

**February 23, 2020**

**Mr. Rod Forsberg  
8078 Wenatchee Place NW  
Silverdale Washington 98383**

**LIMITED GEOLOGICAL RECONNAISSANCE  
SINGLE FAMILY RESIDENCE SITE  
KITSAP COUNTY PARCEL NUMBER 4423-014-001-0100  
8135 SANDY ROAD NE  
BREMERTON, WASHINGTON 98383**

**Dear Mr. Forsberg:**

Resolve Environmental and Geotechnical, Incorporated (Resolve) is pleased to provide this letter report for the limited geological reconnaissance at the above-referenced property. Resolve understands that the object of the investigation was to perform a limited visual inspection of the geologic conditions and general condition of the site and properties near the site; as well as geologic map research. Resolve understands that the reconnaissance is related to permitting for construction of a Single-Family Residence (SFR) on the site.

The subject site is located at 8135 Sandy Road NE, Bremerton, Washington. The Kitsap County Parcel Number is 4423-014-001-0100. The latitude is approximately 47 degrees, 38 minutes, 17.8 seconds north, and the longitude is approximately -122 degrees, 36 minutes 34.3 seconds west. The site is surrounded by rural residential properties with sporadic Single-Family Residences (SFRs), wooded areas, and hillsides. The proposed SFR site is located generally in the eastern portion of the subject property, which will likely be the site of a stick-built home. A soil, gravel, and rock driveway off of Sandy Road NE provides the primary access to the site. A site Vicinity Map is attached to this report.

The subject construction area has been only partially cleared for access for septic system test pits. The site was mostly accessible on our arrival. Beneath significant forest duff and loose materials, very dense soils appear to be in the subsurface at location for the SFR, and appear to be ubiquitous across the site.

Large and medium diameter conifers, deciduous trees, common shrubberies and blackberries occupy most of the surrounding terrain. A Washington State-Licensed Geologist from Resolve (Ronald P. Nance, P.G.) performed the limited site reconnaissance on February 19, 2020. Our observations were preceded by a review of local geologic databases, local geology, and area slope evaluations of the immediate vicinity.

**Soil and Slope Research**

The following information provides a basis for a general understanding of the subject soils and geologic conditions. Further information is provided in the Conclusions and Recommendations section of this Reconnaissance Report.

--Kitsap County Maps:

- Assessors GIS Critical Areas Map: Indicates a Moderate Critical Area for much of the parcel.
- Landslide Hazards Map: Indicates a vague, shallow Landslide Hazard, in non-specific areas toward the south and center of the site.
- Erosion Hazard Map: Indicates only Moderate Erosion hazard areas for the parcel.
- Seismic Hazards Map: Does not indicate the subject site is in a Seismic Hazard area. Also, no Liquefaction Hazards were noted for the subject site. A fault is mapped to the south, across Port Orchard Bay; approximately one to two miles distant.
- The WA DOE Coastal Atlas maps the subject site as being in a stable to intermediately stable zone.

## **USDA Soils**

The United States Department of Agriculture (USDA) Soil Survey of Kitsap County Area, Washington, information indicates the following soil types exist on the project site:

- #2 Alderwood gravelly sandy loam (8 to 15 percent slopes)
- #3 Alderwood gravelly sandy loam (15 to 30 percent slopes)

A soils map and the soil survey descriptions of these soil types are attached to this report.

The soils actually observed in the immediate vicinity of the site indicated that the soils listed by the USDA soil map profile were apparently accurate. Soils were probed with a ½-inch aluminum alloy T-Probe. In subject construction area, heavy forest duff and topsoils were noted, with two to three feet of penetration, with moderate applied pressure. All soils in the construction area were observed as being very dense beneath the forest duff and debris. Resolve also observed three open test pits, and probed the bottom of the pits. The materials were very dense, with varying concentrations of gravel, cobbles, and boulders. They appeared to have a similar profile of thick duff over the Alderwood till.

All areas probed appeared to be the Alderwood soils units, with some minor variation in density and localized fill and forested areas. Soils observed for the subsurface were described in the field as brown, very dense, damp silty sand with gravel and cobbles (USCS SM). They were interpreted in the field as highly compacted, medial energy deposits of glacial till and overridden alluvium and outwash. The access driveway on the site was covered with what appeared to be soils, gravel, unearthened boulders, and other debris.

There were slopes to the south and west of the proposed SFR site with moderate angles, with those to the southwest being steeper. The southern slopes varied some, but beyond the crest of slope, they were measured between 25 and 40 percent. The western slopes varied greatly, with multiple minor topographic rises and falls. They were observed to be between 18 and 30% and varied somewhat across the site, with an average of approximately 25 percent.

The site slopes did not show preferred drainage pathways in any observed areas. This is likely due to the heavy forest duff and infiltration into the shallow subsurface. Also, a rough culvert appears to parallel Sandy Road NE and drain to the north. All slopes surrounding the construction area of the site were vegetated and some areas nearly inaccessible due to blackberries and shrubs. The slopes on and surrounding the site are considered very stable at this time. No large-scale cracks or lineations were noted across the observed site or vicinity.

## **Existing Drainage**

No existing drainage pipes or channels were observed on the parcel. Approximately eight inches of standing rain water was noted in one of the septic test pits to the southwest and upgradient from the construction site at the time of our site visit (at which time it was raining). No weather-driven erosion channels or incised drainage pathways were observed on the site or slopes to the south and west.

## **Geologic Setting**

The subject site lies within the central Puget Lowland. The lowland is part of a regional north-south trending trough that extends from southwestern British Columbia to near Eugene, Oregon. North of Olympia, Washington, this lowland is glacially carved with a depositional and erosional history including at least four separate glacial advances and retreats. The Puget Lowland is bounded on the west by the Olympic Mountains and on the east by the Cascade Range. The lowland is filled with glacial and non-glacial sediments consisting of interbedded gravel, sand, silt, clay, till, and peat lenses.

## **Conclusions and Recommendations**

If the recommendations of this report are utilized and maintained, the subject site appears unlikely to be affected by the slopes to south and west, and will have no adverse effect on said slopes. Drainage should be easily accomplished with distribution from splash-blocks or other systems. Soils are likely to be mostly impermeable below two to three feet below the existing ground surface, and forest duff and unsuitable soils may have to be removed to those depths for construction. Footings should be set well into the very dense materials in the subsurface.

A 'geologic report' per KCC 19.400.440.D.2 is presented in this letter report, and appears to be applicable for this site since geologic hazards are mapped for the subject site and the vicinity. It is Resolve's opinion that a full-scale Geotechnical Engineering Investigation is not warranted.

- Per 19.400.420, the parcel is mapped as having a Moderate Critical Hazard. However, all observed slopes (including the steeper portions of slopes to the south and west) appeared to be very stable, and slopes were mostly vegetated. No bowed trees or other signs of creep were noted.
- Per 19.400.425, the parcel is mapped as having a potential for Landslide Hazard on the southern side of the site. It is considered likely that some of the very near surface materials on the site will undergo weathering at a gradual rate, as they do in most other areas in the Puget Sound region. No recent or historic slumping or landslide issues were noted on the site or the vicinity. The very dense soils in the subsurface are likely to greatly mitigate sliding on the site, and should be stable for the foreseeable future. If slopes are drained properly and vegetated, this will further mitigate any local, potential sliding or sloughing. This type of soil is not considered likely to creep down dip on site.
- Per 19.400.430, no Seismic Hazards are noted for the site. The fault that is mapped in the vicinity of the site (to the south approximately 1-2 miles across Port Orchard Bay) is considered possibly a splay of, or related to, the Seattle Fault zone (per Lamb and Polenz, 2012), and (according to carbon dating) has apparently not been active since A.D. 900 to 930 (Atwater, 1999). Persons living on (or building on) or around slopes are likely to be aware that it is always considered possible in the Puget Sound region that major seismic events can trigger landslides or geological incidents, as the overall region is known for tectonic movement. No Liquefaction Hazards are noted for the site or vicinity.
- The parcel is mapped as a potential Moderate Erosion Hazard area. Slopes to the south and west of the construction site on the parcel may be subject to shallow surficial erosion. No erosion rills or established erosion pathways from sheetflow or stormwater were noted near the proposed construction site. Erosion is anticipated to be at a very low rate on the proposed building site.

The soils are considered very dense in the subsurface of the subject site, so that there is no indication that, provided adequate drainage is developed and maintained, any slopes on the parcel will affect the proposed placement of the SFR and associated construction activities on the site. Soils that area unsuitable for construction should be over-excavated on the site, and Best Management Practices should be undertaken in site activities. Resolve should be contacted to verify soil conditions when footings have been cut, prior to emplacement of forms.

## **Drainage**

It is suggested that dispersion techniques be applied for stormwater mitigation. The site appears to be a adequate for individual splashblocks (BMP T5.10B), with flow-paths in various direction off toward the hillsides/slopes to the north and northwest. The standard flow path criteria, away from the splashblocks is 50-feet on a slope less than 15%. Storm mitigation for the driveway and parking area can likely be accomplished using sheet flow dispersion (BMP T5.12) and/or trenches and culverts. The stormwater for

the area appears to drain northward and eastward. If this method does not appear to be appropriate for the final design on the site, an engineer may be required for more sophisticated design.

It is our opinion that this geological reconnaissance report satisfies the intent of the Kitsap County Critical Areas ordinance for geologically hazardous areas, KCC 19.400, for the subject site, and provides a prudent, current overview of geologic conditions on the site.

As a point of potentially useful information, although there is extensive vegetation on the site, some disturbed areas may require some form of mitigation. Native plants may possibly be planted in the vicinity of the site for mitigation purposes. The following table depicts some recommended plants should such mitigation be desired:

**Table 1: Suggested Slope Mitigation Plants and Approximate Coverages**

<b>Native Plantings</b>	<b>Sizing</b>	<b>Min. Spacing</b>	<b># of Plants</b>	<b>Sq.ft. Coverage</b>
Ocean Spray (Holodiscus discolor)	1 gallon	5 feet	3 plants	30
Salal (Gaultheria shallon)	1 gallon	5 feet	5 plants	50
Red-Flowering Current (Ribes Sanguineum)	1 gallon	5 feet	5 plants	45
Thimbleberry (Rubus parviflorus)	1 gallon	5 feet	4 plants	36
Snowberry (Symphoricarpos albus)	1 gallon	5 feet	5 plants	50
Nootka Rose (Rosa Nutkana)	1 gallon	5 feet	3 plants	27

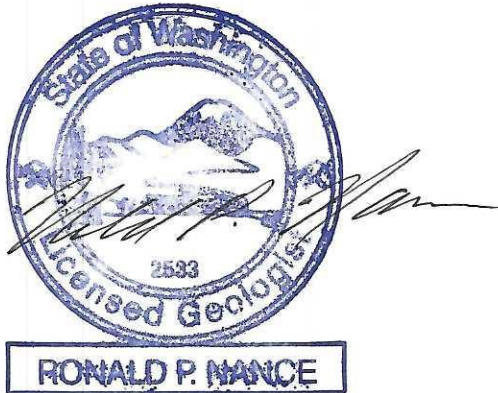
The above-listed plants may or may not be utilized or be selected by the client, however they have been shown in the past to be adequate cover for disturbed areas. Resolve does not retain a certified biologist or botanist, and provides these as suggestions only.

### **Limitations**

Our conclusions are based on the information obtained from available databases, limited field observation of the subject site, and on our interpretation of the visible surface conditions only. No subsurface evaluation or geotechnical engineering report was conducted per the client-requested scope of work. We make no other warranty, either expressed or implied. If conditions are encountered that appear to be different than those described in this report, we should be notified so that we may review and verify or modify our recommendations.

Resolve appreciates the opportunity to provide these services, and hopes the information presented in this report provides for your needs and requirements. Please feel free to call with any comments or questions regarding this letter report. Our telephone number is (360) 865-1843.

Sincerely,  
Resolve Environmental & Geotechnical, Inc.



Ronald P. Nance, P.G.  
Senior Geologist and Environmental Professional  
WA License No. 2533



# Forsberg Site Vicinity Map

- Legend
  - 8135 Sandy Rd NE
  - Brownsville Elementary School
  - Brownsville United Methodist



<div>Resolve Environmental &amp; Geotechnical, Inc.</div> <div>(360) 865-1843</div> <div>resolveveg@comcast.net</div>	<div>Figure 1 :</div> <div>Vicinity Map</div>	<div>PROJECT:</div> <div>Limited Geological Reconnaissance</div> <div>Kitsap Parcel No. 4423-014-001-0100</div> <div>8135 Sandy Road NE</div> <div>Bremerton, Washington</div> <div>Permit Number: 19-05696</div> <div>Prepared for: Mr. Rod Forsberg</div>
	<div>Project No. 20-048</div> <div>Date: February, 2020</div>	

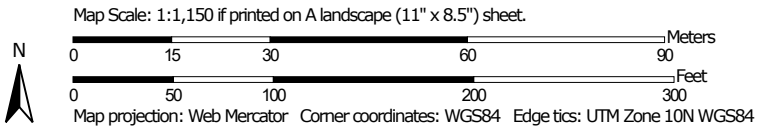


## **USDA INFORMATION**

Soil Map—Kitsap County Area, Washington  
(Forsberg Site Soils Map)



Soil Map may not be valid at this scale.





Soil Map—Kitsap County Area, Washington  
(Forsberg Site Soils Map)


## 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: Kitsap County Area, Washington

Survey Area Data: Version 15, Sep 16, 2019

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

Date(s) aerial images were photographed: Aug 9, 2018—May 23, 2019

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
1	Alderwood gravelly sandy loam, 0 to 8 percent slopes	1.6	23.5%
3	Alderwood gravelly sandy loam, 15 to 30 percent slopes	4.2	63.6%
10	Dystic Xerorthents, 45 to 70 percent slopes	0.9	12.9%
<b>Totals for Area of Interest</b>		<b>6.6</b>	<b>100.0%</b>

## Kitsap County Area, Washington

### 1—Alderwood gravelly sandy loam, 0 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2t625

*Elevation:* 50 to 800 feet

*Mean annual precipitation:* 25 to 60 inches

*Mean annual air temperature:* 48 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):* Summit

*Landform position (three-dimensional):* Crest, 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:* 0 to 8 percent

*Depth to restrictive feature:* 20 to 39 inches to densic material

*Natural drainage class:* Moderately well drained

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)

*Depth to water table:* About 18 to 37 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Very low (about 2.7 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4s

*Hydrologic Soil Group:* B



*Forage suitability group:* 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):* Summit, shoulder  
*Landform position (three-dimensional):* Interflue, crest  
*Down-slope shape:* Convex  
*Across-slope shape:* Convex  
*Hydric soil rating:* No

#### Mckenna

*Percent of map unit:* 5 percent  
*Landform:* Depressions, drainageways  
*Landform position (three-dimensional):* Dip  
*Down-slope shape:* Concave, linear  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

#### 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

## Data Source Information

Soil Survey Area: Kitsap County Area, Washington  
Survey Area Data: Version 15, Sep 16, 2019

## Kitsap County Area, Washington

### 3—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, tal

*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

*Natural drainage class:* Moderately well drained

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)

*Depth to water table:* About 18 to 37 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Very low (about 2.7 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B

*Forage suitability group:* 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

## Data Source Information

Soil Survey Area: Kitsap County Area, Washington  
Survey Area Data: Version 15, Sep 16, 2019