Preliminary Report
Geotechnical Engineering Services
Proposed Residential Development
Forest Ridge Plat
Section 24, Township 20 North, Range 15 East
Cle Elum Area, Kittitas County, Washington

August 23, 2018
ICE File No. 1283-001

Prepared For:
Iron Snowshoe, LLC

Prepared By:
Icicle Creek Engineers, Inc.

ICICLECREEK ENGINEERS

August 23, 2018

Sean Northrop
Iron Snowshoe, LLC
116½ South Washington Street
Seattle, Washington 98104

Icicle Creek Engineers (ICE) is pleased to submit one original copy and an electronic copy (pdf) of our *Preliminary Report, Geotechnical Engineering Services, Proposed Residential Development, Forest Ridge Plat, Section 24, Township 20 North, Range 15 East, Cle Elum Area, Kittitas County, Washington*. ICE's services were provided in general accordance with our Revised Scope of Services and Fee Estimate dated June 5, 2018 and were authorized in writing by Sean Northrop of Iron Snowshoe, LLC on June 5, 2018. This report was submitted in draft format on August 6 and 22, 2018 for your review and comment.

This report is intended to provide a preliminary evaluation of site conditions for the purpose of project planning. Additional geotechnical design considerations are expected depending on the direction of property development.

It has been our pleasure to be of service to Iron Snowshoe, LLC on this project. If you have any questions regarding the contents of this preliminary report or if we can be of further service, please contact us.

Yours very truly,

Icicle Creek Engineers, Inc.

Brian R. Beaman, PE, LEG, LHG
Principal Engineer/Geologist/Hydrogeologist

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Attachment

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FOR
IRON SNOWSHOE, LLC

1.0 EXECUTIVE SUMMARY OF KEY FINDINGS

This Executive Summary provides a brief description of key observations, conclusions and recommendations resulting from our geological, geomorphic and preliminary geotechnical evaluation of the Forest Ridge Plat. We strongly recommend reviewing the entire report to reduce the risk of misinterpretation by readers with varying backgrounds. ICE should be contacted to provide clarification as questions develop. The following are key findings.

General

- The overall area of the Forest Ridge Plat property is shown relative to nearby physical features on the Vicinity Map, Figure 1.
- This preliminary geotechnical evaluation is limited to the more favorable areas for site development. These areas include the west part of the property where the geologic conditions and topography are potentially favorable for development; the more favorable area, referred to as Phase 1, was targeted for this study. The other area, referred to as Phase 2, was limited to subsurface exploration to better understand area geologic conditions. The Phase 2 area is expected to have more geotechnical issues requiring mitigation that were not evaluated for this study. The Phase 1 and 2 areas are shown on the Site Plan, Figure 2.
- The central part of the Forest Ridge Plat contains a deep-seated landslide. No development should be planned in that area.
- The east part of the Forest Ridge Plat contains a potentially developable area. However, this area is relatively small and may be not be cost-effective to connect with utilities, especially water.
- The Phase 1 area consists of about 67 acres (including about 56 acres in the North Parcel and 11 acres in the South Parcel) as shown on Figure 2.
- At this time, the development plan has not been updated for this property. Also, the method of stormwater collection and disposal is not known at this time. We expect that the results of this preliminary report will be used to assist in the planning of lot layout, access and drainage.
- During our preliminary site review, we observed surficial soil conditions in uphill cuts for the access road that suggested unstable surficial soil conditions.

Subsurface Conditions

- Subsurface conditions were explored in the west part of the property by excavating 53 test pits. Test boring explorations (Boring B-1 through B-4) completed by Aspect Consulting (August 19, 2010) in the east portion of the property, and water wells (ALH 940, AKW 661, ALN 806, APB 228 and APB 226) that were included in the Aspect Engineering report were reviewed to supplement our understanding of subsurface conditions at the property. The test pits completed by ICE, test borings completed by Aspect Consulting and the water well locations are shown on Figure 2.
- The near-surface undisturbed soil or bedrock consists of Kittitas Drift (Alpine Glacial Till) or Roslyn Formation (siltstone, sandstone and occasional layers of coal) as shown on the Geologic Map, Figure 3.
- Based on our review of field explorations and laboratory testing, we observed that the surficial (weathered) soils that overlie the Kittitas Drift or Roslyn Formation consist of Loess (wind-blown silt), Completely Weathered Bedrock/Residual Soil, Highly to Moderately Weathered Bedrock and

Weathered Alpine Glacial Till. The surficial soils averaged about 7.4-feet thick with a range of thickness of 2.5 to 13 feet in the test pit explorations (Test Pits TP-1 though TP-32).

Deep-Seated Landslide

- A large, deep-seated landslide (DSLS) complex occurs in the central and east part of the property and has been previously identified by the US Geological Survey (Tabor, R.W., et al, 1982, *Geologic Map of the Wenatchee Quadrangle*, Miscellaneous Investigations Series Map I-1311) and the Washington State Department of Natural Resources (DNR, May 11, 2014, *Mass Wasting Assessment: Landslide Hazard Inventory Project: West Fork Teanaway Watershed, Kittitas County, Washington*; and DNR Geologic Information Portal, Landslide Database (https://www.dnr.wa.gov/geologyportal)). Based on our review of the LiDAR Image, Figure 4 and field observations, we concur that the DSLS complex exists; the ICE interpreted location and perimeter of the DSLS is shown on Figure 3.
- During our field review we did not observe surface evidence of recent ground movement within the DSLS. The ground surface is hummocky and displays evidence of past, likely prehistoric movement. Based on these observations, it is our opinion that the DSLS complex is "inactive" (dormant). However, it has been our experience that inactive landslides can be reactivated by site development. The "reactivation" usually does not affect the entire DSLS area, but much smaller local areas within the DSLS complex. Deep-seated ground movement or slumping on a local scale can be destructive to surface improvements, and typically results in condemnation of these structures. We recommended excluding the area of the DSLS complex from development regardless of additional geotechnical evaluation.
- As described in the preceding bullet, there is a high risk for reactivation on a local scale of the DSLS should development occur in that area. However, at grade (minimal grading), gravel-surfaced access roads can be constructed on a case-by-case basis with geotechnical review.

Geologically Hazardous Areas

- Geologically Hazardous Areas within or adjacent to the Phase 1 area include Mine Hazards, Steep Slopes and Landslide Hazard Areas as shown on the Coal Mine Location Map, Geologic Cross-Section A-A' and Geologically Hazardous Areas Map, Figures 5, 6 and 7, respectively. We expect that Mine Hazards and Landslide Hazards will be avoided and left as open space. Some of the Phase 1 area is bordered by Steep Slopes that will require a structure setback from the top of the Steep Slope. The purpose of the structure setback is to provide a buffer should a slope failure occur that will protect the structure from damage and to also allow for equipment access for slope repair/stabilization, if necessary.
- An abandoned underground coal mine is present in the southwest corner of the property (Phase 1 South Parcel) as shown on Figure 5. The abandoned underground coal mine is relatively shallow (less than 100 feet below the ground surface and should be considered a Severe Coal Mine Hazard Area (no development – passive, open space use only).

Geotechnical Findings

- The Phase 1 area, where undisturbed (no previous grading), appears to be stable in its present condition. Based on our observations, the road cuts and ditch lines for the existing access road have experienced more than expected localized shallow slope failures and adverse erosion likely because of the more than usual sensitivity (to grading and moisture) of the surficial soils.
- The surficial soils are expected to be highly sensitive to grading (cutting and use as structural fill) and moisture content.

- It is likely that the grading plan for general site development will encounter these sensitive surficial soils more often than the deeper, more stable soils including the Alpine Glacial Till and the slightly weathered Roslyn Formation bedrock (siltstone and sandstone).
- The sensitivity of the surficial soils (average thickness of about 7.4 feet in Phase 1) to moisture translates to a high risk of shallow slope failure. Shallow slope failure, once activated, can be difficult if not impossible (from a risk and/or financial perspective) to correct.
- Grading and stormwater management, in general, will require careful planning along with close coordination with the project civil engineer. Less development density will alleviate, but not eliminate, many of these potential problems related to grading and stormwater management.
- As a generality, full basement construction is not recommended (daylight basement with effective gravity drainage is OK) in the Phase 1 area because of the possible unpredictable occurrence of groundwater during the spring snowmelt (usually during late March and early April).
- Earthwork should be completed during the drier season, typically from June through September. Earthwork completed during the wet/cold season, will result in project delays and possibly ground movement (shallow landsliding) with permanent adverse impacts for site development.
- Based on our site observations, soil classification, grain size testing and our local experience, the field infiltration rate within the Phase 1 area soils is very low (less than 1 iph).

2.0 INTRODUCTION

This preliminary report presents the results of Icicle Creek Engineers' (ICE's) geotechnical engineering services regarding a proposed residential development within the Forest Ridge Plat (project site) located on approximately 480 acres within Section 24, Township 20 North, Range 15 East, Willamette Meridian, near Cle Elum in Kittitas County, Washington. The overall area of the Forest Ridge Plat property is shown relative to nearby physical features on the Vicinity Map, Figure 1.

3.0 BACKGROUND INFORMATION

Sean Northrop of Iron Snowshoe, LLC provided ICE with the following information related to the Forest Ridge Plat.

- Aspect Consulting, August 19, 2010, *Forest Ridge Geological Hazard Assessment, Cle Elum, Washington,* prepared for Sapphire Skies, LLC, 61 pages.
- Aspect Consulting, October 2011, Forest Ridge LiDAR hillshade images at various sun angles, five pages.

ICE was recently retained by Iron Snowshoe, LLC to complete a peer review of the 2010 report prepared by Aspect Consulting, including the LiDAR data (2011), and to provide our opinion of the development plan regarding Geologically Hazardous Areas, including the additional geotechnical field investigation plan proposed by Aspect Consulting. Brian Beaman of ICE met with Mr. Northrop on site on May 8, 2018 to complete a preliminary review of site conditions and attended a second meeting on May 14, 2018 at Iron Snowshoe's office with Mr. Northrop and Marc Kirkpatrick of Encompass Engineering & Surveying, the project civil engineer, to discuss the project issues and goals.

During our preliminary site review, we observed surficial soil conditions in uphill cuts for the access road that suggested unstable surficial soil conditions. We were also aware of a large deep-seated landslide (DSLS) complex in the central and east part of the property. Based on our site observations and our review of the August 19, 2010 Aspect Consulting report and LiDAR image, we recommended excluding the area of the large DSLS complex from development regardless of additional evaluation. Other areas of convergent slopes and hillsides where the slopes exceed 33 percent grade may be usable for site development. However, at this time these areas are excluded from the development plan though may be considered depending on the results of the preliminary geotechnical evaluations subject to this report.

This preliminary geotechnical evaluation was limited to the more favorable areas for site development. These areas include the west part of the property where the geologic conditions and topography are potentially favorable for development; the more favorable area, referred to as Phase 1, was targeted for this study. The other area, referred to as Phase 2, was limited to subsurface exploration to better understand area geologic conditions. The Phase 1 and 2 areas are shown on the Site Plan, Figure 2. In this report, the "property" is used to refer to the entire 480-acre Forest Ridge Plat. Phase 1 consists of about 67 acres (including about 56 acres in the North Parcel and 11 acres in the South Parcel).

At the request of Mr. Northrop, ICE completed 53 test pit explorations in the west part of the property to evaluate surficial soil and bedrock conditions. The site observations and subsurface explorations completed by Aspect Consulting LLC were used to supplement the evaluation and findings of this preliminary report.

At this time, the development plan has not been updated for this property. Also, the method of stormwater collection and disposal is not known at this time. We expect that the results of this preliminary report will be used to assist in the planning of lot layout, access and drainage.

4.0 GEOLOGIC AND GEOMORPHIC SETTING

The regional geologic and geomorphic setting was reviewed using the following documents and other on-line resources:

- US Geological Survey (USGS), Tabor, R.W., et al, 1982, *Geologic Map of the Wenatchee Quadrangle*, Miscellaneous Investigations Series Map I-1311.
- Washington State Department of Natural Resources (DNR), May 11, 2014, *Mass Wasting Assessment: Landslide Hazard Inventory Project: West Fork Teanaway Watershed, Kittitas County, Washington*,
- DNR, Geologic Information Portal (https://www.dnr.wa.gov/geologyportal).
- DNR, Washington LiDAR Portal, http://lidarportal.dnr.wa.gov/.

Based on our review of the USGS (1982), the property area is underlain by Roslyn Formation (upper member) bedrock. Based on our site observations and test pit explorations, Kittitas Drift (Alpine Glacial Till) also occurs locally as a surficial soil and is regionally mapped by the USGS (1982) to the east of the property in the foothills of the Teanaway valley. We also observed Loess (a wind-blown silt) that mantles the ground surface in local areas. The interpreted distribution of the geologic units is shown on the Geologic Map, Figure 3.

Kittitas Drift typically consists of an unsorted mixture of clay/silt, sand, gravel, cobbles and boulders (resembling Glacial Till) in a medium dense to dense condition as a result of being overridden by glacial ice. The upper member of the Roslyn Formation typically consists of medium- to fine-grained sandstone, siltstone and occasional layers of coal.

Surficial weathering processes (physical and chemical) have resulted in residual soil and completely weathered bedrock as described in more detail in section **6.3** of this report.

A large, deep-seated landslide (DSLS) complex occurs in the central and east part of the property and has been previously identified by the USGS (Tabor, R.W., et al, 1982, *Geologic Map of the Wenatchee Quadrangle*, Miscellaneous Investigations Series Map I-1311) and the DNR (May 11, 2014, *Mass Wasting Assessment: Landslide Hazard Inventory Project: West Fork Teanaway Watershed, Kittitas County, Washington*; and DNR Geologic Information Portal, Landslide Database (https://www.dnr.wa.gov/geologyportal). Based on our review of the LiDAR Image, Figure 4 and field observations, we concur that the DSLS complex exists; the ICE interpreted location and perimeter of the

DSLS is shown on Figure 3. There are no landslides mapped by the DNR or USGS in the west part to the property (Phase 1 and Phase 2 areas). Based on our review of the LiDAR Image, Figure 4, the extent of the DSLS is clear. The outline of the DSLS is shown on Figure 3.

Regional groundwater is expected to be more than 10-feet deep in the property area. However, during the early spring months, especially following snowmelt or an extended period of heavy rain with frozen ground, seasonally perched groundwater may occur within the weathered soil/bedrock and Loess.
Based on our review of the US Department of Interior, Natural Resources Conservation Service (Soil Survey), the entire property is mapped (the surficial 60 inches) as Teanaway Ashy Loam that consists of loam and gravelly loam; the parent material is typically loess over glacial till or outwash.

5.0 REGULATORY CONSIDERATIONS

5.1 GENERAL

The Phase 1 and Phase 2 areas contain landforms that are considered Potentially Geologically Hazardous Areas (Critical Areas) according to the Kittitas County Code (KCC), Title 17A.02 including Landslide Hazards and Mine Hazards. Slopes that exceed 33 percent grade (referred to as "Steep Slopes" in this report) are also regulated.

5.2 STEEP SLOPES

Kittitas County requires a geotechnical evaluation ("soils report") of proposed house sites in the vicinity of Steep Slopes. The soils report is to include a preliminary evaluation of the "setback from slope." According to Kittitas County Community Development Services (KCCDS), Detail D-002 "Setback from Slopes," Section R403.1.7, *"The placement of buildings and structures on or adjacent to slopes steeper than 1 unit vertical to 3 units horizontal (33.3-percent slope) shall conform to Sections R403.1.7.1 through R403.1.7.4."* For a descending slope condition, the "default" setback from slope is H/3 where H is the height of slope that exceeds 33.3 percent grade. For example, if the Steep Slope is 100 feet in height, then the structure setback from the top of the slope would be a horizontal distance of 33 feet. This default setback can be reduced (or increased if appropriate) with a geotechnical evaluation and approval of the "building official."

5.3 LANDSLIDE HAZARD AREAS

Landslide Hazard Areas are defined by KCC 17A.02.200 as *"geologically hazardous areas subject to severe risk of landslide based on a combination of geologic, topographic, and hydrologic factors, including bedrock, soil, slope gradient, slope aspect, geologic structure, groundwater, or other factors."*

5.4 MINE HAZARDS

Mine Hazards are defined by KCC 17A.02.210 as *"areas directly underlain by, adjacent to, or affected by abandoned mine workings such as adits, tunnels, ducts or air shafts with the potential for creating large underground voids susceptible to collapse. Closed and abandoned mines shall be presumed not hazardous unless specifically identified by the U.S. Department of Mines or other relevant information."* KCC 17A.06.030 indicates that *"Siting of structures on mine hazard areas should be avoided."* KCC does not describe specific development standards or requirements for the geotechnical evaluation of coal mine hazards. Because of the similarity in geology and mining methods between King County and Kittitas County, it is our opinion that using King County Code section 21A.24.205/210 is appropriate for land planning at the Forest Ridge site.

The primary issues regarding public health and safety and/or property damage related to abandoned underground coal mines are defined as follows:

- Severe Coal Mine Hazard Areas – Severe Coal Mine Hazard Areas are *"those areas that pose a significant risk of catastrophic ground surface collapse. Severe coal mine hazard areas may typically include, but are not limited to, areas characterized by unmitigated openings such as entries, portals, adits, mine shafts, air shafts, timber shafts, sinkholes, improperly filled sinkholes, and other areas of past or significant probability for catastrophic ground surface collapse. Severe coal mine hazard areas typically include, but are not limited to, overland surfaces underlain or directly affected by abandoned coal mine workings from a depth of zero to one hundred fifty feet."*
- Moderate Coal Mine Hazard Areas - Moderate Coal Mine Hazard Areas are *"those areas that pose significant risks of property damage which can be mitigated by special engineering or architectural recommendations. Moderate coal mine hazard areas may typically include, but are not limited to, areas underlain or directly affected by abandoned coal mine workings from a depth of zero to three hundred feet or with overburden-cover-to-seam thickness ratios of less than ten to one dependent on the inclination of the seam."*
- Declassified Coal Mine Areas - Declassified Coal Mine Areas are *"those areas for which a risk of catastrophic collapse is not significant and which the hazard assessment report has determined require no special engineering or architectural recommendations to prevent significant risks of property damage. Declassified coal mine areas may typically include, but are not limited to, areas underlain or directly affected by coal mines at depths greater than three hundred feet as measured from the surface but may often include areas underlain or directly affected by coal mines at depths less than three hundred feet."*

Other considerations include the possible presence of mine rock fill and undocumented mining. Mine rock fill includes stockpiles of mining by-products consisting of broken rock and coal. Undocumented mining, typically as shallow prospects, have been encountered in the vicinity of documented underground coal mining.

6.0 SITE CONDITIONS

6.1 GENERAL

Brian Beaman, PE, LEG, LHG of ICE completed a site visit on May 8, 2018 to observe surface conditions in the Phase 1 area as part of ICE's initial geotechnical evaluation. Shane Markus, EIT of ICE completed a site visit on June 6, 2018 to stake test pit locations and to observe the Phase 1 surface conditions. Mr. Markus observed the completion of 32 test pits in the Phase 1 area on June 11 and 12, 2018. Jeff Schwartz, LEG of ICE completed a site visit on June 13, 2018 to stake test pit locations within the Phase 2 area and to observe the surface conditions within the Phase 1 and Phase 2 areas, and the DSLS area. Mr. Markus completed site visits on June 21, 2018 to complete the 21 test pits in the Phase 2 area, then again on July 23, 2018 to observe the steep slopes that border the east and south sides of the north part of Phase 1 (North Parcel as described in section **6.2** of this report).

6.2 SURFACE CONDITIONS

6.2.1 General

The property is undeveloped and generally forested. Based on our review of historical aerial photographs from Google Earth, the property was commercially-thinned of mature trees in the early 1990s. An improved gravel surfaced road accesses the Phase 1 and Phase 2 areas which, based on review of historical aerial photographs (Google Earth), was constructed between 2006 and 2009. We understand that underground power was installed in the shoulder area of the access road. A road cut at the upper switchback failed (slump feature) in the northwest corner of the property as shown on Figure 3 in about 2010, also based on review of historical aerial photographs.

Currently, there are several widely-spaced residential developed properties along the ridgeline north of the property. Scattered residential development is occurring west and south of the property.

The Phase 1 area occupies two separate subareas; for the purpose of this report these separate areas are referred to as the North Parcel and the South Parcel, as shown on Figure 2.

A description of surface conditions of the Phase 2 area is not included in this preliminary report. Our observations of surface conditions within the DSLS area to the east of Phase 1 and Phase 2 are included in section **6.2.4** of this report.

6.2.2 Phase 1 North Parcel

The Phase 1 North Parcel occupies a gently to moderately sloping (level to less than 33 percent grade), relatively planar-surfaced ridgeline extending from the northwest corner of the property at about Elevation 2,980 feet to the southeast at about Elevation 2,620 feet where the ridgeline steepens significantly. A localized "high point" at about Elevation 2,880 feet occurs south of where the access road crosses into the Phase 1 area. South of the access road crossing, the ridgeline is bordered to the east, south and west by steep slopes (more than 33 percent grade), with the steepest slopes (more than 70 percent grade) bordering the east and southeast sides of the ridgeline. An unimproved, generally impassable, single-lane road extends the full length of the ridgeline. Vegetation along the ridgeline includes scattered mature conifer trees with much smaller conifer tree regrowth and light to moderately dense ground cover (brush).

During our field reconnaissance on July 23, 2018, Mr. Markus traversed the east-facing hillside along its crest and along parts of the slope face. The hillside was generally vegetated with conifer trees up to about 3 feet in diameter, and an understory of dense Oregon grape and other deciduous brush. Along the slope face east of Test Pit TP-24, numerous localized shallow soil sloughs exposing bedrock, with "jackstrawed" (leaning) trees up to about 3 feet in diameter, were observed.

A tension crack was observed at the slope crest about 250 feet southeast of Test Pit TP-25 as shown on Figure 3. The tension crack was arcuate-shaped and approximately 150-feet long. The crack was about 6-feet deep and 8-feet wide and contained bedrock exposures on both sides approximately 1- to 2-feet below the ground surface. Fir trees up to about 4 inches in diameter were observed growing from the crack. The area contains numerous jackstrawed trees up to about 2 feet in diameter. A secondary scarp was observed about 50 feet southeast (downhill) of the tension crack. The secondary scarp was about 4-feet high and 90-feet long. Bedrock was exposed in the secondary scarp and appears to be a developing shallow landslide.

We also observed a recent road cut failure (slump) along the uphill side of the access road in the northwest part of the property as shown on Figure 3; this feature was also noted in our aerial photograph review as previously described. Soil conditions in the slump area consisted of clayey silty fine sand.

6.2.3 Phase 1 South Parcel

The Phase 1 South parcel occupies a moderately sloping (less than 33 percent grade) widely divergent area ranging from about Elevation 2,570 feet in the northeast corner to about Elevation 2,430 feet along the south side of this area (property line). As described later in this report, waste coal (Mine Rock Fill) from a historic (abandoned) underground coal mine along with possible "sinkholes" related to an abandoned mine entry and prospect area are located in the southwest part of the Phase 1 South Parcel. Vegetation is similar to the Phase 1 North Parcel, including scattered mature conifers with regrowth of smaller trees. The brush is locally dense in this area. A detention pond that receives ditchwater runoff from the access road is located in the southwest corner of the Phase 1 South Parcel as shown on Figure 2.

6.2.4 Deep-Seated Landslide

We foot-traversed the DSLS area to the east of the Phase 1 and Phase 2 areas as shown on Figure 3. We walked existing forest roads (some abandoned) where possible to complete our foot-traverse. Within the DSLS, the ground surface was observed to be uneven and hummocky, generally sloping down to the south at an average 10 to 15 percent grade. We observed isolated steep slopes (up to about 100 percent grade) in the more hummocky terrain. At the north end of the property, our field review was focused on an area of highly variable blocky terrain that was observed on the LiDAR imagery. We observed a series of irregular rounded hills and swales in this area. The area was vegetated with mature conifers (generally vertical with some sweep to the trunks) and vertical stumps. We did not observe areas of currently active slope movement, however, the hummocky ground within a large area is a clear indicator that ground movement has occurred in the past.

The DSLS, where observed, was generally dry. We observed two areas of surface water including an area at the south-central end of the property where we observed an incised channel about 6-feet deep along the south side of an abandoned road where water was flowing across the road at about 5 gallons per minute. The other area where surface water was observed was a small seep along the north side of a dirt road and some ponded water on the road surface.

We observed fresh dip slope (sedimentary rock bedding inclined coincident with the slope surface) outcrops of Roslyn Formation siltstone and sandstone bedrock in numerous areas within the DSLS. We observed Kittitas Drift (Alpine Glacial Till – described in the following section of this report) in the southeast part of the property.

6.3 PHASE 1 AND PHASE 2 SUBSURFACE CONDITIONS

6.3.1 Subsurface Exploration Program

Subsurface conditions were explored by excavating 53 test pits (Phase 1, Test Pits TP-1 through TP-32; Phase 2, TP-33 through TP-53). Test boring explorations (Boring B-1 through B-4) completed by Aspect Consulting (August 19, 2010) in the east portion of the property, and water wells (ALH 940, AKW 661, ALN 806, APB 228 and APB 226) that were included in the Aspect Engineering report were reviewed to supplement our understanding of subsurface conditions at the property. The test pits completed by ICE, test borings completed by Aspect Consulting and the water well locations are shown on Figure 2. A description of the field exploration program by ICE and the test pit logs are presented in Appendix A. The laboratory testing program and test results completed by ICE for the Phase 1 area are presented in Appendix B. No laboratory testing was completed for the Phase 2 area during the current study.

6.3.2 Soil and Bedrock Conditions

Based on our field reconnaissance and observation of the test pit explorations, and a review of the test borings for a previous study, the near-surface undisturbed soil or bedrock consists of Kittitas Drift (Alpine Glacial Till) or Roslyn Formation Bedrock (siltstone, sandstone and occasional layers of coal) as shown on Figure 3. Based on our review of test pit explorations and laboratory testing, we observed that the surficial (weathered) soils that overlie the Kittitas Drift or Roslyn Formation consist of Loess (wind-blown silt), Completely Weathered Bedrock/Residual Soil, Highly to Moderately Weathered Bedrock and Weathered Alpine Glacial Till). The surficial soils in the Phase 1 area averaged about 7.4-feet thick with a range of thickness of 2.5 to 13 feet in the test pit explorations (Test Pits TP-1 though TP-32). The following is a description of the soil and bedrock types encountered in the test pit explorations.

Sod and Topsoil – All test pits, with the exception of Test Pits TP-41, 48, 49 and 51 encountered a surface layer of about 6- to 12-inches of Sod and Topsoil. The Sod and Topsoil contained fine roots and occasional larger tree roots.

Fill – About 2.5 feet of Fill was encountered beneath the Sod and Topsoil in Test Pit TP-45. The Fill consisted of medium stiff silt with sand and a trace of siltstone and weathered carbonaceous shale fragments.

Loess – Loess generally consisted of loose to medium dense fine to medium sand with silt or silty fine sand, and soft to medium stiff sandy silt or silt. A trace of fine gravel was observed in the Loess in Test Pit TP-17.

Completely Weathered Bedrock/Residual Soil – Completely Weathered Bedrock/Residual Soil consisted of medium dense silty fine sand and silty fine to medium sand or soft to very stiff sandy clay, clay with sand and sandy silt. A trace of gravel was observed in Test Pits TP-9, TP-12, TP-20, TP-38, TP-41 and TP-46. Sandstone fragments were observed in Test Pit TP-15 and coal fragments were observed in Test Pits TP-1, TP-7 and TP-20.

Weathered Alpine Glacial Till – Weathered Alpine Glacial Till consisted of medium dense to dense silty fine sand, clayey fine to medium sand, clayey fine sand and silty fine sand or medium stiff to stiff sandy clay and sandy silt with variable amounts of gravel, cobbles, occasional boulders (6 foot in diameter in Test Pit TP-23) and siltstone/sandstone fragments.

Alpine Glacial Till – Alpine Glacial Till consisted of medium dense to dense (typically dense) clayey fine sand, clayey fine to medium sand and silty fine to medium sand or stiff sandy clay with variable amounts of gravel and cobbles, and occasional boulders.

Highly to Moderately Weathered Bedrock – Highly to Moderately Weathered Bedrock consisted of medium stiff to very stiff silt, sandy silt, sandy clay and clay with siltstone and/or sandstone fragments or medium dense fine to medium sand with silt, silty fine to medium sand, fine sand with silt and silty fine sand with siltstone and/or sandstone fragments.

Roslyn Formation (Upper Member) – The Roslyn Formation (Upper Member) consisted of slightly weathered, moderately weak to strong siltstone and sandstone. A 12-inch-thick layer of slightly weathered, very weak coal was encountered at a depth of about 7.5 feet in Test Pit TP-6; a 6-inch thick layer of similar material (coal) was encountered at a depth of about 8.5 feet in Test Pit TP-8.

6.3.3 Groundwater Conditions

Groundwater seepage was observed below a depth of about 6 feet in Test Pit TP-11 and from a depth of about 7 to 9 feet in Test Pit TP-13. We expect that groundwater conditions can vary seasonally, and with location within the Phase 1 and Phase 2 areas. It is likely that during the spring snowmelt (typically late March to early April), shallow groundwater perched on frozen ground or the Alpine Glacial Till and Roslyn Formation bedrock may be widespread across the property.

6.3.4 Summary of Subsurface Conditions

The following table presents a summary of subsurface soil/bedrock and groundwater conditions observed in the test pits completed for this study.

Test Pit No.	Elevation (feet)	Fill	Sod and Topsoil	Loess	Completely Weathered Bedrock/Residual Soil	Highly to Moderately Weathered Bedrock	Weathered Alpine Glacial Till	Alpine Glacial Till	Slightly Weathered Bedrock	Groundwater (depth in feet)
1	2,948		X			X			X	
2	2,963		X	X		X			X	
3	2,934		X		X	X			X	
4	2,881		X			X			X	
5	2,922		X	X		X			X	
6	2,903		X	X	X				X	
7	2,873		X		X				X	
8	2,892		X	X		X			X	
9	2,882		X		X				X	
10	2,869		X	X	X	X			X	
11	2,870		X	X	X				X	>6
12	2,858		X		X	X		X	X	
13	2,870		X	X					X	7 – 9
14	2,883		X			X			X	
15	2,856		X	X		X		X	X	
16	2,835		X	X			X	X	X	
17	2,840		X	X				X		
18	2,786		X	X			X	X		
19	2,799		X	X				X		
20	2,733		X	X	X				X	
21	2,733		X	X			X	X		
22	2,783		X	X				X		
23	2,721		X				X	X		
24	2,748		X				X	X		
25	2,688		X				X	X		
26	2,690		X				X	X		
27	2,656		X			X	X			
28	2,543		X				X		X	
29	2,520		X			X	X			
30	2,488		X				X		X	
31	2,496		X				X		X	
32	2,461		X				X		X	
33	2,824		X	X		X			X	
34	2,783		X			X	X		X	
35	2,849		X			X			X	
36	2,719		X		X	X				
37	2,762		X			X	X		X	
38	2,645		X		X	X			X	
39	2,707		X		X	X			X	
40	2,619		X		X	X			X	
41	2,664				X	X			X	
42	2,543		X	X		X			X	
43	2,594		X	X		X			X	
44	2,660		X	X		X			X	
45	2,531	X	X			X			X	
46	2,584		X		X				X	
47	2,622		X		X	X			X	
48	2,545				X	X			X	
49	2,583						X		X	
50	2,493		X		X	X				
51	2,501					X	X		X	
52	2,523		X			X	X		X	
53	2,483		X				X		X	

The following is a summary table of the average thickness and thickness range of the combined thickness of Sod and Topsoil, Loess, Completely Weathered Bedrock/Residual Soil and Weathered Alpine Glacial Till.

Sod and Topsoil, Loess, Completely Weathered Bedrock/Residual Soil, Weathered Alpine Glacial Till		
Phase	Average Thickness (feet)	Range of Thickness (feet)
1	7.4	2.5 to 13.0
2	7.3	3.5 to 15.5

6.3.5 Other Observations

Excavatability of the site soils using a John Deere 120 trackhoe was typically easy in the Loess, Completely Weathered Bedrock/Residual Soil and Weathered Alpine Glacial Drift, and increasingly difficult with depth in the Alpine Glacial Drift and Roslyn Formation (bedrock – siltstone and sandstone). Digging refusal in the bedrock was encountered in Test Pits TP-1, TP-2, TP-4, TP-5, TP-9, TP-11, TP-14, TP-20, TP-28, TP-30, TP-33, TP-34, TP-37, TP-39 and TP-42 to TP-49, and TP-51 to TP-53. No caving of the test pit walls was observed with the exception of Test Pit TP-11 which had moderate caving from a depth of about 6 to 7 feet and Test Pit TP-13 that had slight caving from about 7 to 9 feet.

6.4 MINE HAZARDS

6.4.1 Abandoned Underground Coal Mine Description

An abandoned underground coal mine is present in the southwest corner of the property (Phase 1 South Parcel); no other abandoned coal mines are present at the property. Based on historic mine maps on file with the DNR (Geologic Information Portal, https://geologyportal.dnr.wa.gov/#coal), the abandoned underground mine workings are documented by Map KT31A as the *American Canadian Fuel Co's Property in sec 24, T20N, R15E WM*, dated October 1912. The interpreted location (using section line reference) of the American Canadian Fuel Company's (ACF's) abandoned underground mine is shown on the Coal Mine Location Map, Figure 5. A geologic profile, Geologic Cross-Section A-A', Figure 6, shows the approximate depth to the abandoned ACF underground mine.

The abandoned ACF underground mine was developed on the Roslyn Coal Seam. Typically, coal was removed using room-and-pillar mining methods where coal "pillars" were left in place for support of the "rooms" where the coal was removed. Eventually, most, or all, of the coal pillars were removed upon retreat of these production areas to promote collapse of the mined-out areas. The thickness of coal mined was estimated at about 5 feet according to historical records of other mines developed on the Roslyn Coal Seam in Kittitas County.

As shown on Figure 6, the Roslyn Coal Seam that was worked out by ACF is at a depth ranging from less than 20 feet to about 82 feet in the southwest corner of the property. The main entry to the abandoned ACF underground mine is located several hundred feet southwest of the southwest corner of the property. An air-shaft (covered – inaccessible) that connects to the mine workings is located along the shallowest area of the mine as shown on Figure 5. We observed a shallow depression in the ground surface at this approximate location which may be the abandoned air-shaft location. A prospect tunnel (covered – inaccessible) is located east-southeast of the air-shaft near the south property line as shown on Figure 5. We observed a pipe extending out from the ground at this approximate location; this pipe may be evidence of the prospect tunnel location.

6.4.2 Mine Rock Fill

Mine Rock Fill consists of mining by-products such as coal fines, cinders, and broken rock that were extracted from the underground coal mines and typically stockpiled on the ground surface but had no economic value. Mine Rock Fill can emit methane gas when disturbed and is not suitable for foundation support for structures.

Based on our field reconnaissance, Mine Rock Fill occurs at the surface in stockpiles overgrown with brush at the approximate location shown on Figure 5. Other areas of Mine Rock Fill are expected in the southwest corner of the property (Phase 1 South Parcel area), especially near the air shaft entry and the prospect tunnel. Mine Rock Fill was not encountered in our test pit explorations.

6.4.3 Undocumented Mining

The abandoned ACF underground mine is in an area where undocumented mining occurred. However, based on the available information on the abandoned ACF underground mine, it is unlikely that additional coal beds were mined within the property.

6.5 GEOLOGICALLY HAZARDOUS AREAS

Areas within the property evaluated by ICE as being Steep Slopes, Landslide Hazard Areas and Mine Hazard Areas are shown on the Geologically Hazardous Areas Map, Figure 7. The area evaluated for Geologically Hazardous Areas includes Phase 1, Phase 2 and the DSLS area to the east as shown on Figure 7.

6.6 PHASE 1 PRELIMINARY INFILTRATION ANALYSIS

We completed a preliminary evaluation of Infiltration rates for the Phase 1 area in general accordance with the August 2012 Stormwater Management Manual for Western Washington (SMMWW), Volume III, *Hydrologic Analysis and Flow Control BMPs*, section 3.3.6. Considering the climate and soil types for this area, it is our opinion that the August 2012 SMMWW is more appropriate (compared to the 2004 Stormwater Management Manual for Eastern Washington) for infiltration feasibility screening.

As previously mentioned, the method of stormwater collection and disposal is not known at this time. Our preliminary evaluation should be used as a screening tool while evaluating stormwater collection and disposal methods. When stormwater Best Management Practices (BMPs) and/or facilities are known, additional field testing may be needed or required.

Grain size analyses were completed on selected soil samples obtained from the test pits; the particle size distribution reports are presented in Appendix B.

The following is a summary of our infiltration analysis (field/short-term and design/long-term rates):

Test Pit Number / Sample Number	Sample Depth (feet)	Geologic Unit[1]	Soil Type	Soil Infiltration Rate (short-term/long-term[2][3]) (inches per hour - iph)
TP-1 / S-1	4	HMWB	CLAY with sandstone and siltstone fragments	0.4 / 0.1
TP-7 / S-1	4	CWB/RS	Sandy CLAY with a trace of coal fragments	1.5 / 0.3
TP-16 / S-1	3	WAGT	Clayey fine to medium SAND with occasional gravel and cobbles	0.9 / 0.2
TP-19 / S-1	6	AGT	Clayey fine SAND with occasional gravel	2.1 / 0.4
TP-20 / S-1	4.5	CWB/RS	Silty fine to medium SAND with a trace of gravel and coal fragments	4.4 / 0.9
TP-22 / S-1	4.5	AGT	Clayey fine to medium SAND with occasional gravel	2.3 / 0.5
TP-23 / S-1	4.5	WAGT	Sandy CLAY with cobbles and boulders	1.4 / 0.3
TP-27 / S-1	3	WAGT	Sandy SILT with sandstone fragments	0.8 / 0.2
TP-29 / S-1	4	WAGT	Sandy CLAY	0.8 / 0.2
TP-32 / S-1	4	WAGT	Sandy CLAY with a trace of gravel	2.5 / 0.5

(1) HMWB = Highly to Moderately Weathered Bedrock; CWB/RS = Completely Weathered Bedrock/Residual Soil; WAGT = Weathered Alpine Glacial Till; AGT = Alpine Glacial Till

(2) The long-term (design) infiltration rate (includes a correction factor of 0.2 to account for test method, maintenance and biofouling)

(3) The long-term infiltration rate should be used for design (sizing) of infiltration facilities

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 GENERAL

The Phase 1 area, where undisturbed (no previous grading), appears to be stable in its present condition. Based on our observations, the road cuts and ditch lines for the existing access road have experienced more than expected localized shallow slope failures and adverse erosion, likely because of the more than usual sensitivity (to grading and moisture) of the surficial soils.

Grading and stormwater management, in general, will require careful planning. All earthwork should be completed during the drier season, typically from June through September. Earthwork completed during the wet/cold season, will result in project delays and possibly ground movement (shallow landsliding) that be permanent adverse impacts for site development.

Based on our field reconnaissance, test pit explorations and analyses, we observed that the surficial soil conditions consist of surficial soil types (Loess, Completely Weathered Bedrock/Residual Soil, Highly to Moderately Weathered Bedrock and Weathered Alpine Glacial Till) are highly sensitive to grading (cutting and use as structural fill) and moisture content. As previously described, in the Phase 1 area, these soils averaged about 7.4-feet thick with a range of thickness of 2.5 to 13 feet in the test pit explorations (Test Pits TP-1 though TP-32). It is likely that the grading plan for general site development will encounter these sensitive soils more often than the deeper, more stable soils (Alpine Glacial Till and the slightly weathered Roslyn Formation bedrock (siltstone and sandstone).

The Phase 1 area contains Geologically Hazardous Areas including Steep Slopes, Landslide Hazards and Mine Hazards. Landslide and Mine Hazards will be avoided and left as open space. Some of the Phase 1 area is

bordered by Steep Slopes that will require a structure setback from the top of the Steep Slope. The purpose of the structure setback is to provide a buffer should a slope failure occur that will protect the structure from damage and to also allow for equipment access for slope repair, if necessary.

Residential structures may be supported on conventional reinforced concrete spread footings extending to the stiff/medium dense or denser soils or on a pad of Structural Fill that extends to these competent soils.

The surficial (less than 10-feet deep) soil conditions encountered during our field exploration program, with the exception of the Sod and Topsoil and other soil that is soft/medium stiff/loose or contains abundant roots, if encountered, should generally provide adequate subgrade support for pavements and support for properly bedded underground utilities.

The site soils and bedrock are highly moisture sensitive. It will be preferable to construct the project during the normally drier months such as late spring through early fall to reduce earthwork-related costs. We expect that the excavated surficial soils in the Phase 1 area (average thickness of 7.4 feet and range from 2.5- to 13-feet thick) will be difficult, if not impossible to reuse as Structural Fill.

We do not expect that excavation dewatering will be necessary. If localized seasonal groundwater is encountered, we expect it can be handled by pumping from a sump within the trench.

Based on our site observations, soil classification, grain size testing and our local experience, the field infiltration rate within the soils is very low across Phase 1 area (less than 1 iph).

It is important to implement appropriate temporary and permanent erosion controls for the site. Conventional temporary erosion controls should be adequate provided they are properly installed and maintained. Control of dust will be a concern during site grading if completed during extended periods of dry weather. Permanent erosion protection should be accomplished promptly after completion of construction and maintained as necessary until the construction area is stabilized.

As a generality, full basement construction is not recommended (daylight basement with effective gravity drainage is acceptable) in the Phase 1 area because of the possible unpredictable occurrence of groundwater during the spring snowmelt (usually during late March and early April).

7.2 MINE HAZARDS

7.2.1 Severe Coal Mine Hazard Areas

Severe Coal Mine Hazard Areas are underlain by abandoned underground coal mines at a depth of less than 150 feet. As previously described in section **6.4**, the abandoned ACF underground mine is located at a depth of less than 20 feet to 80 feet beneath the Phase 1 South Parcel as shown on Figure 6. For this reason, this area should be considered a Severe Coal Mine Hazard Area (no development – passive, open space use only). At this time, a 100-foot buffer has been added to the "updip" or northeast side of the projected underground mine workings to compensate for possible mapping inaccuracy.

7.2.2 Moderate Coal Mine Hazard Areas

All areas mapped as a Severe Coal Mine Hazard Area are also included as a Moderate Coal Mine Hazard Area. This is an area where regional ground subsidence may occur. Regional ground subsidence occurs when the ground surface subsides over a large area. Surface deflection is caused by plastic deformation of the strata overlying the mine as the roof sags into the mine. The affected area is expected to be much

larger than the vertical projection of the underground mine workings. The effects of regional ground subsidence include vertical ground subsidence, ground strain and tilt.

7.2.3 Declassified Coal Mine Areas

At this time, no Declassified Coal Mine Areas have been identified at the Phase 1 South Parcel. Subsurface exploration, referred to as "ground proofing", can be completed to evaluate the collapse status of the abandoned ACF underground mine. If the mine can be shown to be substantially collapsed then it may be possible to "declassify" the hazard, or reduce the buffer width.

7.3 FOREST RIDGE PLAT SLOPE STABILITY

Our preliminary review of the property using the USGS (1982) geologic map and landslide inventories by the DNR (May 11, 2014 and the Geologic Information Portal), no landslides have been regionally mapped within the Phase 1 or Phase 2 areas. The large DSLS complex in the central and eastern part of the Forest Ridge Plat has been identified by the USGS (1982) and DNR (May 11, 2014 and Geologic Information Portal). We reviewed the LiDAR image from the DNR (Washington LiDAR Portal) and concur that the DSLS exists, along the ICE revising the perimeter of the DSLS as shown on Figure 3 to more accurately show the location of the DSLS.

During our field review we did not observe surface evidence of recent ground movement within the DSLS. The ground surface is hummocky and displays evidence of past, likely prehistoric movement. Based on these observations, it is our opinion that the DSLS complex is "inactive" (dormant). However, it has been our experience that inactive landslides can be reactivated by site development. The "reactivation" usually does not affect the entire DSLS area, but much smaller local areas within the DSLS complex. Deep-seated ground movement or slumping on a local scale can be destructive to surface improvements, and typically results in condemnation of these structures.

In our opinion, there is a high risk for reactivation on a local scale of the DSLS should development occur in that area. However, at grade (minimal grading), gravel-surfaced access roads can be constructed on a case-by-case basis with geotechnical review.

Shallow landsliding has been observed in the tension crack area near the south end of the Phase 1 North Parcel area. It appears this landslide occurred recently (within the past 20 years) as a "wedge" or "block" in bedrock. In our opinion this localized shallow slope failure with unique conditions should not be considered a persistent problem across the property. However, the other shallow landslide (the road cut slump) that occurred along the uphill side of the access road in the northwest corner of the property has geologic conditions that are common across the Phase 1 and Phase 2 areas. Unsupported open cut slopes will be a persistent problem and need to be carefully considered/evaluated for future grading plans.

Based on our review of the test pit logs for Phase 1 and Phase 2, we did not observe landslide debris in the near-surface soils. However, the, Completely Weathered Bedrock/Residual Soil, Highly to Moderately Weathered Bedrock and Weathered Alpine Glacial Till) are highly sensitive to grading (cutting and use as Structural Fill) and moisture content. As previously described, in the Phase 1 area, these soils averaged about 7.4 feet thick with a range of thickness of 2.5 to 13 feet in the test pit explorations (Test Pits TP-1 though TP-32). It is likely that the grading plan for general site development will encounter these sensitive soils more often than the deeper, more stable soils (Alpine Glacial Till and the slightly weathered Roslyn Formation bedrock (siltstone and sandstone).

For project planning we recommend that permanent open cuts should be avoided. Grading that results in cuts, such as for daylight basement construction, should be resupported with a structural (basement) wall with adequate drainage (footing and wall drain) installed.

7.4 PHASE 1 STEEP SLOPE STRUCTURE SETBACK

Steep Slopes occur along the perimeter of the Phase 1 North Parcel and South Parcel. As previously described, Kittitas County regulates development adjacent to Steep Slopes by a "default setback" as described by KCCDS, Detail D-002 "Setback from Slopes," Section R403.1.7. This default setback can be reduced (or increased if appropriate) with a geotechnical evaluation and approval of the "building official."

At this time, the layout of roads and lots is not known. The "density" of this plan will affect our recommendation for structure setback. It is also likely that the orientation of the slope will also result in different structure setback recommendations.

For the purpose of project planning, we recommend a structure setback of 35 feet from the top of steep slope along the east and south sides of Phase 1 North Parcel and a structure setback of 30 feet from the top of steep slope along the west side of Phase 1 North Parcel. A Steep Slope area occurs along the east side of Phase 1 South Parcel. For project planning, we recommend a structure setback of 30 feet from the top of the Steep Slope.

As the development plan progresses, we expect to provide updated recommendations based on the layout of the development and the stormwater management plan.

7.5 PHASE 1 STORMWATER DISPOSAL

7.5.1 Stormwater Infiltration

The following is a summary of infiltration rates (short-term/field and long-term/design) from section **6.6** of this report based on the results of our grain size analysis of samples obtained from the test pit explorations.

Test Pit Number	Soil Infiltration Rate (short-term / long-term) (inches per hour – iph[1])
TP-1	0.4 / 0.1
TP-7	1.5 / 0.3
TP-16	0.9 / 0.2
TP-19	2.1 / 0.4
TP-20	4.4 / 0.9
TP-22	2.3 / 0.5
TP-23	1.4 / 0.3
TP-27	0.8 / 0.2
TP-29	0.8 / 0.2
TP-32	2.5 / 0.5

(1) The long-term (design) infiltration rate includes a correction factor of 0.2 to account for test method, maintenance and biofouling. The long-term infiltration rate should be used for design (sizing) infiltration facilities.

We expect that additional field infiltration testing will be required when the location of stormwater BMPs and facilities are known. The infiltration rates provided in this table are informational for project planning.

It is possible that these infiltration rates could be increased (or decreased) depending on the results of field testing by large-scale field infiltration testing.

7.5.2 Stormwater Dispersion

In our opinion, stormwater discharge can be accomplished using "engineered dispersion" or "natural dispersion" in general accordance with methods developed by WSDOT (April 2014, *Highway Runoff Manual, M31-16.04, Stormwater Best Management Practices*, Chapter 5-4.2.2, FC-01 and FC-02).

8.0 USE OF THIS REPORT

We have prepared this preliminary report for use by Iron Snowshoe, LLC. The data and report should be provided to prospective contractors for their bidding or estimating purposes, but our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

At this time, no development plan is available for the Forest Ridge Plat. As this plan develops, ICE should be requested to provide geotechnical design recommendations, that may require additional subsurface exploration, as appropriate.

There are possible variations in subsurface conditions between the explorations and also with time. A contingency for unexpected conditions should be included in the budget and schedule. Sufficient observation, testing and consultation by our firm should be provided during construction to evaluate that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions encountered during the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications.

There are always risks related to slope stability issues in mountainous areas. These areas are naturally active geologically with respect to mass wasting, erosional and sedimentation processes exacerbated by other factors such as earthquakes, extreme precipitation events and climate change. This risk related to slope stability issues can be reduced using currently accepted standards of geological and geotechnical practices, but the risk cannot be eliminated.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time the report was prepared. No warranties or other conditions, express or implied, should be understood.

****

We trust this report meets your present needs. Please call if you have any questions.

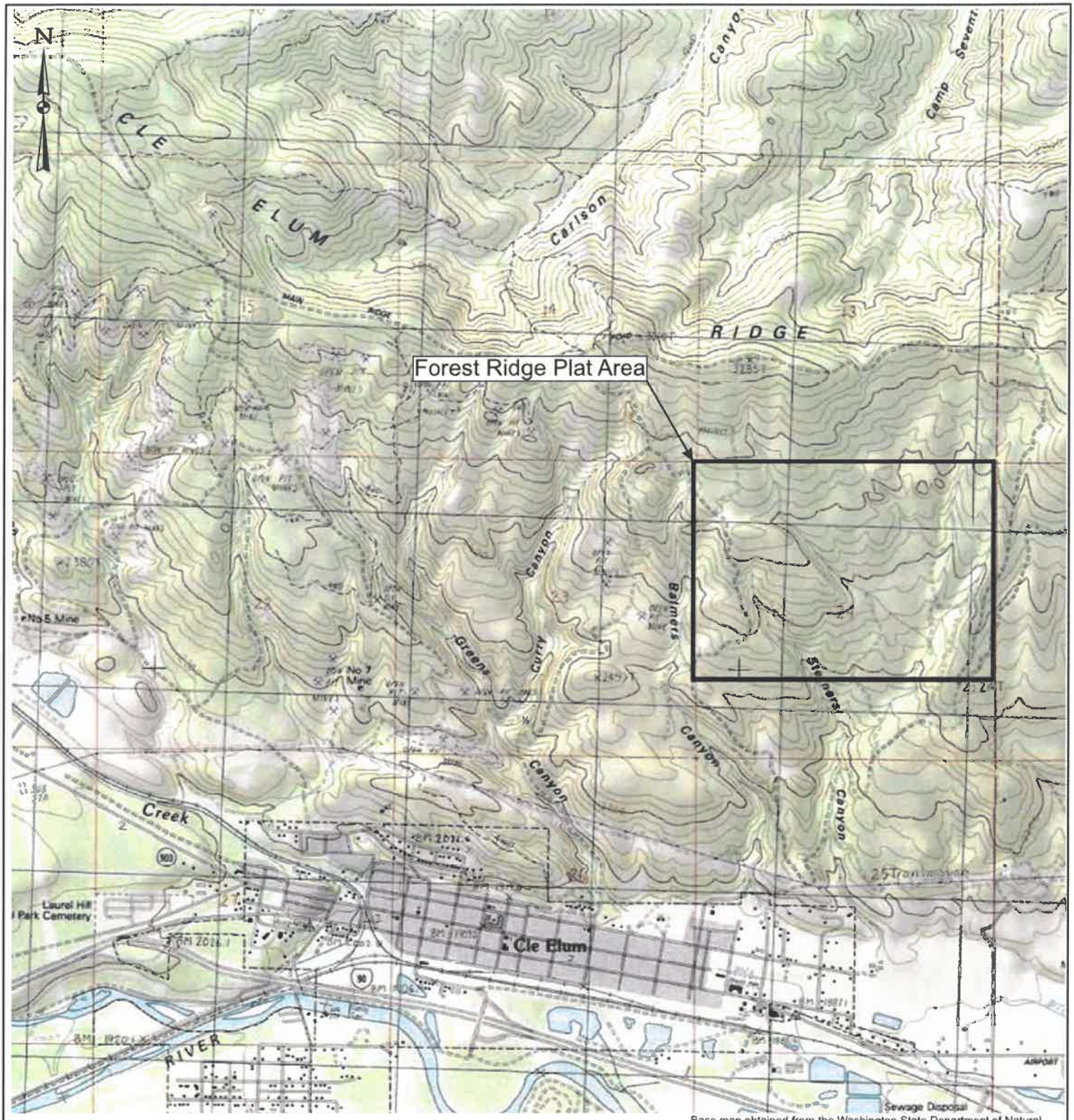
Yours very truly,
Icicle Creek Engineers, Inc.

Kathy S. Killman, LEG
Principal Engineering Geologist

Brian R. Beaman, PE, LEG, LHG
Principal Engineer/Geologist/Hydrogeologist

Document ID: 1283001.PRELIMREP

FIGURES



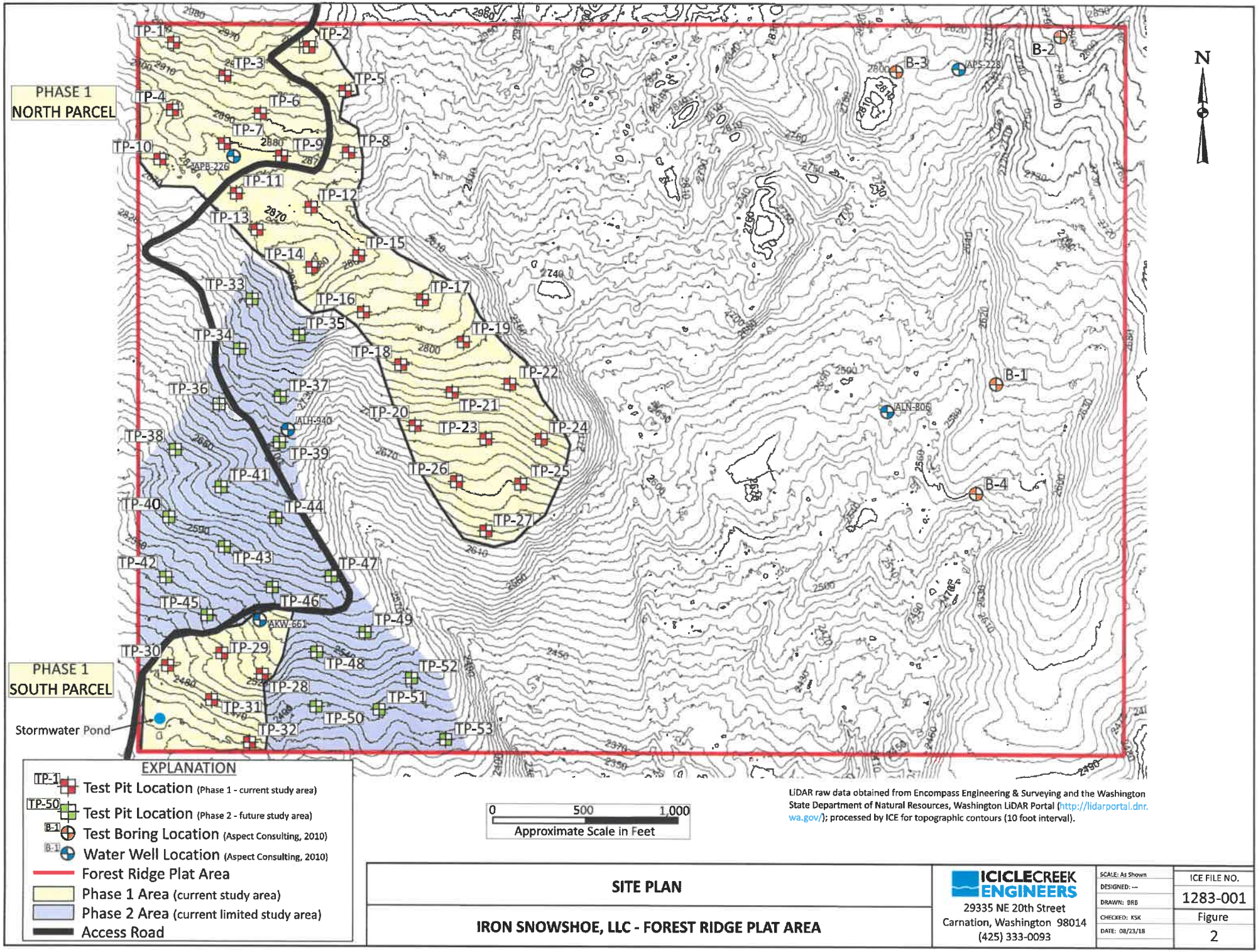
Base map obtained from the Washington State Department of Natural Resources, Geologic Information Portal (https://geologyportal.dnr.wa.gov/)

VICINITY MAP

IRON SNOWSHOE, LLC - FOREST RIDGE PLAT AREA

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: As Shown	ICE FILE NO.
DESIGNED: ---	1283-001
DRAWN: BRB	Figure
CHECKED: KSK	1
DATE: 08/23/18	



LIDAR raw data obtained from Encompass Engineering & Surveying and the Washington State Department of Natural Resources, Washington LiDAR Portal (http://lidarportal.dnr.wa.gov/); processed by ICE for topographic contours (10 foot interval).

SITE PLAN

IRON SNOWSHOE, LLC - FOREST RIDGE PLAT AREA

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: As Shown	ICE FILE NO.
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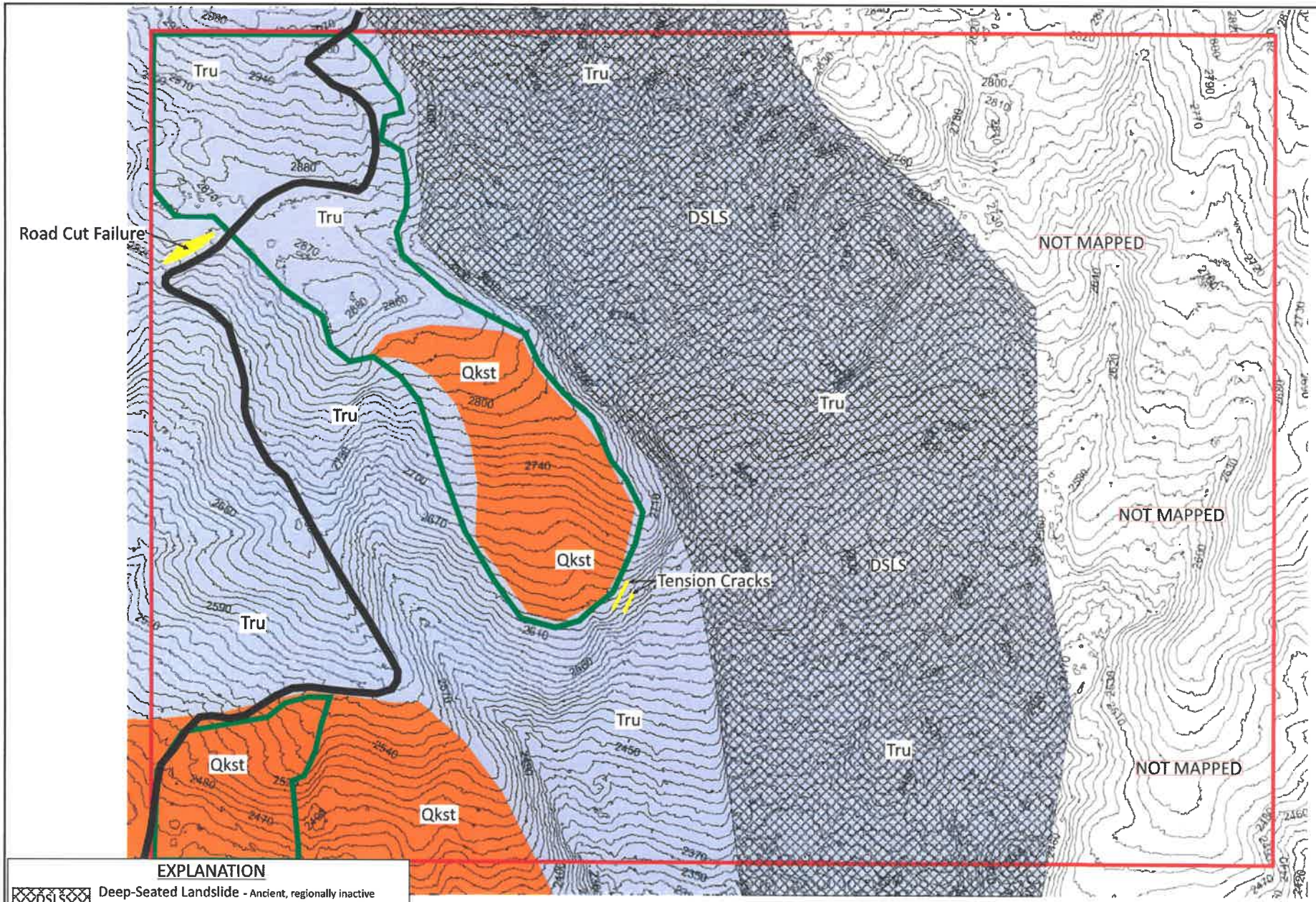
DRAWN: BRB	Figure
CHECKED: KSK	2
DATE: 08/23/18	



EXPLANATION

- DSLS — Deep-Seated Landslide - Ancient, regionally inactive deep-seated landslide.
- Qkst — Kittitas Drift - Alpine Glacial Till - Medium dense to dense unsorted mixture of clay, silt, sand, gravel, cobbles and boulders
- Tru — Roslyn Formation (upper member) - Medium- to fine-grained sandstone, siltstone and occasional layers of coal.
- Forest Ridge Plat Area
- Phase 1 Area (current study area)
- Access Road

Note: Loess (wind-blown sandy silt) occurs locally at the surface (0.5- to 5-feet thick)

0 500 1,000
Approximate Scale in Feet

Notes: 1) Base map obtained from LiDAR based topography (DNR Washington LiDAR Portal (http://lidarportal.dnr.wa.gov); processed by ICE for 10 contour interval.
2) Geologic Map Reference: US Geological Survey, Tabor, R.W., et al, 1982, *Geologic Map of the Wenatchee Quadrangle*, Miscellaneous Investigations Series Map I-1311.
3) See report text for details.

GEOLOGIC MAP

IRON SNOWSHOE, LLC - FOREST RIDGE PLAT AREA

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: As Shown
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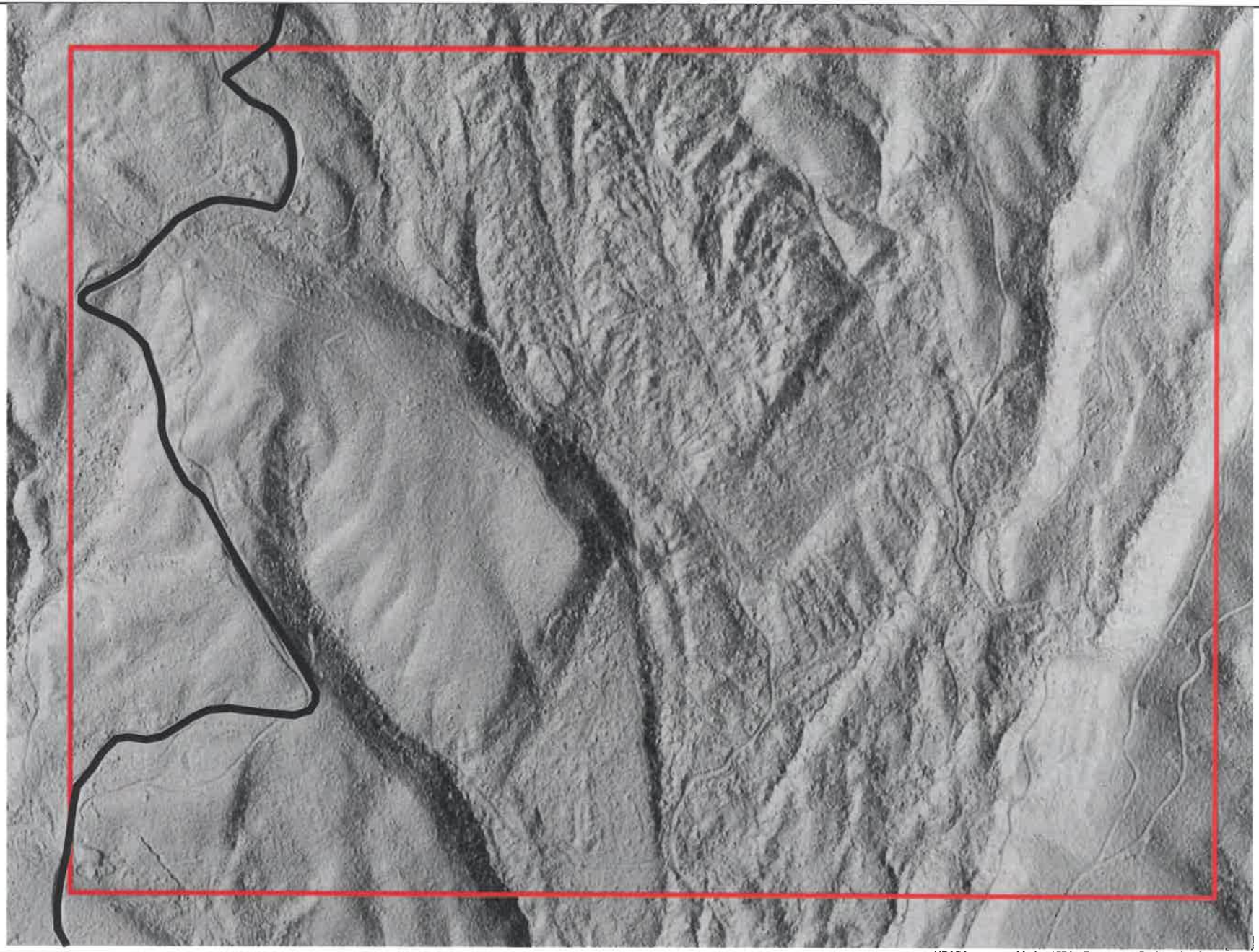
DRAWN: BRB
CHECKED: KSK
DATE: 08/23/18

ICE FILE NO. 1283-001
Figure 3



LiDAR image provided to ICE by Encompass Engineering & Surveying

EXPLANATION

Forest Ridge Plat Area

Access Road

0 500 1,000

Approximate Scale in Feet

LIDAR IMAGE

IRON SNOWSHOE, LLC - FOREST RIDGE PLAT AREA

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29335 NE 20th Street
Carnation, Washington 98014
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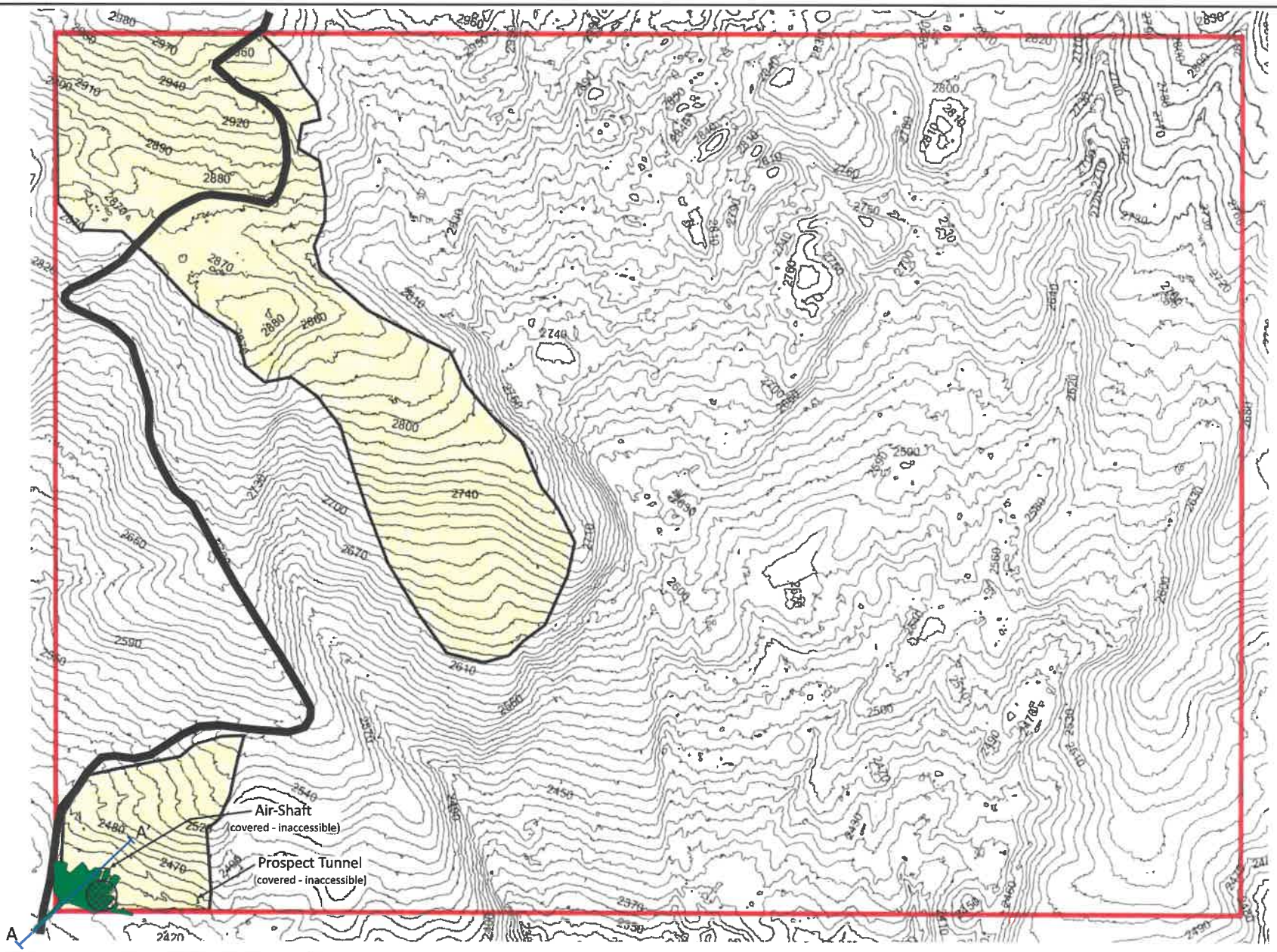

EXPLANATION

- American Canadian Fuel Company Mine
- Mine Rock Fill (approximate location)
- A — A' Geologic Cross-Section A-A' (see Figure 6)
- Phase 1 Area (current study area)
- Forest Ridge Plat Area
- Access Road

0 500 1,000
Approximate Scale in Feet

Notes: 1) Base map obtained from LiDAR based topography (DNR Washington LiDAR Portal (http://lidarportal.dnr.wa.gov); processed by ICE for 10-foot contour interval.
2) Coal Mine Map Reference: Washington State Department of Natural Resources Coal Mine Map Collection (https://geologyportal.dnr.wa.gov/#coal), Map Kt-31.
3) See report text for details.

COAL MINE LOCATION MAP

IRON SNOWSHOE, LLC - FOREST RIDGE PLAT AREA

ICICLE CREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: As Shown
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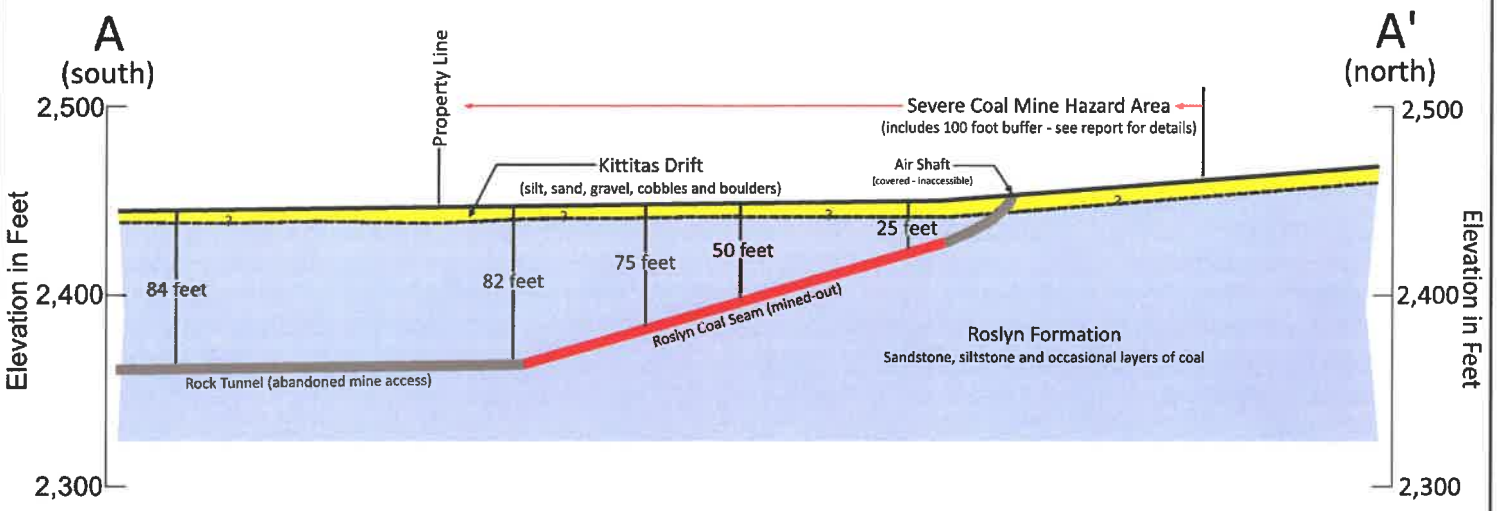
CHECKED: KSK
DATE: 08/23/18

ICE FILE NO. 1283-001

Figure 5



0 100 200

Approximate Scale in Feet

Horizontal Scale = Vertical Scale

Notes: 1) Geologic section location shown on the Coal Mine Location Map, Figure 5.
2) See report text for description coal mine conditions.
3) Subsurface soil and groundwater conditions shown on the geologic cross-section are based on available information and may vary from that shown.

GEOLOGIC CROSS-SECTION A-A'

IRON SNOWSHOE, LLC - FOREST RIDGE PLAT AREA

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

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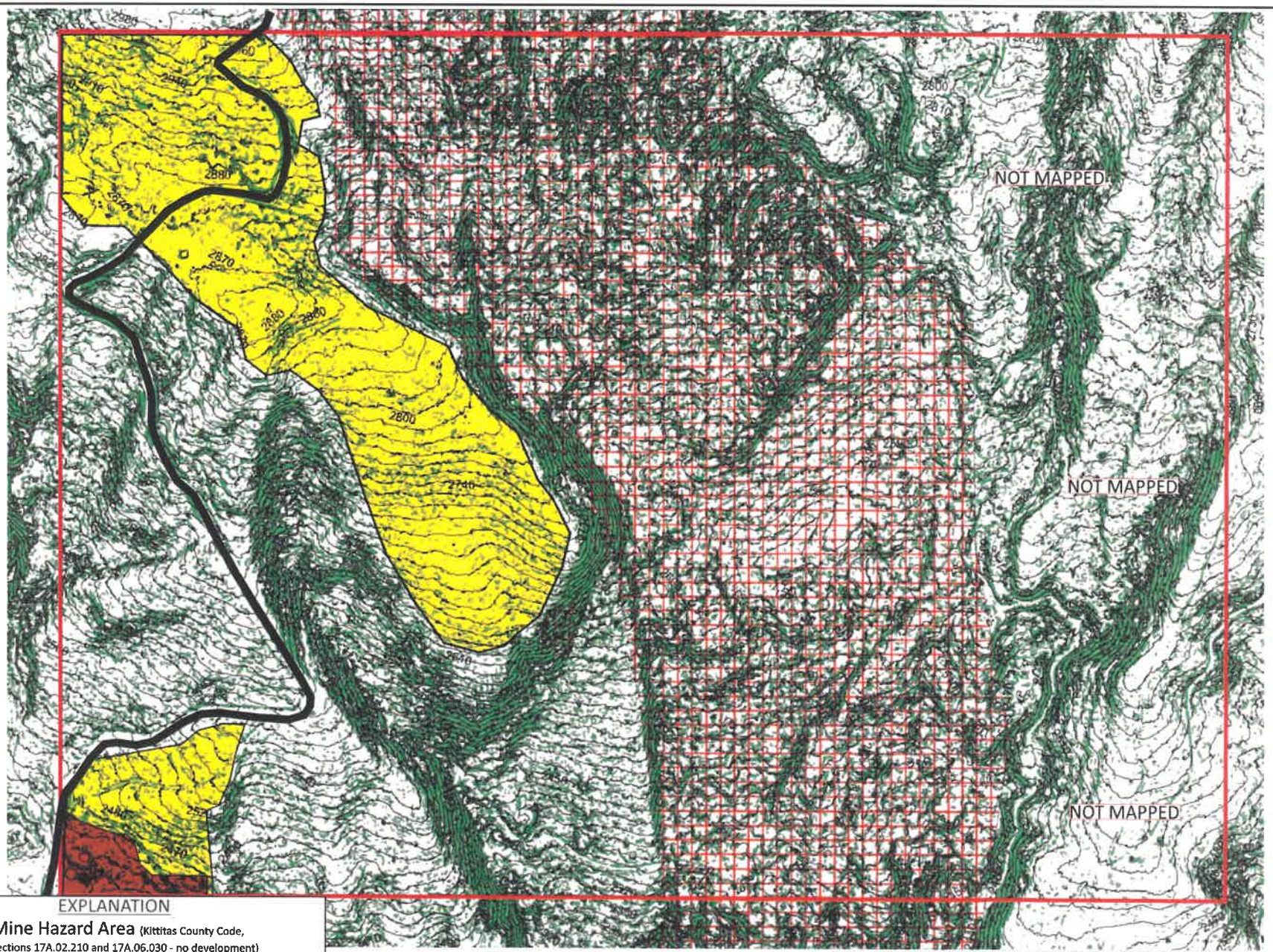

EXPLANATION

- Mine Hazard Area (Kittitas County Code, sections 17A.02.210 and 17A.06.030 - no development)
- Steep Slopes (Kittitas County, undated, Setback from Slopes, Detail D-002; slope > 33 percent grade)
- Landslide Hazard Area (Kittitas County Code, section 17A.02.200 - no development)
- Forest Ridge Plat Area
- Phase 1 Area (current study area)
- Access Road

0 500 1,000
Approximate Scale in Feet

LiDAR raw data obtained from Encompass Engineering & Surveying and the Washington State Department of Natural Resources, Washington LiDAR Portal (http://lidarportal.dnr.wa.gov/); processed by ICE for topographic contours and 33-percent slope.

GEOLOGICALLY HAZARDOUS AREAS MAP

IRON SNOWSHOE, LLC - FOREST RIDGE PLAT AREA

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: As Shown
DESIGNED: ---
DRAWN: BRB
CHECKED: KSK
DATE: 08/23/18

ICE FILE NO.
1283-001
Figure
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APPENDIX A

SUBSURFACE EXPLORATION PROGRAM

APPENDIX A
SUBSURFACE EXPLORATION PROGRAM

Subsurface conditions at the Phase 1 North Parcel and Phase 1 South Parcel were explored by excavating 32 test pits (Test Pits TP-1 through TP-32) to depths of about 5.0 to 11.5 feet on June 11 and 12, 2018 using a John Deere 120 trackhoe owned and operated by McCormick Excavating of Cle Elum, Washington. An additional 21 test pits (Test Pits TP-33 through 53) were completed in the Phase 2 area on June 23, 2018 using the same excavation equipment and operator. Locations of the test pits were obtained in the field by measuring distances from existing site features and using a geo-referenced exploration plan. The approximate locations of the test pits are shown on the Site Plan, Figure 2.

The test pit explorations were continuously observed by an engineer from ICE who visually classified the soils, obtained representative soil samples, observed groundwater conditions and prepared a detailed log of each exploration. The test pit logs are based on our interpretation of the field and laboratory data and indicate the various types of soil encountered. The densities noted on the test pit logs are based on the difficulty of digging, probing with a ½-inch-diameter steel rod, and our experience and judgment. The logs also indicate the depths at which the soil characteristics change, although the change might be gradual. Soils encountered were classified in general accordance with the classification system described in Figure A-1. The test pit logs completed for this study are presented in Figures A-2 through A-16.

Approximate ground surface elevations shown on the test pit logs are based on LiDAR-based data obtained from the Washington State Department of Natural Resources, Washington, LiDAR Portal and processed by ICE for 2 and 5-foot contour intervals using ArcGIS 10.6.

The weather at the time of test pit exploration (June 11, 12 and 23, 2018) was clear and warm (60s - 70s).

The test pits were backfilled upon completion by placing the excavated soil into the test pit in approximate 1½-foot-thick loose lifts; each lift was compacted by tamping with the trackhoe bucket.

Unified Soil Classification System (USCS)

MAJOR DIVISIONS			Soil Group Symbol and Name	
Coarse-Grained Soils	GRAVEL More than 50% of coarse fraction retained on the No. 4 sieve	CLEAN GRAVEL	GW	Well-graded gravels
			GP	Poorly-graded gravels
		GRAVEL WITH FINES	GM	Gravel and silt mixtures
			GC	Gravel and clay mixtures
	SAND More than 50% of coarse fraction passes the No. 4 sieve	CLEAN SAND	SW	Well-graded sand
			SP	Poorly-graded sand
More than 50% retained on the No. 200 sieve		SAND WITH FINES	SM	Sand and silt mixtures
			SC	Sand and clay mixtures
Fine-Grained Soils	SILT AND CLAY Liquid Limit less than 50	INORGANIC	ML	Low-plasticity silts
			CL	Low-plasticity clays
		ORGANIC	OL	Low plasicity organic silts and organic clays
More than 50% passing the No. 200 sieve	SILT AND CLAY Liquid Limit greater than 50	INORGANIC	MH	High-plasticity silts
			CH	High-plasticity clays
		ORGANIC	OH	High-plasticity organic silts and organic clays
Highly Organic Soils	Primarily organic matter with organic odor		PT	Peat

Notes: 1) Soil classification based on visual classification of soil in general accordance with ASTM D2488.
2) Soil classification using laboratory tests is based on ASTM D2487.
3) Description of soil density or consistency is based on interpretation of blow count data and/or test data.

Soil Moisture Modifiers

Soil Moisture	Description
Dry	Absence of moisture
Moist	Damp, but no visible water
Wet	Visible water

Soil Particle Size Definitions

Component	Size Range
Boulders	Greater than 12 inch
Cobbles	3 inch to 12 inch
Gravel	3 inch to No. 4 (4.78 mm)
Coarse	3 inch to 3/4 inch
Fine	3/4 inch to No. 4 (4.78 mm)
Sand	No. 4 (4.78 mm) to No. 200 (0.074 mm)
Coarse	No. 4 (4.78 mm) to No. 10 (2.0 mm)
Medium	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Less than No. 200 (0.074 mm)

SOIL CLASSIFICATION SYSTEM

IRON SNOWSHOE, LLC - FOREST RIDGE PLAT AREA

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: No Scale	ICE FILE NO.
DESIGNED: --	1283-001
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DATE: 08/23/18	

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-1	Approximate Ground Surface Elevation: 2,948 feet	Latitude 47.2181, Longitude -120.9201
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	ML	Light brown sandy SILT (medium stiff, dry) (Loess)
2.0 - 6.5	CL/Rock	Yellowish-brown CLAY with sandstone and siltstone fragments (medium stiff, moist) (Highly to Moderately Weathered Bedrock)
		grades to grayish-brown with thin layers of weathered coal at about 3.5 feet
6.5 - 7.5	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 7.5 feet on 06/12/18 because of digging refusal
		Very difficult excavation below about 7.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 4.0 and 7.0 feet
Test Pit TP-2	Approximate Ground Surface Elevation: 2,963 feet	Latitude 47.2180, Longitude -120.9173
0.0 - 1.0		Sod and Topsoil
1.0 - 1.5	SM	Light brown silty fine SAND (medium dense, dry to moist) (Loess)
1.5 - 3.5	SP-SM/Rock	Light yellowish-brown fine SAND with silt and sandstone fragments (medium dense, moist) (Highly to Moderately Weathered Bedrock)
3.5 - 5.5	Rock	Light yellowish-brown SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 5.5 feet on 06/12/18 because of digging refusal
		Very difficult excavation below about 5.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil sample obtained at about 3.0 feet
Test Pit TP-3	Approximate Ground Surface Elevation: 2,934 feet	Latitude 47.2177, Longitude -120.9191
0.0 - 0.5		Sod and Topsoil
0.5 - 2.5	SM	Light brown silty fine SAND with occasional coal fragments (medium dense, moist) (Completely Weathered Bedrock/Residual Soil)
2.5 - 8.0	SM/Rock	Light brown silty fine SAND with sandstone fragments and occasional coal fragments (medium dense, moist) (Highly to Moderately Weathered Bedrock)
8.0 - 9.5	CL/Rock	Black COAL interbedded with grayish-brown sandy CLAY with siltstone fragments (medium stiff to stiff, moist) (Highly to Moderately Weathered Bedrock)
9.5 - 10.0	Rock	Gray SILTSTONE (slightly weathered, moderately weak bedrock) (Roslyn Formation)
		Test pit completed at about 10.0 feet on 06/12/18
		Moderately difficult excavation below about 9.5 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 1.0, 6.0 and 9.0 feet
Test Pit TP-4	Approximate Ground Surface Elevation: 2,881 feet	Latitude 47.2171, Longitude -120.9203
0.0 - 1.0		Sod and Topsoil
1.0 - 3.0	SM/Rock	Light yellowish-brown silty fine SAND with sandstone and siltstone fragments (medium dense to dense, moist) (Highly to Moderately Weathered Bedrock)
3.0 - 5.0	Rock	Light yellowish-brown SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 5.0 feet on 06/12/18 because of digging refusal
		Very difficult excavation below about 4.5 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil sample obtained at about 3.0 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-5	Approximate Ground Surface Elevation: 2,922 feet	Latitude 47.2174, Longitude -120.9165
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	ML	Light brown sandy SILT (stiff, dry to moist) (Loess)
2.0 - 3.0	ML/Rock	Light yellowish-brown sandy SILT with sandstone and siltstone fragments (stiff to very stiff, moist) (Highly to Moderately Weathered Bedrock)
3.0 - 4.0	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 4.0 feet on 06/12/18 because of digging refusal
		Very difficult excavation below about 4.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 2.5 and 3.5 feet
Test Pit TP-6	Approximate Ground Surface Elevation: 2,903 feet	Latitude 47.2171, Longitude -120.9180
0.0 - 0.5		Sod and Topsoil
0.5 - 2.5	SM	Brown silty fine SAND (medium dense, dry to moist) (Loess)
2.5 - 6.0	CL	Light reddish-brown sandy CLAY (medium stiff to stiff, moist) (Completely Weathered Bedrock/Residual Soil)
6.0 - 7.5	Rock	Gray SILTSTONE (slightly weathered, moderately weak bedrock) (Roslyn Formation)
7.5 - 8.5	Rock	Black CARBONACEOUS SHALE and COAL (slightly weathered, very weak bedrock) (Roslyn Formation)
8.5 - 10.0	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 10.0 feet on 06/12/18
		Very difficult excavation below about 10.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 4.0 and 7.5 feet
Test Pit TP-7	Approximate Ground Surface Elevation: 2,873 feet	Latitude 47.2167, Longitude -120.9191
0.0 - 0.5		Sod and Topsoil
0.5 - 9.0	CL	Light reddish-brown sandy CLAY with a trace of coal fragments (medium stiff, moist) (Completely Weathered Bedrock/Residual Soil)
9.0 - 9.5	Rock	Reddish-yellow SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 9.5 feet on 06/12/18
		Difficult excavation below about 9.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil sample obtained at about 4.0 feet
Test Pit TP-8	Approximate Ground Surface Elevation: 2,892 feet	Latitude 47.2165, Longitude -120.9165
0.0 - 0.5		Sod and Topsoil
0.5 - 1.0	SM	Brown silty fine SAND (medium dense, dry to moist) (Loess)
1.0 - 6.5	SM/Rock	Reddish-brown silty fine SAND with sandstone and siltstone fragments (medium dense, moist) (Highly to Moderately Weathered Bedrock)
6.5 - 8.5	Rock	Interbeds of reddish-brown SANDSTONE and gray SILTSTONE (slighly weathered, moderately weak bedrock) (Roslyn Formation)
8.5 - 9.0	Rock	Black CARBONACEOUS SHALE and COAL (sligthly weathered, very weak bedrock) (Roslyn Formation)
9.0 - 10.0	Rock	Interbeds of reddish-brown SANDSTONE and gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 10.0 feet on 06/12/18
		Moderately difficult excavation below about 9.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 3.0 and 8.5 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-9	Approximate Ground Surface Elevation: 2,882 feet	Latitude 47.2165, Longitude -120.9182
0.0 - 0.5		Sod and Topsoil
0.5 - 5.0	CL	Brown sandy CLAY with a trace of gravel (stiff to very stiff, moist) (Completely Weathered Bedrock/Residual Soil)
5.0 - 7.5	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 7.5 feet on 06/12/18 because of digging refusal Very difficult digging below about 7.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 3.0 and 5.5 feet
Test Pit TP-10	Approximate Ground Surface Elevation: 2,869 feet	Latitude 47.2164, Longitude -120.9203
0.0 - 0.5		Sod and Topsoil
0.5 - 5.0	SP-SM	Brown fine to medium SAND with silt (medium dense, moist) (Loess)
5.0 - 7.0	SM	Light reddish-brown silty fine to medium SAND (medium dense, moist) (Completely Weathered Bedrock/Residual Soil)
7.0 - 8.5	SP-SM/Rock	Light reddish-brown fine to medium SAND with silt and sandstone and siltstone fragments (medium dense, moist) (Highly to Moderately Weathered Bedrock)
8.5 - 9.5	Rock	Reddish-brown SANDSTONE (slightly weathered, moderately weak bedrock) (Roslyn Formation)
		Test pit completed at about 9.5 feet on 06/12/18 Moderately difficult digging below about 8.5 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 3.0 and 9.5 feet
Test Pit TP-11	Approximate Ground Surface Elevation: 2,870 feet	Latitude 47.2159, Longitude -120.9187
0.0 - 0.5		Sod and Topsoil
0.5 - 4.0	SP-SM	Brown fine to medium SAND with silt (loose to medium dense, moist) (Loess)
4.0 - 7.0	CL	Light reddish-brown sandy CLAY (soft, moist to wet) (Completely Weathered Bedrock/Residual Soil)
7.0 - 8.5	Rock	Reddish-brown SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 8.5 feet on 06/12/18 because of digging refusal Difficult digging below about 8.0 feet Moderate caving of the test pit walls observed between about 6.0 and 7.0 feet Groundwater seepage was observed below a depth of about 6.0 feet Disturbed soil samples obtained at about 1.5 and 5.5 feet
Test Pit TP-12	Approximate Ground Surface Elevation: 2,858 feet	Latitude 47.2157, Longitude -120.9172
0.0 - 1.0		Sod and Topsoil
1.0 - 2.5	SC	Light grayish-brown clayey fine to medium SAND with occasional gravel and cobbles (medium dense to dense, moist) (Weathered Alpine Glacial Till)
2.5 - 4.0	SM	Reddish-brown silty fine SAND with a trace of gravel (medium dense, moist) (Completely Weathered Bedrock/Residual Soil)
4.0 - 7.5	SM/Rock	Reddish-brown silty fine SAND with sandstone fragments and a trace of gravel (dense, moist) (Highly to Moderately Weathered Bedrock)
7.5 - 9.5	Rock	Reddish-brown SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 9.5 feet on 06/12/18 Difficult digging below about 9.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 2.0 and 5.0 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-13	Approximate Ground Surface Elevation: 2,870 feet	Latitude 47.2153, Longitude -120.9185
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	SM	Brown silty fine SAND (medium dense, dry to moist) (Loess)
2.0 - 10.0	Rock	Gray SILTSTONE (slightly weathered, moderately weak bedrock) (Roslyn Formation)
10.0 - 11.0	Rock	Black CARBONACEOUS SHALE and COAL (slightly weathered, very weak bedrock) (Roslyn Formation)
11.0 - 11.5	Rock	Yellowish-brown SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 11.5 feet on 06/11/18
		Very difficult excavation below about 11.0 feet
		Slight caving of the test pit walls observed between about 7.0 and 9.0 feet
		Groundwater seepage observed between about 7.0 and 9.0 feet
		Disturbed soil samples obtained at about 4.0 and 10.5 feet
Test Pit TP-14	Approximate Ground Surface Elevation: 2,883 feet	Latitude 47.2148, Longitude -120.9172
0.0 - 0.5		Sod and Topsoil
0.5 - 4.0	SM/Rock	Yellowish-brown silty fine to medium SAND with sandstone fragments (medium dense, moist) (Highly to Moderately Weathered Bedrock)
4.0 - 7.0	Rock	Light yellowish-brown SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 7.0 feet on 06/11/18 because of digging refusal
		Very difficult excavation below about 5.5 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil sample obtained at about 4.0 feet
Test Pit TP-15	Approximate Ground Surface Elevation: 2,856 feet	Latitude 47.2149, Longitude -120.9161
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	ML	Light brown sandy SILT (medium stiff, dry to moist) (Loess)
2.0 - 6.0	SC	Light reddish-brown clayey fine to medium SAND with occasional gravel and cobbles (medium dense, moist) (Weathered Alpine Glacial Till)
6.0 - 7.5	SM/Rock	Yellowish-brown silty fine SAND with sandstone fragments (medium dense, moist) (Highly to Moderately Weathered Bedrock)
7.5 - 10.5	Rock	Light yellowish-brown SANDSTONE interbedded with gray SILTSTONE (slightly weathered, moderately weak bedrock) (Roslyn Formation)
		Test pit completed at about 10.5 feet on 06/11/18
		Difficult excavation below about 8.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 4.0 and 6.5 feet
Test Pit TP-16	Approximate Ground Surface Elevation: 2,835 feet	Latitude 47.2142, Longitude -120.9161
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	SM	Light brown silty fine SAND (medium dense, dry to moist) (Loess)
2.0 - 5.0	CH	Light reddish-brown CLAY with sand (medium stiff, moist) (Weathered Alpine Glacial Till)
5.0 - 9.0	SC	Light reddish-brown clayey fine to medium SAND with occasional gravel and cobbles (dense, moist) (Alpine Glacial Till)
9.0 - 9.5	Rock	Light reddish-brown SANDSTONE (slightly weathered, moderately weak bedrock) (Roslyn Formation)
		Test pit completed at about 9.5 feet on 06/11/18
		Difficult excavation below about 8.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 3.0 and 9.5 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-17	Approximate Ground Surface Elevation: 2,840 feet	Latitude 47.2143, Longitude -120.9148
0.0 - 0.5		Sod and Topsoil
0.5 - 2.5	SM	Light brown silty fine SAND (medium dense, dry to moist) (Loess)
2.5 - 9.0	SC	Light reddish-brown clayey fine SAND with occasional gravel and cobbles (medium dense, moist) (Alpine Glacial Till) grades to dense at about 6 feet
9.0 - 9.5	Rock	Light yellowish-brown SANDSTONE (slightly weathered, moderately weak bedrock) (Roslyn Formation)
		Test pit completed at about 9.5 feet on 06/11/18 Difficult excavation below about 9.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 4.5 and 9.5 feet
Test Pit TP-18	Approximate Ground Surface Elevation: 2,786 feet	Latitude 47.2134, Longitude -120.9152
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	SM	Light brown silty fine SAND with a trace of fine gravel (loose, dry to moist) (Loess)
2.0 - 5.0	SC	Light reddish-brown clayey fine SAND with gravel and cobbles (medium dense to dense, moist) (Weathered Alpine Glacial Till)
5.0 - 9.5	SC	Light reddish-brown clayey fine to medium SAND with gravel and cobbles (medium dense to dense, moist) (Alpine Glacial Till)
		Test pit completed at about 9.5 feet on 06/11/18 No caving of test pit walls observed No groundwater seepage observed Disturbed soil sample obtained at about 4.5 feet
Test Pit TP-19	Approximate Ground Surface Elevation: 2,799 feet	Latitude 47.2137, Longitude -120.9139
0.0 - 0.5		Sod and Topsoil
0.5 - 5.5	ML	Brown sandy SILT (medium stiff, dry to moist) (Loess)
5.5 - 9.0	SC	Light reddish-brown clayey fine SAND with occasional gravel (dense, moist) (Alpine Glacial Till)
		Test pit completed at about 9.0 feet on 06/11/18 Difficult excavation below about 7.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 6.0 and 9.0 feet
Test Pit TP-20	Approximate Ground Surface Elevation: 2,733 feet	Latitude 47.2125, Longitude -120.9149
0.0 - 0.5		Sod and Topsoil
0.5 - 4.0	ML	Brown SILT (stiff, dry to moist) (Loess) grades to medium stiff at about 2.0 feet
4.0 - 8.5	SM	Light reddish-brown silty fine to medium SAND with a trace of gravel and coal fragments (medium dense, moist) (Completely Weathered Bedrock/Residual Soil)
8.5 - 9.0	Rock	Light yellowish-brown SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 9.0 feet on 06/11/18 because of digging refusal Very difficult digging below about 8.5 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 4.5 and 8.5 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-21	Approximate Ground Surface Elevation: 2,773 feet	Latitude 47.2130, Longitude -120.9141
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	SM	Brown silty fine SAND with a trace of fine gravel (loose, moist) (Loess)
2.0 - 4.0	CL	Brown and gray sandy CLAY with a trace of gravel (stiff, moist) (Weathered Alpine Glacial Till)
4.0 - 9.5	SC	Reddish-brown clayey fine to medium SAND with gravel and cobbles (medium dense to dense, moist) (Alpine Glacial Till)
		Test pit completed at about 9.5 feet on 06/11/18
		Moderately difficult excavation below about 6.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 3.0 and 6.5 feet
Test Pit TP-22	Approximate Ground Surface Elevation: 2,783 feet	Latitude 47.2131, Longitude -120.9128
0.0 - 0.5		Sod and Topsoil
0.5 - 4.0	ML	Light reddish-brown SILT (medium stiff, moist) (Loess)
4.0 - 10.5	SC	Light reddish-brown clayey fine to medium SAND with occasional gravel (dense, moist) (Alpine Glacial Till)
		grades to with occasional cobbles and boulders up to about 2 feet in diameter at about 9.0 feet
		Test pit completed at about 10.5 feet on 06/11/18
		Moderately difficult excavation below about 4.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil sample obtained at about 4.5 feet
Test Pit TP-23	Approximate Ground Surface Elevation: 2,721 feet	Latitude 47.2123, Longitude -120.9134
0.0 - 1.0		Sod and Topsoil
1.0 - 5.0	CL	Light reddish-brown sandy CLAY with cobbles and boulders up to about 6 feet in diameter and a trace of gravel (medium stiff, moist) (Weathered Alpine Glacial Till)
5.0 - 11.0	SC	Yellowish-brown clayey fine to medium SAND with occasional cobbles and boulders up to about 18 inches in diameter, and a trace of sandstone and siltstone fragments (dense, moist) (Alpine Glacial Till)
		Test pit completed at about 11.0 feet on 06/11/18
		Moderately difficult excavation below about 5.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 4.5 and 10.5 feet
Test Pit TP-24	Approximate Ground Surface Elevation: 2,748 feet	Latitude 47.2123, Longitude -121.9122
0.0 - 0.5		Sod and Topsoil
0.5 - 6.0	CL	Light reddish-brown sandy CLAY with occasional gravel (stiff, moist) (Weathered Alpine Glacial Till)
		grades to with cobbles at about 3.0 feet
6.0 - 10.5	SC	Light reddish-brown clayey fine to medium SAND with gravel and occasional cobbles (dense, moist) (Alpine Glacial Till)
		Test pit completed at about 10.5 feet on 06/11/18
		Moderately difficult excavation below about 6.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 4.0 and 9.5 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-25	Approximate Ground Surface Elevation: 2,688 feet	Latitude 47.2117, Longitude -120.9127
0.0 - 0.5		Sod and Topsoil
0.5 - 5.5	CL	Light reddish-brown sandy CLAY (stiff, moist) (Weathered Alpine Glacial Till)
5.5 - 11.0	SC	Light brown clayey fine to medium SAND with gravel, cobbles and boulders up to about 2 feet in diameter (dense, moist) (Alpine Glacial Till)
		Test pit completed at about 11.0 feet on 06/11/18
		Moderately difficult excavation below about 5.5 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 5.0 and 8.0 feet
Test Pit TP-26	Approximate Ground Surface Elevation: 2,690 feet	Latitude 47.2117, Longitude -120.9140
0.0 - 0.5		Sod and Topsoil
0.5 - 8.5	SC	Light reddish-brown clayey fine to medium SAND with gravel, cobbles and boulders up to about 2 feet in diameter (medium dense, moist) (Weathered Alpine Glacial Till)
8.5 - 11.5	SC	Yellowish-brown clayey fine to medium SAND with gravel, cobbles and boulders up to about 2 feet in diameter (dense, dry to moist) (Alpine Glacial Till)
		Test pit completed at about 11.5 feet on 06/11/18
		Very difficult excavation below about 11 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 5.0 and 10.0 feet
Test Pit TP-27	Approximate Ground Surface Elevation: 2,656 feet	Latitude 47.2110, Longitude -120.9134
0.0 - 0.5		Sod and Topsoil
0.5 - 10.0	ML	Light reddish-brown sandy SILT with gravel and boulders up to about 2 feet in diameter (stiff, moist) (Weathered Alpine Glacial Till)
10.0 - 11.5	ML/Rock	Yellowish-brown sandy SILT with sandstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
		Test pit completed at about 11.5 feet on 06/11/18
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 3.0 and 11.5 feet
Test Pit TP-28	Approximate Ground Surface Elevation: 2,543 feet	Latitude 47.2088, Longitude -120.9184
0.0 - 0.5		Sod and Topsoil
0.5 - 4.0	MH	Yellowish-brown sandy SILT with occasional gravel and cobbles (stiff, moist) (Weathered Alpine Glacial Till)
4.0 - 7.0	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 7.0 feet on 06/12/18 because of digging refusal
		Very difficult excavation below about 6.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 2.5 and 7.0 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-29	Approximate Ground Surface Elevation: 2,520 feet	Latitude 47.2090, Longitude -120.9193
0.0 - 0.5		Sod and Topsoil
0.5 - 9.0	CL	Light grayish-brown sandy CLAY (stiff, moist) (Weathered Alpine Glacial Till) grades to reddish-brown at about 2 feet grades to with gravel and cobbles at about 8 feet
9.0 - 11.0	CL/Rock	Light reddish-brown sandy CLAY with siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
		Test pit completed at about 11.0 feet on 06/12/18 No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.5, 4.0 and 10.0 feet
Test Pit TP-30	Approximate Ground Surface Elevation: 2,488 feet	Latitude 47.2089, Longitude -120.9203
0.0 - 0.5		Sod and Topsoil
0.5 - 2.5	CL	Light brown sandy CLAY (stiff, moist) (Weathered Alpine Glacial Till)
2.5 - 8.0	CL	Light reddish-brown sandy CLAY with a trace of gravel (medium stiff, moist) (Weathered Alpine Glacial Till)
8.0 - 9.5	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 9.5 feet on 06/12/18 because of digging refusal Very difficult excavation below about 9.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.5 and 3.5 feet
Test Pit TP-31	Approximate Ground Surface Elevation: 2,496 feet	Latitude 47.2085, Longitude -120.9193
0.0 - 0.5		Sod and Topsoil
0.5 - 3.5	SC	Light Yellowish-brown clayey fine SAND with occasional gravel and cobbles (medium dense to dense, moist) (Weathered Alpine Glacial Till)
3.5 - 6.0	CL	Reddish-brown sandy CLAY with a trace of gravel and cobbles (medium stiff, moist) (Weathered Alpine Glacial Till)
6.0 - 9.0	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 9.0 feet on 06/12/18 Very difficult excavation below about 8.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 4.0 and 7.0 feet
Test Pit TP-32	Approximate Ground Surface Elevation: 2,461 feet	Latitude 47.2079, Longitude -121.9186
0.0 - 0.5		Sod and Topsoil
0.5 - 8.0	CL	Light reddish-brown sandy CLAY with a trace of gravel (stiff, moist) (Weathered Alpine Glacial Till) grades to with occasional gravel and cobbles at about 3.0 feet
8.0 - 9.5	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 9.5 feet on 06/21/18 Difficult excavation below about 9.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil sample obtained at about 4.0 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-33	Approximate Ground Surface Elevation: 2,824 feet	Latitude 47.2143, Longitude -120.9184
0.0 - 0.5		Sod and Topsoil
0.5 - 3.5	SM	Lightly brown silty fine SAND (medium dense, moist) (Loess) grades to reddish-brown at about 1.5 feet
3.5 - 6.5	SP-SM/Rock	Yellowish-brown fine to medium SAND with silt and sandstone fragments (medium dense, moist) (Highly to Moderately Weathered Bedrock)
6.5 - 8.0	Rock	Yellowish-brown fine to medium SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 8.0 feet on 06/21/18 because of digging refusal Very difficult excavation below about 7.5 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.0 and 4.0 feet
Test Pit TP-34	Approximate Ground Surface Elevation: 2,783 feet	Latitude 47.2136, Longitude -120.9187
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	ML	Light brown sandy SILT (stiff to very stiff, moist) (Weathered Alpine Glacial Till)
2.0 - 4.5	ML	Yellowish-brown sandy SILT with occasional gravel and siltstone and sandstone fragments (moist, stiff) (Weathered Alpine Glacial Till)
4.5 - 8.5	ML/Rock	Yellowish-brown sandy SILT with sandstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
8.5 - 9.5	Rock	Yellowish-brown fine SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 9.5 feet on 06/21/18 because of digging refusal Very difficult excavation below about 9.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil sample obtained at about 3.0 feet
Test Pit TP-35	Approximate Ground Surface Elevation: 2,849 feet	Latitude 47.2139, Longitude -120.9175
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	SM	Light brown silty fine to medium SAND with gravel and cobbles up to about 12 inches in diameter (dense, moist) (Weathered Alpine Glacial Till)
2.0 - 11.5	ML/Rock	Yellowish-brown sandy SILT with siltstone and sandstone fragments (stiff to very stiff, moist) (Highly to Moderately Weathered Bedrock)
11.5 - 13.0	Rock	Grayish-brown SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 13.0 feet on 06/21/18 Difficult excavation below about 11.5 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 0.5 and 6.0 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-36	Approximate Ground Surface Elevation: 2,719 feet	Latitude 47.2128, Longitude -120.9192
0.0 - 0.5		Sod and Topsoil
0.5 - 7.0	ML	Light brown sandy SILT (medium stiff to stiff, moist) (Completely Weathered Bedrock/Residual Soil)
7.0 - 12.5	ML	Reddish-brown sandy SILT with a trace of siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock) grades to with occasional sandstone and siltstone fragments at about 11.0 feet
12.5 - 13.0	ML/Rock	Reddish-brown sandy SILT with sandstone and siltstone fragments (very stiff, moist) (Highly to Moderately Weathered Bedrock)
		Test pit completed at about 13.0 feet on 06/21/18 Moderately difficult excavation below about 12.5 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 10.0 and 12.0 feet
Test Pit TP-37	Approximate Ground Surface Elevation: 2,762 feet	Latitude 47.2129, Longitude -120.9178
0.0 - 0.5		Sod and Topsoil
0.5 - 3.5	ML	Light brown sandy SILT with occasional cobbles (medium stiff, moist) (Weathered Alpine Glacial Till) grades to light reddish-brown at about 1.0 foot grades to with occasional siltstone fragments at about 2.5 feet
3.5 - 4.0	ML/Rock	Light reddish-brown sandy SILT with siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
4.0 - 4.5	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 4.5 feet on 06/21/18 because of digging refusal Very difficult excavation below about 4.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil sample obtained at about 3.5 feet
Test Pit TP-38	Approximate Ground Surface Elevation: 2,645 feet	Latitude 47.2121, Longitude -120.9201
0.0 - 0.5		Sod and Topsoil
0.5 - 13.0	ML	Light brown sandy SILT with a trace of fine gravel (stiff, moist) (Completely Weathered Bedrock/Residual Soil) grades to reddish-brown at about 2.0 feet grades to with a trace of siltstone and sandstone fragments at about 3.0 feet
13.0 - 15.5	ML/Rock	Reddish-brown sandy SILT with sandstone and siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
15.5 - 16.0	Rock	Yellowish-brown SANDSTONE (slightly weathered, moderately weak bedrock) (Roslyn Formation)
		Test pit completed at about 16.0 feet on 06/21/18 Moderately difficult excavation below about 15.5 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil sample obtained at about 7.0 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-39	Approximate Ground Surface Elevation: 2,707 feet	Latitude 47.2122, Longitude -120.9179
0.0 - 0.5		Sod and Topsoil
0.5 - 2.5	SM	Light brown silty fine SAND (medium dense, moist) (Completely Weathered Bedrock/Residual Soil)
2.5 - 3.5	SM/Rock	Reddish-brown silty fine SAND with siltstone and sandstone fragments (medium dense, moist) (Highly to Moderately Weathered Bedrock)
3.5 - 4.5	Rock	Yellowish-brown fine SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 4.5 feet on 06/21/18 because of digging refusal Very difficult excavation below about 4.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.0 and 3.5 feet
Test Pit TP-40	Approximate Ground Surface Elevation: 2,619 feet	Latitude 47.2112, Longitude -120.9201
0.0 - 0.5		Sod and Topsoil
0.5 - 3.0	ML	Light brown sandy SILT (stiff, moist) (Completely Weathered Bedrock/Residual Soil) grades to yellowish-brown at about 1.5 feet
3.0 - 8.0	ML/Rock	Yellowish-brown sandy SILT with siltstone and sandstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
8.0 - 11.5	Rock	Yellowish-brown fine to medium SANDSTONE (slightly weathered, moderately weak bedrock) (Roslyn Formation)
		Test pit completed at about 11.5 feet on 06/21/18 Moderately difficult excavation below about 11.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.0, 7.0 and 8.0 feet
Test Pit TP-41	Approximate Ground Surface Elevation: 2,664 feet	Latitude 47.2115, Longitude -120.9191
0.0 - 1.0	ML	Light brown sandy SILT with a trace of fine gravel (stiff, moist) (Completely Weathered Bedrock/Residual Soil)
1.0 - 11.0	ML/Rock	Light reddish-brown and yellowish-brown sandy SILT with siltstone and sandstone fragments (medium stiff, moist) (Highly to Moderately Weathered Bedrock) grades to with weathered carbonaceous shale fragments between about 10.5 and 11.0 feet
11.0 - 11.5	Rock	Yellowish-brown fine to medium SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 11.5 feet on 06/21/18 Moderately difficult excavation below about 11.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.0 and 3.0 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-42	Approximate Ground Surface Elevation: 2,543 feet	Latitude 47.2102, Longitude -120.9203
0.0 - 0.5		Sod and Topsoil
0.5 - 1.0	SM	Light brown silty fine SAND (medium dense, moist) (Loess)
1.0 - 3.5	ML/Rock	Light yellowish-brown and reddish-brown sandy SILT with siltstone and sandstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
3.5 - 5.5	Rock	Yellowish-brown fine SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 5.5 feet on 06/21/18 because of digging refusal
		Very difficult excavation below about 5.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 0.5, 3.0 and 4.5 feet
Test Pit TP-43	Approximate Ground Surface Elevation: 2,594 feet	Latitude 47.2106, Longitude -120.9191
0.0 - 0.5		Sod and Topsoil
0.5 - 2.5	SM	Light brown silty fine SAND (medium dense, moist) (Loess)
2.5 - 4.0	ML/Rock	Reddish-brown sandy SILT with siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
4.0 - 5.5	Rock	Yellowish-brown fine SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 5.5 feet on 06/21/18 because of digging refusal
		Very difficult excavation below about 5.0 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 1.0, 3.0 and 5.0 feet
Test Pit TP-44	Approximate Ground Surface Elevation: 2,660 feet	Latitude 47.2111, Longitude -120.9179
0.0 - 0.5		Sod and Topsoil
0.5 - 2.0	SM	Light brown silty fine SAND (medium dense, moist) (Loess)
2.0 - 4.0	ML/Rock	Brownish-gray sandy SILT with sandstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
4.0 - 6.0	Rock	Grayish-brown SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 6.0 feet on 06/21/18 because of digging refusal
		Very difficult excavation below about 5.5 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil samples obtained at about 2.5 and 5.5 feet
Test Pit TP-45	Approximate Ground Surface Elevation: 2,531 feet	Latitude 47.2097, Longitude -120.9196
0.0 - 0.5		Sod and Topsoil
0.5 - 3.0	ML	Light grayish-brown SILT with sand and a trace of siltstone and weathered carbonaceous shale fragments (medium stiff, moist) (Fill)
3.0 - 4.5	ML/Rock	Light grayish-brown sandy SILT with siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
4.5 - 7.0	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 7.0 feet on 06/21/18 because of digging refusal
		Very difficult excavation below about 6.5 feet
		No caving of test pit walls observed
		No groundwater seepage observed
		Disturbed soil sample obtained at about 3.0 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-46	Approximate Ground Surface Elevation: 2,584 feet	Latitude 47.2101, Longitude -120.9179
0.0 - 0.5		Sod and Topsoil
0.5 - 6.0	ML	Brown sandy SILT with a trace of gravel (stiff, moist) (Completely Weathered Bedrock/Residual Soil) grades to grayish-brown and no gravel at about 2.5 feet
6.0 - 9.5	Rock	Yellowish-brown fine SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 9.5 feet on 06/21/18 because of digging refusal Very difficult excavation below about 8.5 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.0, 4.0 and 6.5 feet
Test Pit TP-47	Approximate Ground Surface Elevation: 2,622 feet	Latitude 47.2103, Longitude -120.9168
0.0 - 0.5		Sod and Topsoil
0.5 - 4.0	ML	Light grayish-brown SILT with occasional siltstone fragments (very stiff, moist) (Completely Weathered Bedrock/Residual Soil) grades to grayish-brown, stiff, moist at about 2.0 feet
4.0 - 5.5	SM/Rock	Yellowish-brown silty fine SAND with sandstone fragments (dense, moist) (Highly to Moderately Weathered Bedrock)
5.5 - 7.0	Rock	Yellowish-brown fine SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 7.0 feet on 06/21/18 because of digging refusal Very difficult excavation below about 6.5 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil sample obtained at about 2.0 feet
Test Pit TP-48	Approximate Ground Surface Elevation: 2,545 feet	Latitude 47.2091, Longitude -120.9171
0.0 - 3.0	ML	Light brown sandy SILT (stiff, moist) (Completely Weathered Bedrock/Residual Soil)
3.0 - 4.0	ML/Rock	Grayish-brown sandy SILT with siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
4.0 - 6.0	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 6.0 feet on 06/21/18 because of digging refusal Very difficult excavation below about 5.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.0 and 5.0 feet
Test Pit TP-49	Approximate Ground Surface Elevation: 2,583 feet	Latitude 47.2095, Longitude -120.9160
0.0 - 1.0	ML	Light brown sandy SILT (stiff, moist) (Weathered Alpine Glacial Till)
1.0 - 3.5	ML	Light grayish-brown sandy SILT with a trace of siltstone fragments (medium stiff, moist) (Weathered Alpine Glacial Till)
3.5 - 8.0	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 8.0 feet on 06/21/18 because of digging refusal Very difficult excavation below about 7.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 2.0 and 4.5 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-50	Approximate Ground Surface Elevation: 2,493 feet	Latitude 47.2083, Longitude -120.9171
0.0 - 0.5		Sod and Topsoil
0.5 - 2.5	SM	Light brown silty fine to medium SAND (medium dense, moist) (Completely Weathered Bedrock/Residual Soil)
2.5 - 10.0	ML	Light grayish-brown sandy SILT with occasional siltstone and sandstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
10.0 - 11.5	ML/Rock	Light grayish-brown sandy SILT with siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
		Test pit completed at about 11.5 feet on 06/21/18 Moderately difficult excavation below about 10.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.0 and 3.0 feet
Test Pit TP-51	Approximate Ground Surface Elevation: 2,501 feet	Latitude 47.2083, Longitude -120.9157
0.0 - 2.0	SM	Light brown silty fine to medium SAND with occasional gravel (dense, moist) (Alpine Glacial Till)
2.0 - 4.0	ML	Dark gray SILT with occasional siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
4.0 - 7.0	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 7.0 feet on 06/21/18 because of digging refusal Very difficult excavation below about 6.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil sample obtained at about 3.0 feet
Test Pit TP-52	Approximate Ground Surface Elevation: 2,523 feet	Latitude 47.2088, Longitude -120.9151
0.0 - 0.5		Sod and Topsoil
0.5 - 4.0	ML	Light brown sandy SILT (stiff, moist) (Weathered Alpine Glacial Till) grades to light grayish-brown with a trace of siltstone fragments at about 2 feet
4.0 - 7.0	ML	Light grayish-brown SILT with occasional siltstone fragments (stiff, moist) (Highly to Moderately Weathered Bedrock)
7.0 - 8.0	Rock	Gray SILTSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 8.0 feet on 06/21/18 because of digging refusal Very difficult excavation below about 7.5 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 1.0 and 3.0 feet

See Notes on Figure A-16

Depth [1] (feet)	Soil Group Symbol [2]	Test Pit Description [3]
Test Pit TP-53	Approximate Ground Surface Elevation: 2,483 feet	Latitude 47.2079, Longitude -120.9142
0.0 - 0.5		Sod and Topsoil
0.5 - 1.5	ML	Light brown sandy SILT (stiff, moist) (Loess)
1.5 - 8.0	ML	Light grayish-brown sandy SILT (stiff, moist) (Weathered Alpine Glacial Till) grades to grayish-brown at about 3.0 feet grades to brown, trace of sand and with occasional siltstone fragments at about 5.0 feet grades to with occasional gravel and cobbles at about 7.0 feet
8.0 - 10.5	SM	Light grayish-brown silty fine to medium SAND with gravel and cobbles (dense to very dense, moist) (Alpine Glacial Till)
10.5 - 11.0	Rock	Yellowish-brown fine SANDSTONE (slightly weathered, moderately strong bedrock) (Roslyn Formation)
		Test pit completed at about 11.0 feet on 06/21/18 because of digging refusal Very difficult excavation below about 10.0 feet No caving of test pit walls observed No groundwater seepage observed Disturbed soil samples obtained at about 3.0, 5.5, 7.0 and 11.0 feet

Notes:

(1) The depths on the test pit logs are shown in 0.5 foot increments, however these depths are based on approximate measurements across the length of the test pit and should be considered accurate to 1.0 foot. The depths are relative to the adjacent ground surface.

(2) The soil group symbols are based on the Soil Classification System, Figure A-1.

(3) The approximate test pit locations are shown on the Site Plan, Figure 2.

APPENDIX B

LABORATORY TESTING PROGRAM

APPENDIX B
LABORATORY TESTING PROGRAM

The soil samples obtained from the test pits were returned to ICE's laboratory for further visual examination and laboratory testing. Selected samples from the Phase 1 area were tested to evaluate moisture content in general accordance with ASTM Test Method D 2216, grain size analysis (particle size distribution) by ASTM Test Method D 422, and the liquid and plastic limits (Atterberg Limits) in general accordance with ASTM Test Method D 4318. The moisture content test results are presented on Figure B-1. The particle size distribution reports are presented on Figures B-2 through B-11; the liquid and plastic limits test report is presented on Figure B-12.

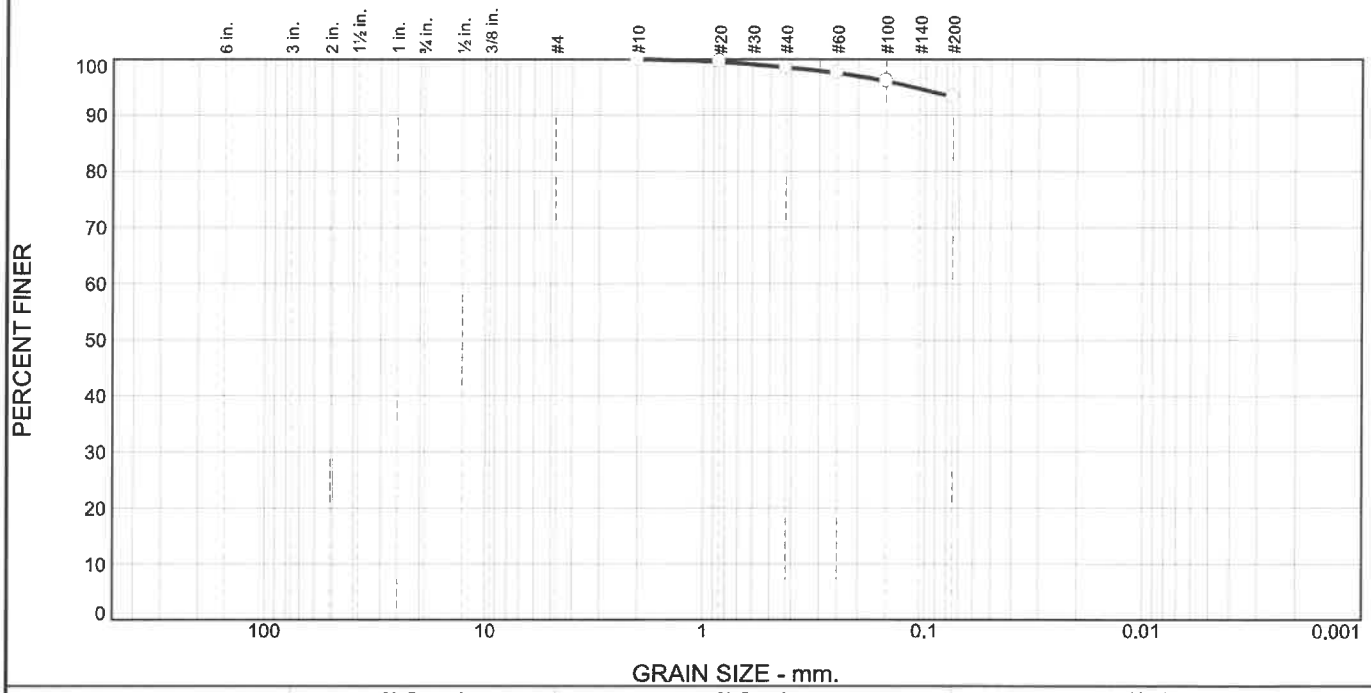
Test Pit Number	Sample Number	Sample Depth (feet)	Moisture Content (%)
TP-1	S-1	4	19
TP-1	S-2	7	9
TP-2	S-1	3	9
TP-3	S-1	1	9
TP-3	S-2	6	13
TP-3	S-3	9	28
TP-4	S-1	3	12
TP-5	S-1	2.3	10
TP-5	S-2	3.5	9
TP-6	S-1	4	18
TP-6	S-2	7.5	10
TP-7	S-1	4	20
TP-8	S-1	3	12
TP-8	S-2	8.5	23
TP-9	S-1	3	14
TP-9	S-2	5.3	9
TP-10	S-1	3	6
TP-10	S-2	9.5	13
TP-11	S-1	1.5	7
TP-11	S-2	5.5	24
TP-12	S-1	2	12
TP-12	S-2	5	15
TP-13	S-1	4	13
TP-13	S-2	10.5	20
TP-14	S-1	4	16
TP-15	S-1	4	16
TP-15	S-2	6.5	10
TP-16	S-1	3	22
TP-16	S-2	9.5	10
TP-17	S-1	4.5	15
TP-17	S-2	9.5	6
TP-18	S-1	4.5	12
TP-19	S-1	6	14
TP-19	S-2	9	15
TP-20	S-1	4.5	11
TP-20	S-2	8.5	9

Moisture Content Results - Figure B-1

Test Pit Number	Sample Number	Sample Depth (feet)	Moisture Content (%)
TP-21	S-1	3	20
TP-21	S-2	6.5	12
TP-22	S-1	4.5	11
TP-23	S-1	4.5	20
TP-23	S-2	10.5	11
TP-24	S-1	4	14
TP-24	S-2	9.5	9
TP-25	S-1	5	21
TP-25	S-2	8	12
TP-26	S-1	5	10
TP-26	S-2	10	11
TP-27	S-1	3	14
TP-27	S-2	11	15
TP-27	S-3	11.5	2
TP-28	S-1	2.5	21
TP-28	S-2	7	7
TP-29	S-1	1.5	12
TP-29	S-2	4	20
TP-29	S-3	10	15
TP-30	S-1	1.5	13
TP-30	S-2	3.5	18
TP-31	S-1	4	17
TP-31	S-2	7	9
TP-32	S-1	4	20

Moisture Content Results - Figure B-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.5	5.3	93.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#20	99.5		
#40	98.5		
#60	97.5		
#100	96.0		
#200	93.2		

* (no specification provided)

Material Description

Yellowish-brown CLAY with sandstone and siltstone fragments

Atterberg Limits (ASTM D 4318)

PL= 25 **LL=** 38 **PI=** 13

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-6(13)

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 19%

Date Received: 06/14/2018 **Date Tested:** 07/05/2018

Tested By: SED

Checked By: JMS

Title: Project Eng. Geologist

Source of Sample: Test Pit **Depth:** 4.0 feet **Date Sampled:** 06/12/2018

Sample Number: TP-1, S-1

ICICLE CREEK ENGINEERS, INC.

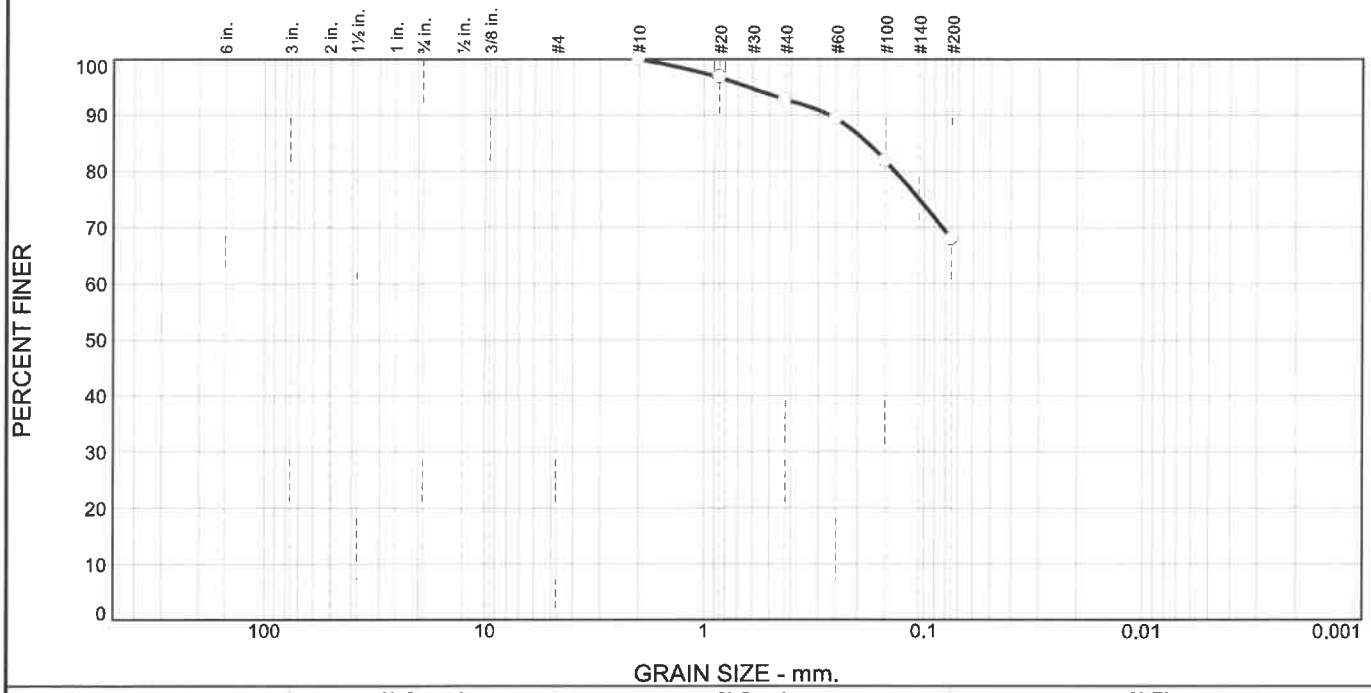
Carnation, WA

Client: Iron Snowshoe LLC

Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	7.2	24.9	67.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#10	100.0		
#20	96.7		
#40	92.8		
#60	89.3		
#100	81.9		
#200	67.9		

* (no specification provided)

Material Description

Light reddish-brown sandy CLAY with a trace of coal fragments

Atterberg Limits (ASTM D 4318)

PL= 21 LL= 35 PI= 14

Classification

USCS (D 2487)= CL AASHTO (M 145)= A-6(8)

Coefficients

D_{90}= 0.2682 D_{85}= 0.1800 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 20%

Date Received: 06/14/2018 **Date Tested:** 07/05/2018
Tested By: SED
Checked By: JMS
Title: Project Eng. Geologist

Source of Sample: Test Pit **Depth:** 4.0 feet **Date Sampled:** 06/12/2018
Sample Number: TP-7, S-1

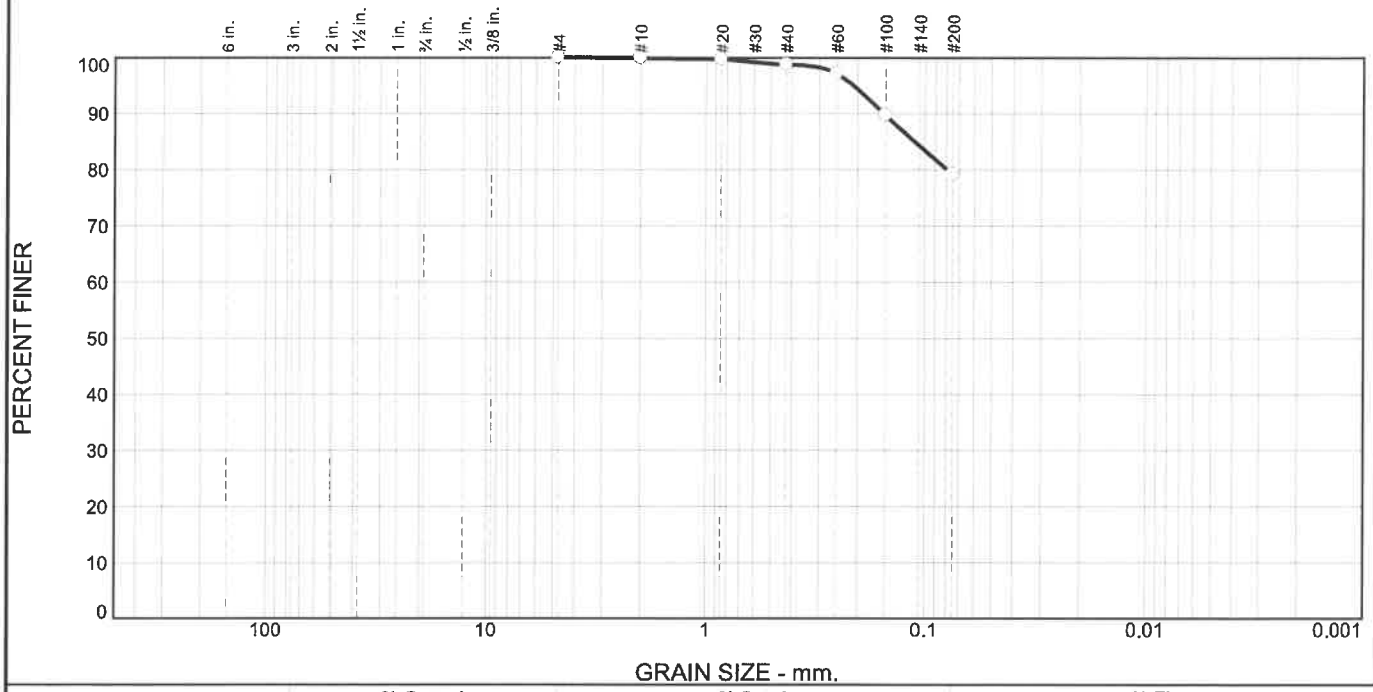
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Iron Snowshoe LLC
Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.1	19.6	79.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#20	99.7		
#40	98.8		
#60	97.1		
#100	89.7		
#200	79.2		

* (no specification provided)

Material Description

Light reddish-brown CLAY with sand

Atterberg Limits (ASTM D 4318)

PL= 19 **LL=** 53 **PI=** 34

Classification

USCS (D 2487)= CH **AASHTO (M 145)=** A-7-6(27)

Coefficients

D_{90}= 0.1524 D_{85}= 0.1110 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 22%

Date Received: 06/14/2018 **Date Tested:** 07/05/2018

Tested By: SED

Checked By: JMS

Title: Project Eng. Geologist

Source of Sample: Test Pit **Depth:** 3.0 feet **Date Sampled:** 06/11/2018

Sample Number: TP-16, S-1

ICICLE CREEK ENGINEERS, INC.

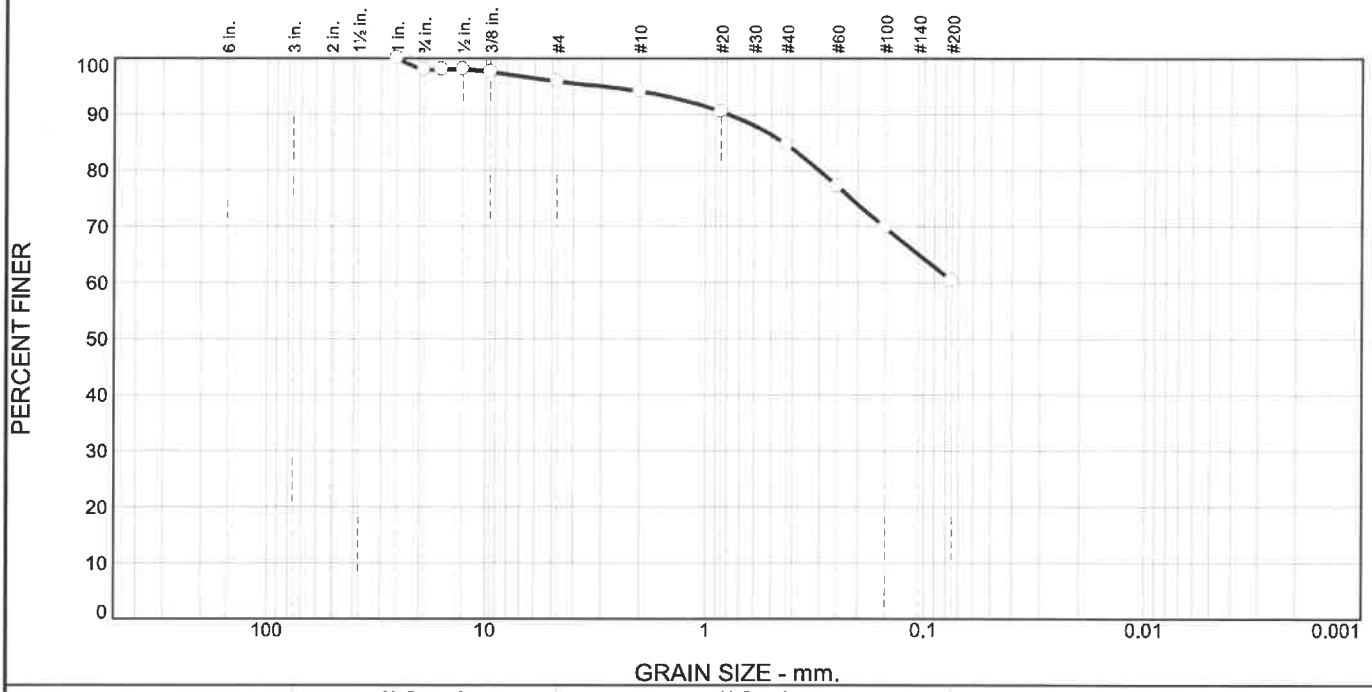
Carnation, WA

Client: Iron Snowshoe LLC

Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.1	2.0	1.8	9.5	24.2	60.4	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
3/4	97.9		
5/8	97.9		
1/2	97.9		
3/8	97.5		
#4	95.9		
#10	94.1		
#20	90.4		
#40	84.6		
#60	77.2		
#100	69.9		
#200	60.4		

* (no specification provided)

Material Description

Light reddish-brown sandy SILT with a trace of gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= ML AASHTO (M 145)=

Coefficients

D_{90}= 0.7918 D_{85}= 0.4415 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 14%

Date Received: 06/18/2018 **Date Tested:** 06/19/2018

Tested By: SED

Checked By: JMS

Title: Project Eng. Geologist

Source of Sample: Test Pits **Depth:** 6.0 feet **Date Sampled:** 06/11/2018

Sample Number: TP-19, S-1

ICICLE CREEK ENGINEERS, INC.

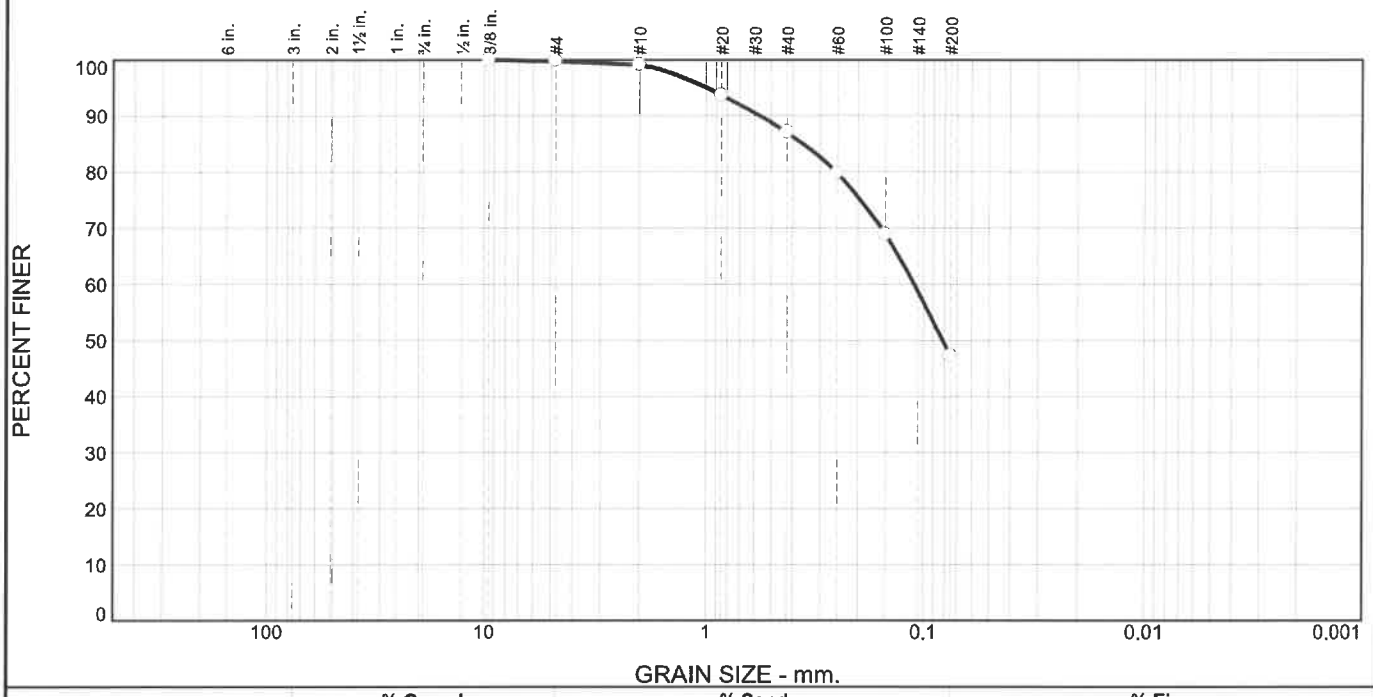
Carnation, WA

Client: Iron Snowshoe LLC

Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.6	12.1	39.7	47.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8	100.0		
#4	99.7		
#10	99.1		
#20	93.7		
#40	87.0		
#60	79.8		
#100	68.9		
#200	47.3		

* (no specification provided)

Material Description

Light reddish-brown silty fine to medium SAND with a trace of gravel and coal fragments

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

D_{90}= 0.5658 D_{85}= 0.3587 D_{60}= 0.1104
D_{50}= 0.0813 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 11%

Date Received: 06/18/2018 **Date Tested:** 06/19/2018

Tested By: SED

Checked By: JMS

Title: Project Eng. Geologist

Source of Sample: Test Pits **Depth:** 4.5 feet **Date Sampled:** 06/11/2018

Sample Number: TP-20, S-1

ICICLE CREEK ENGINEERS, INC.

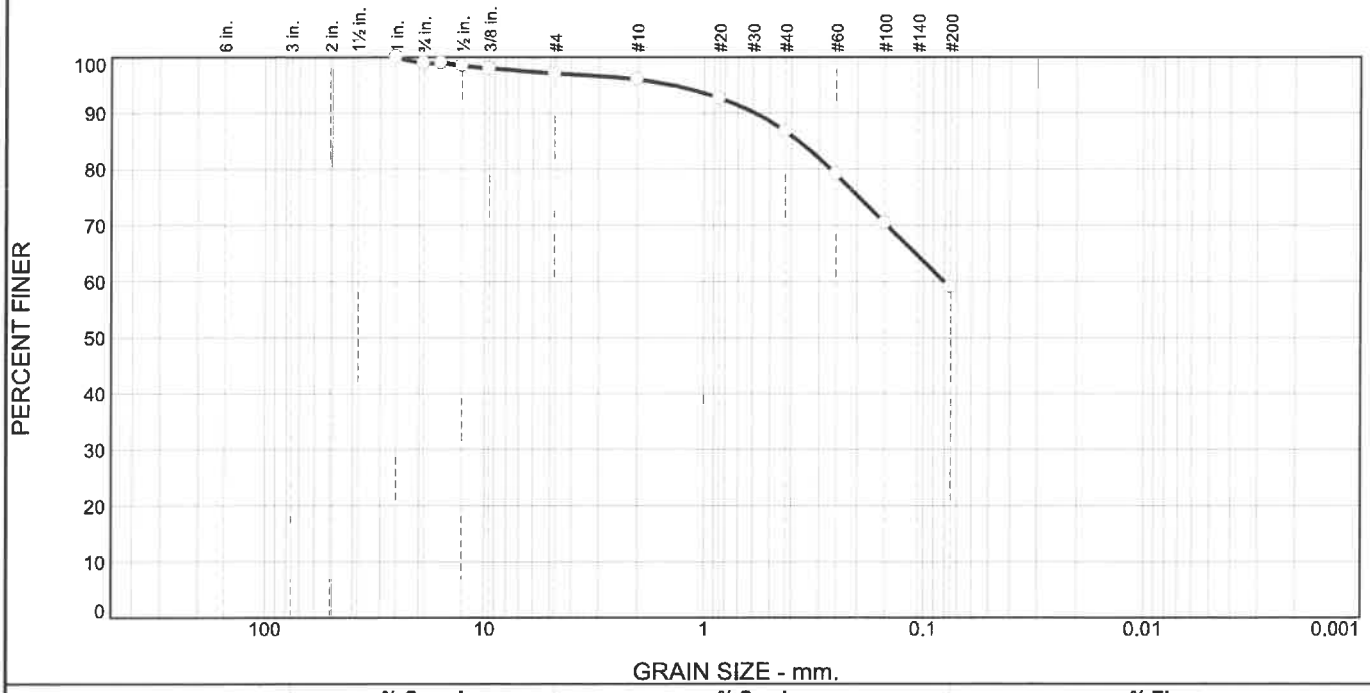
Carnation, WA

Client: Iron Snowshoe LLC

Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-6

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.1	1.8	1.1	9.3	27.8	58.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
3/4	98.9		
5/8	98.9		
1/2	98.5		
3/8	98.0		
#4	97.1		
#10	96.0		
#20	92.6		
#40	86.7		
#60	79.1		
#100	70.4		
#200	58.9		

* (no specification provided)

Material Description

Light reddish-brown sandy SILT with a trace of gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= ML AASHTO (M 145)=

Coefficients

D_{90}= 0.5885 D_{85}= 0.3715 D_{60}= 0.0801
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 11%

Date Received: 06/18/2018 **Date Tested:** 06/19/2018

Tested By: SED

Checked By: JMS

Title: Project Eng. Geologist

Source of Sample: Test Pits **Depth:** 4.5 feet **Date Sampled:** 06/11/2018

Sample Number: TP-22, S-1

ICICLE CREEK ENGINEERS, INC.

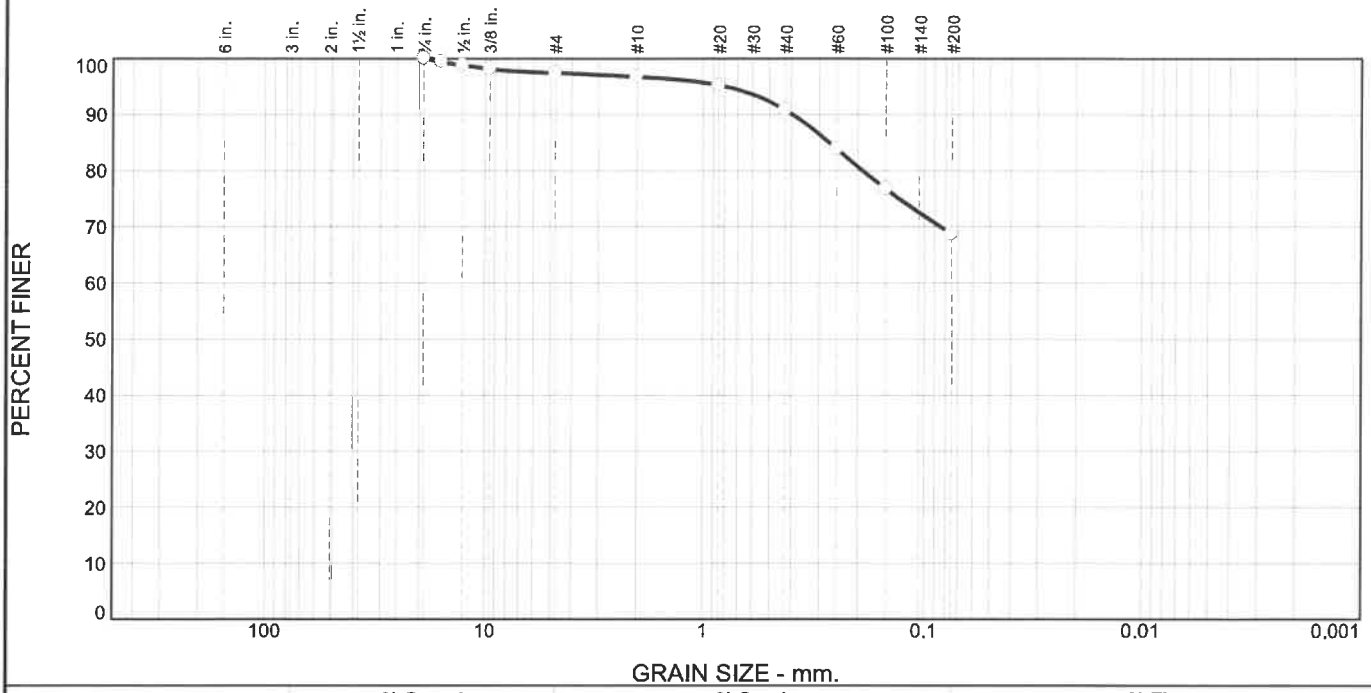
Carnation, WA

Client: Iron Snowshoe LLC

Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.6	0.6	6.0	22.0	68.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4	100.0		
5/8	99.4		
1/2	98.8		
3/8	98.1		
#4	97.4		
#10	96.8		
#20	95.2		
#40	90.8		
#60	83.9		
#100	76.8		
#200	68.8		

* (no specification provided)

Material Description

Light-brown sandy CLAY with a trace of gravel

Atterberg Limits (ASTM D 4318)

PL= 24 **LL=** 48 **PI=** 24

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-7-6(16)

Coefficients

D_{90}= 0.3955 D_{85}= 0.2705 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 20%

Date Received: 06/14/2018 **Date Tested:** 07/05/2018

Tested By: SED

Checked By: JMS

Title: Project Eng. Geologist

Source of Sample: Test Pit **Depth:** 4.5 feet **Date Sampled:** 06/11/2018

Sample Number: TP-23, S-1

ICICLE CREEK ENGINEERS, INC.

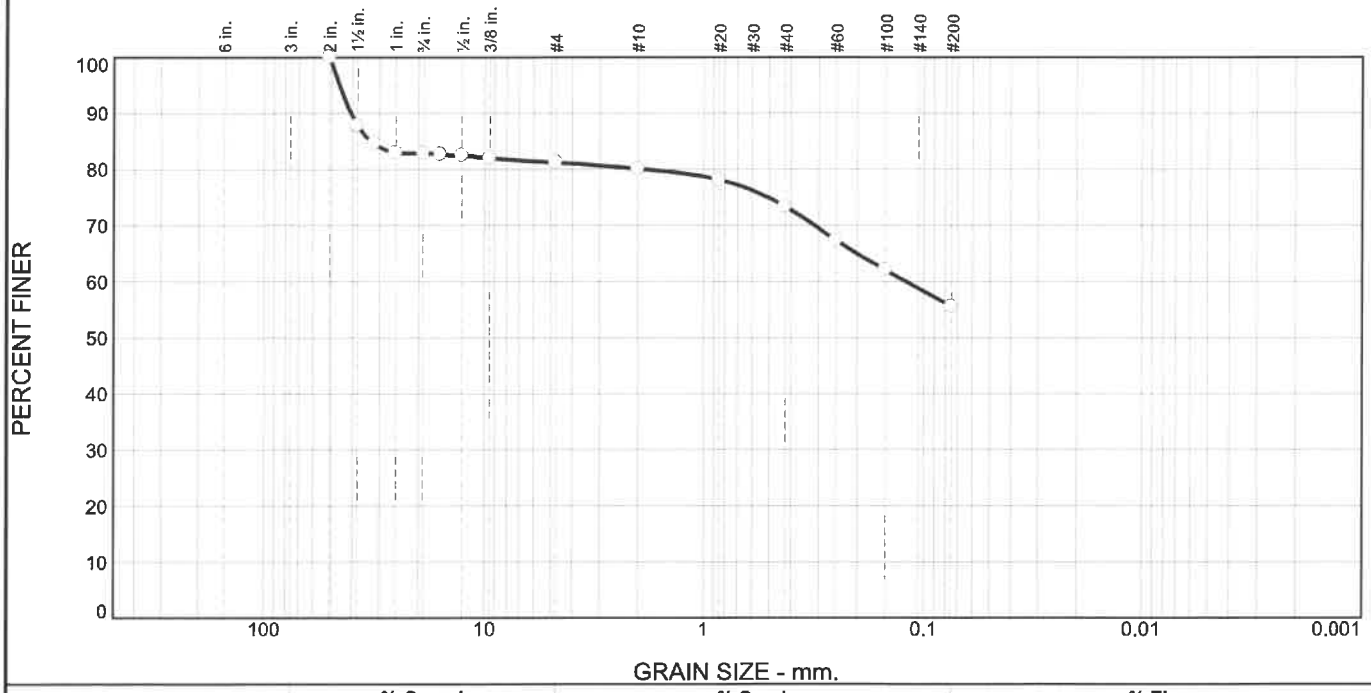
Carnation, WA

Client: Iron Snowshoe LLC

Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-8

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	17.1	1.7	1.1	6.7	17.9	55.5	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2	100.0		
1 1/2	87.8		
1 1/4	84.6		
1	82.9		
3/4	82.9		
5/8	82.7		
1/2	82.5		
3/8	82.0		
#4	81.2		
#10	80.1		
#20	78.1		
#40	73.4		
#60	67.3		
#100	62.1		
#200	55.5		

* (no specification provided)

Material Description

Light reddish-brown sandy SILT with gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= ML AASHTO (M 145)=

Coefficients

D_{90}= 40.7645 D_{85}= 32.7936 D_{60}= 0.1210
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 14%

Date Received: 06/18/2018 **Date Tested:** 06/19/2018

Tested By: SED

Checked By: JMS

Title: Project Eng. Geologist

Source of Sample: Test Pits **Depth:** 3.0 feet **Date Sampled:** 06/11/2018

Sample Number: TP-27, S-1

ICICLE CREEK ENGINEERS, INC.

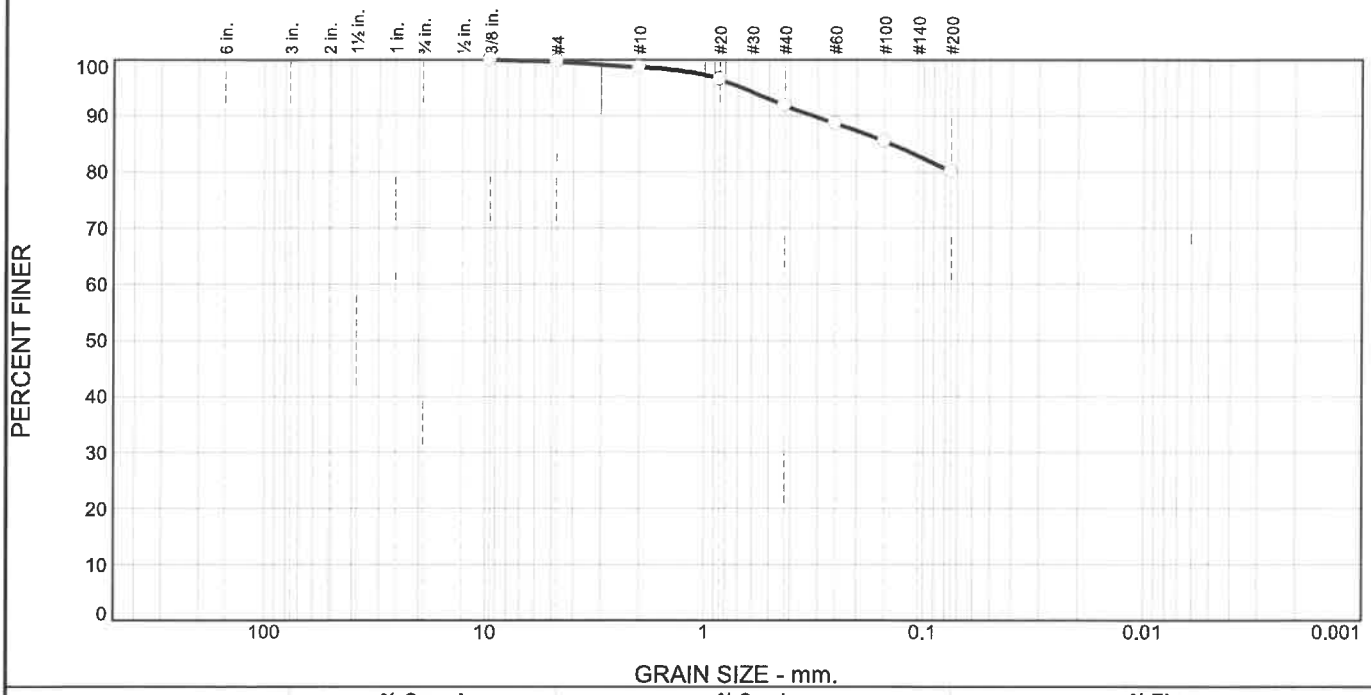
Carnation, WA

Client: Iron Snowshoe LLC

Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-9

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	1.0	6.8	11.8	80.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8	100.0		
#4	99.6		
#10	98.6		
#20	96.4		
#40	91.8		
#60	88.6		
#100	85.4		
#200	80.0		

* (no specification provided)

Material Description

Light reddish-brown CLAY with sand and a trace of gravel

Atterberg Limits (ASTM D 4318)

PL= 16 **LL=** 37 **PI=** 21

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-6(15)

Coefficients

D_{90}= 0.3171 D_{85}= 0.1411 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 20%

Date Received: 06/14/2018 **Date Tested:** 07/09/2018

Tested By: SED

Checked By: JMS

Title: Project Eng Geologist

Source of Sample: Test Pit **Depth:** 4.0 feet **Date Sampled:** 06/12/2018

Sample Number: TP-29, S-2

ICICLE CREEK ENGINEERS, INC.

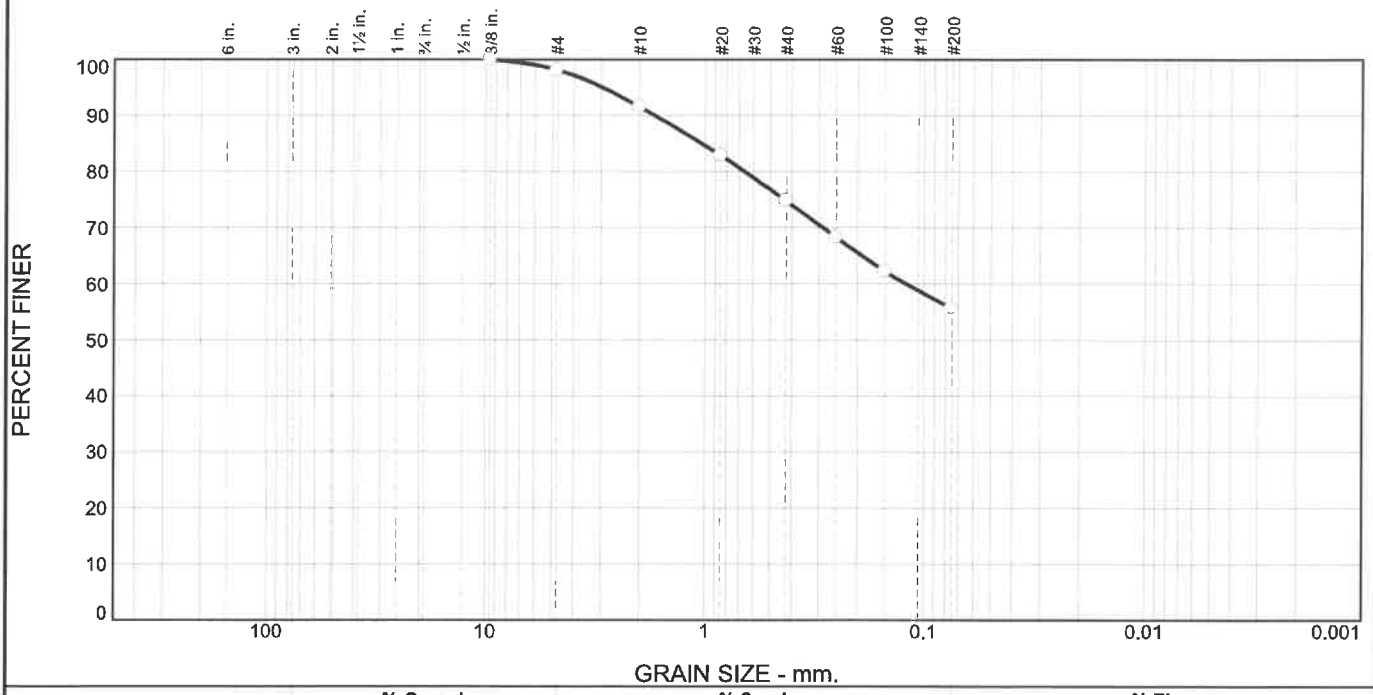
Carnation, WA

Client: Iron Snowshoe LLC

Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-10

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.9	6.6	16.7	19.2	55.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/8	100.0		
#4	98.1		
#10	91.5		
#20	82.9		
#40	74.8		
#60	68.3		
#100	62.2		
#200	55.6		

* (no specification provided)

Material Description

Light reddish-brown sandy SILT with a trace of gravel

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= ML AASHTO (M 145)=

Coefficients

D_{90}= 1.7077 D_{85}= 1.0360 D_{60}= 0.1208
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Moisture Content 20%

Date Received: 06/18/2018 **Date Tested:** 06/19/2018
Tested By: SED
Checked By: JMS
Title: Project Eng. Geologist

Source of Sample: Test Pits **Depth:** 4.0 feet **Date Sampled:** 06/12/2018
Sample Number: TP-32, S-1

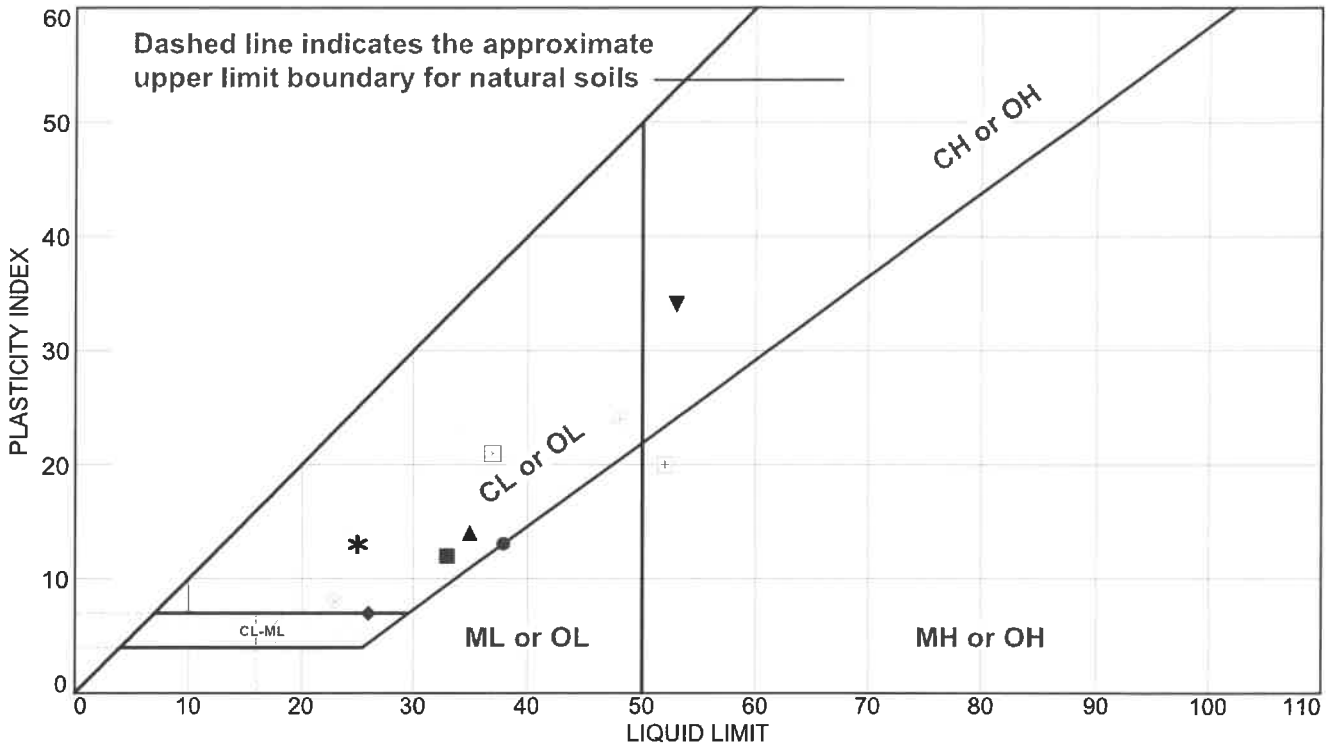
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Iron Snowshoe LLC
Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No: 1283-001 **Figure** B-11

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Test Pit	TP-1, S-1	4.0 feet	18.6	25	38	13	CL
■	Test Pit	TP-6, S-1	4.0 feet	18.0	21	33	12	CL
▲	Test Pit	TP-7, S-1	4.0 feet	19.8	21	35	14	CL
◆	Test Pit	TP-9,S-1	3.0 feet	13.5	19	26	7	CL
▼	Test Pit	TP-16, S-1	3.0 feet	21.6	19	53	34	CH
✱	Test Pit	TP-18, S-1	4.0 feet	12.2	12	25	13	CL
⊕	Test Pit	TP-23, S-1	4.5 feet	20.0	24	48	24	CL
⊞	Test Pit	TP-28, S-1	2.5 feet	20.5	32	52	20	MH
⊘	Test Pit	TP-29, S-1	1.5 feet	11.6	15	23	8	CL
⊠	Test Pit	TP-29, S-2	4.0 feet	20.0	16	37	21	CL

ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Iron Snowshoe LLC

Project: Forest Ridge Plat, Cle Elum Area, Kittitas County

Project No.: 1283-001 **Figure** B-12

Tested By: SED **Checked By:** JMS