches below the soil surface, where possible, in order to describe the soil and hydrologic conditions throughout the study area. We sampled

soil at locations that corresponded with vegetation sampling areas and potential wetland areas. Soil colors were determined using the Munsell Soil Color Chart (Munsell Color 2009). We used the indicators described in the Regional Supplement (COE 2010) to determine the presence of hydric soils and wetland hydrology.

3.0 EXISTING CONDITIONS

3.1 RESULTS OF BACKGROUND INVESTIGATION

The U.S.D.A. NRCS (2022) Web Soil Survey shows the project site mapped as Alderwood gravelly sandy loam soils series (Figure 2). Alderwood gravelly sandy loam does not meet the criteria of a hydric soil but may contain hydric inclusions including Shalcar and Norma soils. Soil series boundaries are mapped using aerial photo interpretation with limited field verification. Thus, the mapping of soils within an area may vary from one location to another.

The USFWS (2022) NWI shows that the portion the project site in the intertidal area along the Puget Sound shoreline contains an estuarine, and marine wetland E2AB/USN (Figure 3). Wetlands shown on the NWI are general in terms of location and extent, as they are determined primarily from aerial photograph interpretation. Thus, the number and extent of existing wetlands located within the project area may differ from those marked on an NWI map.

King County (2022b) iMap depicts the intertidal area on the north end of the subject parcel as a wetland (Figure 4).

The WDFW (2022) PHS database map shows the beach at the project site as a breeding area for surf smelt (Figure 5). The PHS map also identifies the intertidal area at the north end of the subject parcel as an estuarine and marine wetland. The Washington Natural Heritage Program (2021) database does not identify a natural heritage feature within the section where the project is located.

3.2 RESULTS OF FIELD INVESTIGATIONS

The project site consists of one 0.47-acre parcel that contains a garage, house, deck, gardens, and a mowed lawn. The lawn area is dominated by Kentucky bluegrass (*Poa pratensis*, FAC), bentgrass (*Agrostis sp.*), and common dandelion (*Taraxacum officinale*, FACU). The slope contains native plantings including holly-leaf Oregon grape (*Mahonia aquifolium*, FACU), common snowberry (*Symphoricarpos albus*, FACU), blood currant (*Ribes sanguineum*, FACU), pineland sword fern (*Polystichum munitum*, FACU), salmon raspberry (*Rubus spectabilis*, FAC), and salal (*Gaultheria shallon*, FACU). The western property line is planted with a row of western red arborvitae (*Thuja plicata*, FAC). The eastern property line contains common snowberry (FACU) and pineland sword fern (FACU).

Soils across the project site vary between hydric and not hydric. The soil behind the bulkhead has over 5 inches of dark grayish brown (10YR 4/2) silt clay loam (Sample Plot 1). The soil at the top of the slope near the western property line consists of 6 inches of dark brown (10YR 3/3) gravelly sandy loam soils over olive brown (2.5Y 4/3) gravelly sandy loam with dark yellowish brown (10YR 3/6) redoximorphic concentrations within

the soil matrix (Sample Plot 2). Soil at the top of the slope near the eastern property line consists of 8 inches of olive brown (2.5Y 4/3) silt clay loam soils with dark yellowish brown (10YR 4/4) redoximorphic concentrations within the soil matrix over gray (2.5Y 5/1) silt clay loam soils with dark yellowish brown (10YR 4/4) redoximorphic concentrations within the soil matrix (Sample Plot 3). Soils near the shoreline and the eastern property line meet the hydric soil criteria depleted matrix (F3) as defined by the COE wetland delineation manual (Environmental Laboratory 1987) and the regional supplement (COE 2010) (Figure 6). During our site investigation, we did not observe any indicators of wetland hydrology such as a shallow groundwater table, soils saturation within the upper 12 inches of the soil profile, or any secondary indicators of wetland hydrology (water-stained leaves, drift deposits, areas of seasonal ponding, algal mats, etc.) within the project site.

3.2.1 Puget Sound Shoreline

As noted above, the property is bordered to the north by the Puget Sound (Figure 6). We marked the OHWM with pink and black flagging. A rock bulkhead is located along the Puget Sound OHWM. The bulkhead appears to correspond to the location of the marine OHWM with a more natural marine, cobble and substrate beach environment extending to the north. The Puget Sound shoreline is designated as a Type S water or "shoreline of the state."

4.0 REGULATORY CONSIDERATIONS

Wetlands are protected by Section 404 of the Federal Clean Water Act and other state and local policies and ordinances including King County (2022a) code. Regulatory considerations pertinent to wetlands identified within the study area are discussed below; however, this discussion should not be considered comprehensive. Additional information may be obtained from agencies with jurisdictional responsibility for, or interest in, the site. A brief review of the U.S. Army Corps of Engineers regulations and King County policy, relative to wetlands, is presented below.

4.1 FEDERAL CLEAN WATER ACT (U.S. ARMY CORPS OF ENGINEERS)

Federal law (Section 404 of the Clean Water Act) discourages the discharge of dredged or fill material into the nation's waters, including most wetlands and streams, without a permit from the U.S. Army Corps of Engineers (COE 2021, 2022). The COE makes the final determination as to whether an area meets the definition of "Waters of the U.S." as defined by the federal government (Federal Register 1986:41251), and thus, if it is under their jurisdiction.

We should caution that the placement of fill within wetlands or other "Waters of the U.S." without authorization from the COE is not advised, as the COE makes the final determination regarding whether any permits would be required for any proposed alteration (COE 2021, 2022). Because the COE makes the final determination regarding permitting under their jurisdiction, a jurisdictional determination from the COE is generally recommended prior to any construction activities, if any modification of wetlands is proposed. A jurisdictional determination would also provide evaluation and confirmation of the wetland delineations by the COE.

4.2 WASHINGTON STATE

Under Section 401 of the Clean Water Act, an activity involving a discharge in waters of the U.S. authorized by a federal permit must receive water quality certification by the affected certifying agency. In Washington State, the certifying agency is WDOE, which has regulatory authority over waters of the state, including streams and isolated wetlands, under the state Water Pollution Control Act (90.48 RCW) and the Shoreline Management Act (90.58 RCW).

4.3 KING COUNTY

King County (2022a) code regulates wetlands, streams, and shorelines as critical areas. Alterations of critical areas and their buffers are generally prohibited, except as allowed under certain conditions. All direct impacts must be mitigated through creation, restoration, or enhancement. King County (2022a) has the final authority to determine ratings, buffers, and allowed uses of critical areas, their buffers, and other sensitive areas that are under their jurisdiction.

King County (2022a) provides a range of buffer widths for shorelines depending on the water type and location in relation to the Urban Growth Area. The King County (2022b) iMap Urban Growth Area layer identifies the project site as rural. King County (2022a) code Section 21A.24.358 requires a 165-foot-wide buffer for Type S waters outside the Urban Growth Area.

5.0 LIMITATIONS

We have prepared this report for the exclusive use of Phil and Anne Guadagno and their consultants. No other person or agency may rely upon the information, analysis, or conclusions contained herein without permission from Phil and Anne Guadagno.

The determination of ecological system classifications, functions, values, and boundaries is an inexact science, and different individuals and agencies may reach different conclusions. With regard to wetlands, the final determination of their boundaries for regulatory purposes is the responsibility of the various agencies that regulate development activities in wetlands. We cannot guarantee the outcome of such determinations. Therefore, the conclusions of this report should be reviewed by the appropriate regulatory agencies.

We warrant that the work performed conforms to standards generally accepted in our field, and prepared substantially in accordance with then-current technical guidelines and criteria. The conclusions of this report represent the results of our analysis of the information provided by the project proponent and their consultants, together with information gathered in the course of the study. No other warranty, expressed or implied, is made.

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FIGURES

FIGURE 1 - Regional & Vicinity Map

Guadagno, King County WA

14282 Olympic Drive SW, Vashon Island WA

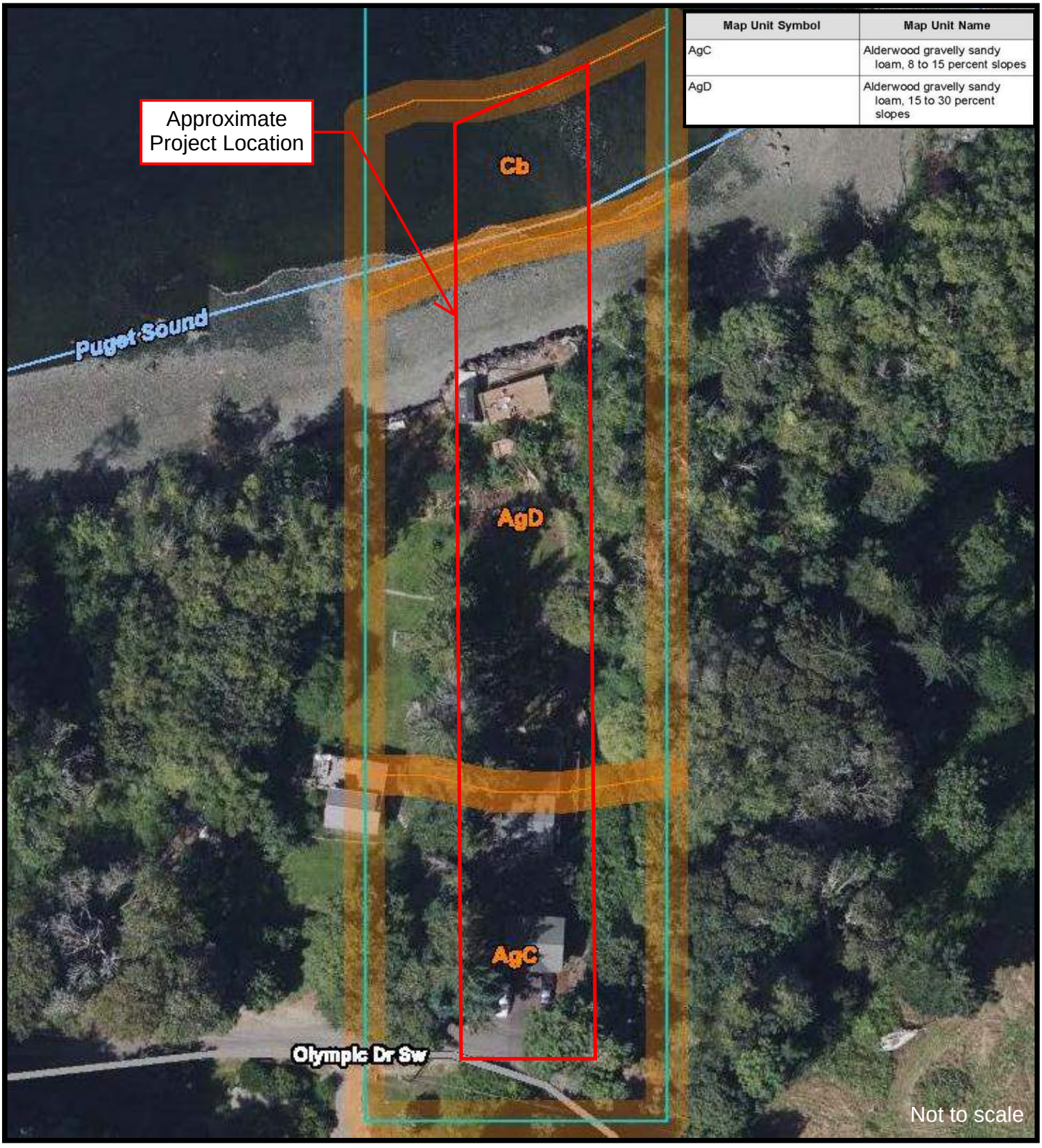
RAI PROJECT: 2022-043-001

PREPARED: 05/27/2022

BY: CLS

Raedeke Associates, Inc.

2111 N. Northgate Way,
Suite 219 Seattle, WA 98133



Map Unit Symbol	Map Unit Name
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes
AgD	Alderwood gravelly sandy loam, 15 to 30 percent slopes

FIGURE 2 - NRCS Web Soil Survey Map

Guadagno, King County WA

14282 Olympic Drive SW, Vashon Island WA

RAI PROJECT: 2022-043-001

PREPARED: 05/27/2022

BY: CLS

Image source: NRCS Web Soil Survey https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

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FIGURE 3 - National Wetland Inventory Map
Guadagno, King County WA

14282 Olympic Drive SW, Vashon Island WA
RAI PROJECT: 2022-043-001

PREPARED: 05/27/2022
BY: CLS

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

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Legend:

- class 1
- class 2 perennial
- class 2 salmonid
- class 3
- unclassified
- Wetland (1990 SAO)
- Lakes and large rivers

FIGURE 4 - King County iMap

Guadagno, King County WA

14282 Olympic Drive SW, Vashon Island WA

RAI PROJECT: 2022-043-001

PREPARED: 05/27/2022
BY: CLS

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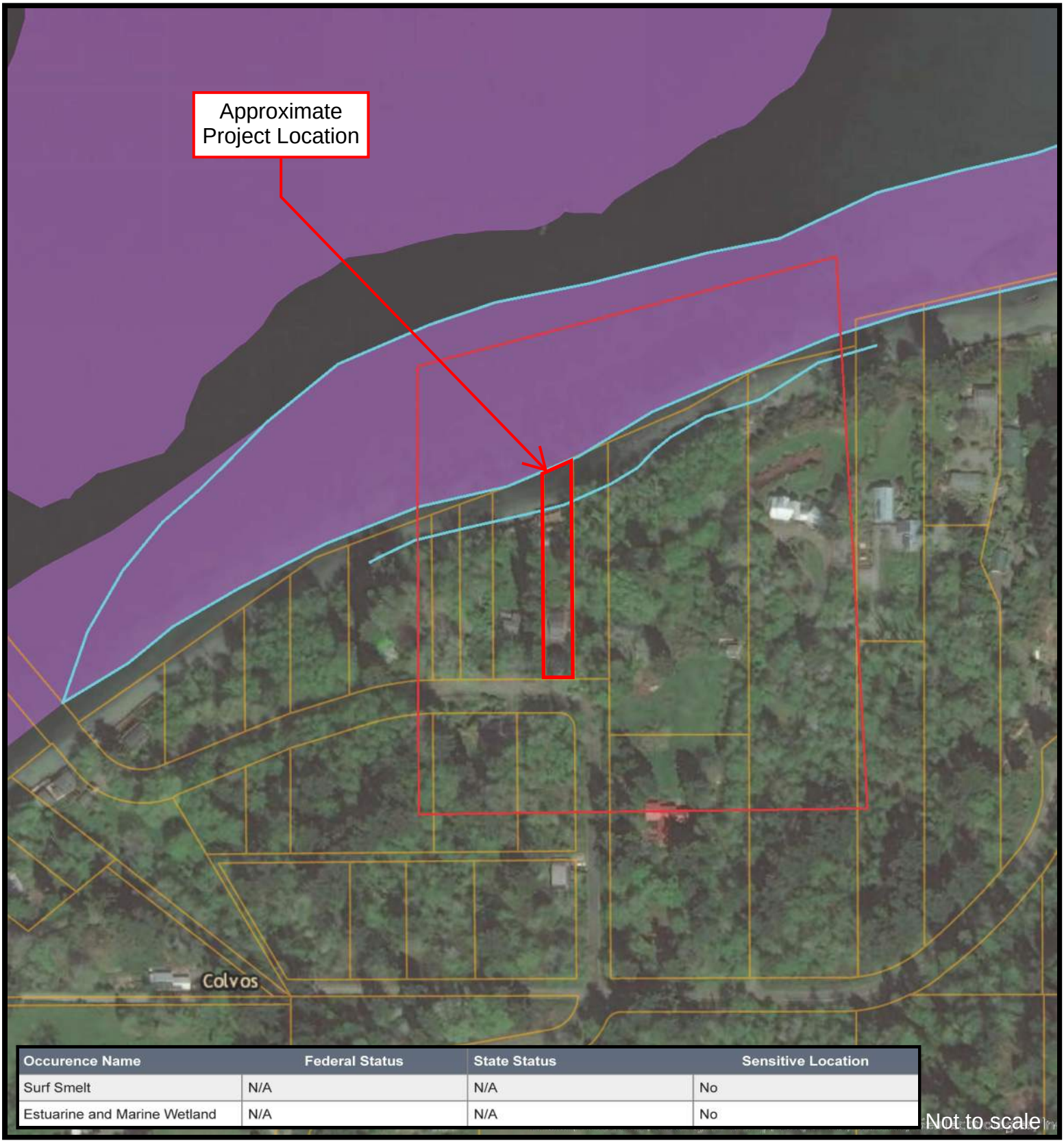

Occurence Name	Federal Status	State Status	Sensitive Location
Surf Smelt	N/A	N/A	No
Estuarine and Marine Wetland	N/A	N/A	No

Not to scale

Legend:

- Mapped Species

FIGURE 5 - WDFW Priority Habitats & Species

Guadagno, King County WA

14282 Olympic Drive SW, Vashon Island WA

RAI PROJECT: 2022-043-001

PREPARED: 05/27/2022
BY: CLS

SOURCE INFORMATION: Washington Fish and Wildlife Priority Habitat & Species Online Mapping tool - http://apps.wdfw.wa.gov/phsontheweb/

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FIGURE 6 - Guadagno King County - Existing Conditions

RAI Project #: 2022-043-001
Date: 05/27/2022
Created by: C. Straight

Note: Shoreline OHWM boundaries are based on GPS coordinates and interpretation of aerial imagery. Boundaries are approximate and for planning purposes only.

APPENDIX A

Field Survey Data

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Guadagno King County City/County: Vashon Island, King County Sampling Date: April 22, 2022

Applicant/Owner: Phil and Anne Guadagno State: WA Sampling Point: SP 1

Investigator(s): Annamaria Clark & Courtney Straight Section, Township, Range: S13, T23N, R2E, W.M.

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR): Northwest Forests & Coasts (LRR A) Lat: 47.47851 Long: -122.49055 Datum:

Soil Map Unit Name: Alderwood gravelly sandy loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☐ No ☒ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes ☐ No ☒

Remarks: Sample Plot 1 is located in the northeast corner of the shoreline above the bulkhead.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5 m)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 3 m)			
1. Rosa sp.	5	Y	Unk
2.			
3.			
4.			
5.			
	5 = Total Cover		
Herb Stratum (Plot size: 1 m)			
1. Poa pratensis (Kentucky bluegrass)	40	Y	FAC
2. Taraxacum officinale (common dandelion)	10	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	50 = Total Cover		
Woody Vine Stratum (Plot size: 3 m)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 15

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species 0	x 1 = 0
FACW species 0	x 2 = 0
FAC species 40	x 3 = 120
FACU species 10	x 4 = 40
UPL species 0	x 5 = 0
Column Totals: 50 (A)	160 (B)

Prevalence Index = B/A = 3.2

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks: Rosa sp. not included in analsis as WIS unknown. No indicators of hydrophytic vegetation observed.

SOIL

Sampling Point: SP 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 5+	10YR 4/2	90	10YR 4/4	10	C	M	Si. Cl. L.	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Refusal - hard pan

Depth (inches): 5

Hydric Soil Present? Yes ☒ No ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): _____

Water Table Present? Yes ☐ No ☒ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): _____

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No primary or secondary indicators of wetland hydrology observed.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Guadagno King County City/County: Vashon Island, King County Sampling Date: April 22, 2022

Applicant/Owner: Phil and Anne Guadagno State: WA Sampling Point: SP 2

Investigator(s): Annamaria Clark & Courtney Straight Section, Township, Range: S13, T23N, R2E, W.M.

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): concave Slope (%): 5-10

Subregion (LRR): Northwest Forests & Coasts (LRR A) Lat: 47.47851 Long: -122.49055 Datum:

Soil Map Unit Name: Alderwood gravelly sandy loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☒ No ☐ Hydric Soil Present? Yes ☐ No ☒ Wetland Hydrology Present? Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes ☐ No ☒

Remarks: Sample Plot 2 is located at the top of the slope in the lawn near western property line.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Thuja plicata (western red arborvitae)	40	Y	FAC
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 3 m)			
1. Cratageous douglasii (black hawthorn)	2	Y	FAC
2.			
3.			
4.			
5.			
	2	= Total Cover	
Herb Stratum (Plot size: 1 m)			
1. Poa pratensis (Kentucky bluegrass)	50	Y	FAC
2. Agrostis sp.	15	N	Unk
3. Taraxacum officinale (common dandelion)	5	N	FACU
4. Equisteum arvense (field horsetail)	5	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	75	= Total Cover	
Woody Vine Stratum (Plot size: 3 m)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 15

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

Remarks: Agrostis sp. not included in analsis as WIS unknown.

SOIL

Sampling Point: SP 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 6	10YR 3/3	100					Gr. S. L.	
6-13+	2.5Y 4/3	90	10YR 3/6	10	C	M	Gr. S. L.	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☐ No ☒

Remarks: No indicators of hydric soils observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): _____

Water Table Present? Yes ☐ No ☒ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): _____

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No primary or secondary indicators of wetland hydrology observed.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Guadagno King County City/County: Vashon Island, King County Sampling Date: April 22, 2022

Applicant/Owner: Phil and Anne Guadagno State: WA Sampling Point: SP 3

Investigator(s): Annamaria Clark & Courtney Straight Section, Township, Range: S13, T23N, R2E, W.M.

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): concave Slope (%): 5-10

Subregion (LRR): Northwest Forests & Coasts (LRR A) Lat: 47.47851 Long: -122.49055 Datum: _____

Soil Map Unit Name: Alderwood gravelly sandy loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☒ No ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes ☐ No ☒

Remarks: Sample Plot 3 is located at the top of the slope in a depresion near the eastern property line.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5 m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus rubra (red alder)	30	Y	FAC
2. Sorbus aucuparia (European moutain ash)	10	Y	NI
3.			
4.			
	40	= Total Cover	
Sapling/Shrub Stratum (Plot size: 3 m)			
1. Prunus laurocerasus (cherry laurel)	30	Y	NI
2. Malus fusca (Oregon crabapple)	30	Y	FACW
3. Rubus ursinus (California dewberry)	10	N	FACU
4. Rubus armeniacus (Himalayan blackberry)	5	N	FAC
5. Ilex aquifolium (English holly)	5	N	FACU
6. Lonicera ciliosa (orange honeysuckle)	5	N	NI
7. Hedera helix (English ivy)	5	N	FACU
8. Rubus spectabilis (salmon raspberry)	3	N	FAC
	93	= Total Cover	
Herb Stratum (Plot size: 1 m)			
1. Ranunculus repense (creeping buttercup)	50	Y	FAC
2. Vinca minor (common periwinkle)	20	N	NI
3. Equisteum arvense (field horsetail)	20	N	FAC
4. Pteridium aquilinum (northern bracken fern)	10	N	FACU
5. Polysticum munitum (pineland sword fern)	2	N	FACU
6.			
7.			
8.			
9.			
10.			
11.			
	102	= Total Cover	
Woody Vine Stratum (Plot size: 3 m)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks: Sorbus acuparia, Pruns laurocerasus, Lonicera ciliosa, and Vinca minor not included in analsis as WIS unknown.

SOIL

Sampling Point: SP 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 8	2.5Y 4/3	90	10YR 4/4	10	C	M.	Si. Cl. L.	
8-14+	2.5Y 5/1	90	10YR 4/4	10	C	M	Si. Cl. L.	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

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- ☐ Depleted Below Dark Surface (A11)
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- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
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Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☒ No ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
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- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

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Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): _____

Water Table Present? Yes ☐ No ☒ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): _____

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No primary or secondary indicators of wetland hydrology observed.

TIR Section VII – Other Permits

TIR Section VII

Narrative

It is not anticipated that other permits will be required for this project.

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TIR Section VIII – CSWPPP Analysis and Design

TIR Section VIII Summary

Narrative

ESC Measures

SWPPS Measures

This section of the TIR provides a summary of erosion controls and source controls for the site and serves as a supplement to the erosion control plan civil drawing sheets.

In the proposed condition, a retaining wall and two wooden staircases will be constructed on the northern portion of the site. The site contains a steep slope hazard area, flood hazard area, and is within a landslide hazard area.

ESC and SWPP measures were chosen per Section D.2 of the 2021 King County Surface Water Design Manual. Less than 1 acre of land will be disturbed and, therefore, the Department of Ecology SWPPP and Construction Stormwater General Permit are not required.

ESC Measures

The following ESC measures are suggested for each category below:

1. **Clearing Limits:**

   To protect adjacent properties, existing trees to stay, and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. The BMPs relevant to marking the clearing limits that will be applied for this project include:

   - High Visibility Plastic or Metal Fence

2. **Cover Measures**

   Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. Temporary cover shall be installed if an area is to remain unworked for more than seven days during the dry season (May 1 to September 30) or for more than two consecutive working days during the wet season (October 1 to April 30). The suggested BMPs for soil stabilization that shall be used on this project include:

   - Temporary & Permanent Seeding
   - Mulching
   - Nets & Blankets
   - Plastic Covering

3. **Perimeter Protection**

   All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged. The specific BMPs to be used for controlling sediment on this project include:

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- Silt Fence

4. Traffic Area Stabilization

The purpose of a stabilized construction entrance is to reduce the amount of sediment transported off site and to reduce erosion of areas disturbed by vehicle traffic. The site contains a preexisting gravel driveway with access from Olympic Drive SW that can serve the same purposes. An additional traffic area stabilization BMP is not anticipated to be needed.

5. Sediment Retention

The site is flat enough where the work will be accomplished, and a silt fence will be located above the bulkhead so that sediment retention is not anticipated to be needed. Sediment transport should be prevented using silt fence around the downstream work area. The BMPs relevant to downstream sediment control that will be applied for this project include:

- Silt Fence

6. Surface Water Collection

The purpose of surface water control is to collect and convey surface water so that erosion is minimized. The site is flat enough near the bulkhead that surface water collection is not anticipated to be needed.

7. Dewatering Control

Dewatering is not anticipated to be necessary.

8. Dust Control

Dust control is not anticipated to be necessary.

9. Flow Control

Increases in the 2-year and 10-year runoff event is expected to be small due to the size and topography of the site and amount of impervious area proposed. Flow control facilities are not proposed on this site as flow control requirements are not required for the Targeted Drainage Review.

10. Protect Existing and Proposed Flow Control BMPs

The proposed dispersal tee should be protected during construction by placing high visibility plastic or metal fence around it. The BMPs relevant to protecting flow control BMPs that will be applied for this project include:

- High visibility plastic or metal fence

11. Maintain Protective BMPs

BMPs will be maintained and repaired as necessary throughout construction. The CSWPP supervisor shall review the site for ESC and SWPPS at least weekly and within 24 hours of significant storms. All temporary erosion and sediment control BMPs will be removed within 30 days after achieving final site stabilization.

12. Manage the Project

Projects shall assign a qualified CSWPPP supervisor to be the primary contact for ESC and SWPPP issues and reporting.

SWPPS Measures

Stormwater pollution prevention standard (SWPPS) measures are required to prevent, reduce, or eliminate the discharge of pollutants to on-site or adjacent stormwater systems. See Appendix D.2.2 of the 2021 SWDM for detailed specifications for the implementation of the following SWPPS Measures:

- Material Delivery, Storage and Containment: These procedures are suitable for use at all construction sites with delivery and storage of the following materials: Petroleum products such as fuel, oil and grease; Soil stabilizers and binders (e.g. Polyacrylamide); Fertilizers, pesticides and herbicides; Detergents; Asphalt and concrete compounds; Hazardous chemicals such as acids, lime, adhesives, paints, solvents and curing compounds; Any other material that may be detrimental if released to the environment.

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TIR Section IX – Bond Quantities, Facility Summaries, and Declaration of Covenant

TIR Section IX Summary:

Narrative

Not applicable per Section II.

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TIR Section X – Operation and Maintenance Manual

TIR Section X Summary:

Narrative

Not applicable per Section II.

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