Updated Geologically Hazardous Areas Assessment

Hop Hill Solar Development
Benton County, Washington

Prepared for:
HOHI bn, LLC
13123 E Emerald Coast Parkway, Suite B#158
Inlet Beach, Florida 32461-9604

July 21, 2022
PBS Project 66388.000

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1 INTRODUCTION

1.1 General

This report presents results of PBS Engineering and Environmental Inc. (PBS) geologically hazardous areas assessment prepared for HOHI bn, LLC, a subsidiary of BrightNight, LLC (BrightNight), for the proposed Hop Hill photovoltaic (PV) solar project (Hop Hill Solar Development) located in Benton County, Washington (site). The general site location is shown on the Vicinity Map, Figure 1. The locations of PBS' explorations in relation to existing and proposed site features are shown on the Site Plan, Figure 2.

1.2 Purpose and Scope

The purpose of PBS' services was to complete a geologically hazardous areas assessment as outlined by WAC 365-190-120 and adopted in Benton County Code (BCC) 15.12. The intent of this report is to provide a review of applicable geologic hazards and considerations in order to assist with future planning and to guide geotechnical engineering phases of work. This report should <u>not be considered a preliminary geotechnical assessment, nor should it be used for design.</u>

1.2.1 Literature and Records Review

PBS reviewed various published geologic maps of the area for information regarding geologic conditions and hazards at or near the site.

- Reidel, S. P., and Fecht, K. R. (1994). Geologic map of Richland 1:100,000 quadrangle, Washington. Washington Division of Geology and Earth Resources, Open File Report 94-8, map scale 1:100,000.
- WADNR (2022). Washington Geologic Information Portal. Accessed May 2022 from: https://www.dnr.wa.gov/geologyportal.
- Benton County Planning Department. GIS Portal. Accessed May 2022 from: https://bentonco.maps.arcgis.com/apps/webappviewer/index.html?id=ef4beb2778be4895ad44d7744dc127d1.
- GN Northern, Inc. (2020). Geotechnical Site Investigation and Critical Areas/Geohazards Report, Goose Prairie Photovoltaic (PV) Solar Array Project, State Route 24 and Desmarais Cutoff, Moxee, Yakima County, Washington. Prepared for OER WA Solar 1, LLC, GNN Project No. 220-1274, report date December 14, 2020.
- Westwood Professional Services. (2020). Preliminary Geotechnical Investigation Report, Horse Heaven Wind Project, Benton County, Washington. Prepared for Horse Heaven Wind Farm, LLC, Westwood Professional Services Project No. R0020776.01, report dated June 4, 2020.

In addition, PBS acquired publicly available light detection and ranging (LiDAR) digital elevation models (DEM) from the Washington Columbia Valley 2018 dataset (acquisition date of November 1, 2019, through February 7, 2020) to evaluate surface morphology and existing slope conditions through the USGS TNM (v2.0) portal.

LiDAR is acquired by aerial flights, which perform a laser scan of the ground surface below. The accuracy of a LiDAR DEM is significantly affected by the presence of vegetation and the degree to which vegetation (and other non-ground features) can be excluded from the DEM. For instance, a densely vegetated area may only have three or four returns, whereas an area of bare earth, such as a beach, may have a much greater return. In areas of low vegetation (such as throughout the site) the returns are high and therefore the DEM is more accurate than in heavily vegetated areas.

1.2.2 Subsurface Explorations

PBS explored subsurface conditions within areas targeted for development by observing exploration of 12 test pits to depths of up to 8.5 feet below the existing ground surface (bgs). The test pits were logged and representative soil samples collected by a member of the PBS geotechnical engineering staff. Interpreted test pit logs are included as Figures A1 through A6 in Appendix A, Field Explorations.

1.2.3 Geologic Hazards Analysis

Data collected during our site reconnaissance, literature research, and desktop review were used to identify site-specific geologic hazards for future geotechnical considerations and site development.

1.2.4 Report Preparation

This geologically hazardous areas assessment report summarizes the results of our work including information relating to the following:

- Field exploration logs and site plan showing approximate exploration locations
- Discussion of site geology and applicable regional geology
- Discussion of existing slope conditions:
  - Slope inclinations/gradients
  - Slope heights
  - Slope processes
- Discussion of mapped hazards:
  - Erosion hazard
  - Liquefaction hazard
  - Steep slopes
  - Seismicity and faulting
- Geologic hazard conclusions
- Groundwater considerations
- Preliminary geotechnical design considerations

1.3 Project Understanding

PBS understands that BrightNight Solar is currently assessing the feasibility of developing an approximately 12,000-acre parcel into 3,000- to 4,000-acre PV arrays (Figure 2). The site will transmit power via a future transmission line to the Midway Substation located approximately 17 miles north and adjacent to the Columbia River. Future site structures will likely include single-story structures for the maintenance and operations center, and associated access roads.

2 SITE CONDITIONS

2.1 Surface Description

The site is located within the Yakima Valley and east-northeast of the town of Sunnyside, Washington, in Benton County. The site is positioned along a broad, relatively flat piedmont along the south side of the Rattlesnake Hills (Figure 1). Elevations throughout the site range from approximately 2440 feet in the northeast to 1049 feet in the southwest (NAVD 88; Figure 3). The piedmont consists of an approximately 4% average slope that slopes from the northeast down to the south and southwest (Figure 4). The ground surface is largely vegetated with sagebrush and grasses and has numerous rudimentary access roads created from driving over in situ site soils; some access roads have been improved by surfacing with gravel.

The piedmont is incised by near-linear drainages that are pronounced within LiDAR hillshades and slopeshades in the accompanying report figures (Figure 3, 4, and 5). The piedmont is characterized as a relatively flat surface with deeply incised linear drainages. A subtle slope break between 1770 feet and 1640 feet coincides with the termination of some of the linear drainages, and more frequent V-shaped patterns within the contours depicted on Figure 3.

The drainages, consisting of the Black Canyon, Spring Creek, and unnamed drainages, are incised into the piedmont and are bedrock control drainages with seasonal ephemeral streams. Abrupt slope breaks within the drainages that exceed 33% generally coincide with bedrock outcrops observed in the field and within the LiDAR DEM. The drainages slopes are on the order of 15 to 40% slope (Figure 4, Figure 5). Geologically hazardous slopes as outlined by BCC15.12.020 are present primarily within the drainages and along Sage Brush Ridge (Figure 5).

Sage Brush Ridge forms a near-linear, east-west oriented ridgeline and local topographic high point near the toe of the piedmont and is an anticlinal fold (to be discussed in additional detail in the local geology section). A water gap formed by the confluence of Spring Creek and several unnamed creeks truncates Sage Brush Ridge near the southern extent of the site.

2.2 Regional Geologic Setting

The site is located within the Columbia Basin geologic province and positioned within the Yakima fold and thrust belt (YFTB), a structural-tectonic sub-province occupying the western extent of the greater Columbia Basin geologic province (Figure 6). The Columbia Basin province is composed primarily of volcanic basement rocks of the Columbia River Basalt Group (CRBG) subdivided into smaller recognizable flows and members that are overlain by Quaternary deposits (Derkey et al., 2006). These older flood basalts were generated by volcanic eruptions in eastern Oregon, eastern Washington, and western Idaho during the Miocene between 16.7 million years ago (Ma) and 5.5 Ma (Reidel, 2004).

The YFTB is an actively deforming series of faults and folds that is accommodating clockwise rotation through crustal shortening within the western Columbia Province (McCaffrey et al., 2016). Northwest-southeast and east-west trending anticlinal ridges and wide synclinal valleys dominate much of the YFTB forming near-linear ridgelines of deformed CRBG bedrock with pervasive thrust faults bounding the flanks of these fold complexes (Gomberg et al., 2012).

The Yakima Valley is bounded to the north by the Rattlesnakes Hills and to the south by the Horse Heaven Hills and Toppenish Ridge. Throughout the Pleistocene, cataclysmic outburst flood waters from Glacial Lake Missoula (Missoula Floods) resulted in rapid sedimentation as floodwaters ponded behind the Horse Heaven Hills Anticline and inundated the Yakima Valley. Slowing flood waters blanketed the southern Columbia Basin with slackwater flood deposits deposited over much of the low-lying areas, as well as created extensive gravel bar complexes near the Columbia River. After glacial outburst flooding, reworking of fine-grained material by aeolian processes has created deposits of loess in elevated areas that were not directly affected by glacial floodwaters (Reidel and Fecht, 1994; Schuster, 1994).

2.3 Local Geology

The site is mapped as underlain by multiple geologic units consisting of Holocene to Pleistocene age loess, Holocene to Pleistocene age alluvium, and Tertiary age volcanic rocks of the Columbia River Basalt Group (CRBG) (Reidel and Fecht, 1994; Figure 7). Loess occupies the low gradient surfaces of the piedmont as depicted on map unit Ql (Figure 6). The Holocene to Pleistocene age alluvium (map unit Qal) is primarily mapped within the drainage floor of Black Canyon, Spring Creek, and the unnamed tributary drainage that forms a confluence with Spring Creek near Sage Brush Hill. CRBG bedrock is mapped primarily within drainage slopes.

Field reconnaissance indicates the loess is a relatively thin veneer of sediment accumulation estimated on the order of less than 5 feet thick and blanketing older CRBG bedrock, as well as drainage slopes. Bedrock observed throughout the site was generally discontinuous lineaments protruding through the loess along drainage slopes. Bedrock was exposed within the floor of some drainages indicating the rate of sedimentation from typical slope processes, such as soil creep, is outpaced by periodic flows within the drainages. In addition, bedrock and bedrock float (out of place rocks and cobbles embedded within the soil) was observed within the smaller, less distinguishable swales that drain into the more pronounced drainages. Limited bedrock exposures were also observed near the toe of Sage Brush Ridge.

Sage Brush Ridge is mapped as an anticlinal fold by Reidel and Fecht (1994) and an undifferentiated fold within the WADNR Geologic Portal. This feature forms a near-linear high point that is distinguishable from the subtle slope of the piedmont due to its stark, east-west orientation and elevated ridgeline. Anticlines form topographic high points by deforming bedrock through compressive tectonic forces. Anticlinal folds typically coincide with a fault boundary within the YFTB; however, review of the USGS Quaternary Fault and Fold Database does not indicate the presence of a fault (Figure 9).

2.4 Subsurface Conditions

The site was explored by excavating 12 test pits, designated TP-1 through TP-12, to depths between 1.5 and 8.5 feet bgs. All the test pits were terminated due to refusal in basalt bedrock. The excavation was performed by Van Belle Excavating, LLC, of Grandview, Washington, using a Deere 50G excavator outfitted with a 24-inch-wide, toothed bucket.

PBS has summarized the subsurface units as follows:

SILT (ML):	Brown silt with variable fine-grained sand content was found at and below the surface in all test pits except test pit TP-7. Silt was intermixed with orange, coarse-grained sand in test pit TP-4. The silt extended to depths of up to 8.5 feet bgs but generally was less than 3 feet thick. The silt exhibited low plasticity and was dry to moist.
Silty SAND (SM):	Brown, fine-grained sand intermixed with silt was found at the surface of test pit TP-7. The sand was dry and extended to a depth of 3 feet bgs.
BASALT:	All test pits terminated in basalt at depths ranging from 1.5 to 8.5 feet bgs. The basalt was dark gray with a white, mineral crust and was generally slightly to moderately vesicular and unweathered. Test pits were able to penetrate up to 2 feet into basalt with the equipment used for exploration.

2.5 Groundwater

Static groundwater was not encountered during our explorations. We anticipate that the static groundwater level is present at a depth greater than 100 feet bgs given the lack of flows, seepages, or springs within the drainages. Please note that groundwater levels can fluctuate during the year depending on climate, irrigation season, extended periods of precipitation, drought, and other factors.

In addition, springs and seeps were not observed at the time of our reconnaissance and the ephemeral streams located throughout the site were absent of stream flow.

3 GEOLOGICALLY HAZARDOUS AREAS

Geologically hazardous areas are areas established under WAC 354-190-120 and adopted under Benton County Code (BCC) 15.12 that include erosion hazards, landslide hazards, seismic hazards, and volcanic hazards. For the purpose of this geologically hazardous areas assessment, we are applying the criteria of BCC 15.12 to further assess site hazards.

3.1 Critical Areas Code Review

Review of Benton County GIS layers identified the following geologic hazards within the site: (1) erosion hazard, (2) landslide hazard, and (3) seismic hazards. We have compiled the county code and used **bold** to indicate portions of the code that apply to this site.

(1) Erosion Hazard Areas BCC 15.12.020 (a)

- **Slopes between 15% and 39%;**
- **Slopes 40% or greater; or**
- **Slopes 15% or greater that contain soils or soils complexes identified by the US Department of Agriculture's Natural Resource Conservation Service or the Soil Survey for Benton County as having "severe" or "very severe" erosion hazard potential.**

(2) Landslide Hazard Areas BCC 15.12.020 (b)

- **Slopes 15% or greater that have a relatively permeable geologic unit overlying a relatively impermeable unit and have springs or groundwater seeps;**
- **Slopes 40% or greater with a vertical relief of 10 or more feet except areas composed of competent rock and properly engineered slopes designed and approved by a geotechnical engineer licensed in the state of Washington and experienced with the site;**
- **Potentially unstable slopes resulting from rapid river or stream incision, river or stream bank erosion, or undercutting by wave action. These include slopes exceeding 10 feet in height adjacent to rivers, streams, lakes and shorelines with more than a 35% gradient;**
- Areas that have shown evidence of historical failure or instability, including, but not limited to, back-rotated benches on slopes; areas with structures that exhibit structural damage such as settling and racking of building foundations; and areas that have toppling, leaning, or bowed trees caused by ground surface movement;
- Slopes having gradients steeper than 80% subject to rock fall during seismic shaking;
- **Areas that are at risk of mass wasting due to seismic forces;**
- Areas of historical landslide movement; or
- Areas mapped by the State of Washington Department of Natural Resources as landslides or landslide deposits.
- Areas identified as landslide runout areas or areas at the top and sides of landslide hazards likely to slide.

(3) Seismic Hazards Areas BCC 15.12.020 (c)

- **Seismic hazard areas shall include areas subject to a severe risk of earthquake damage as a result of seismically induced ground shaking, differential settlement, slope failure, settlement,**

> **lateral spreading, mass wasting, surface faulting or soil liquefaction. They include areas identified by the State of Washington Department of Natural Resources as having liquefaction susceptibility of moderate, moderate to high, and/or high.**

3.2 Erosion Hazards

The United States Department of Agriculture (USDA) defines soil erosion as the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, and gravity. PBS evaluated soil erosion at the site using the USDA Web Soil Survey (WSS) tool, which provides soil data and information produced by the National Cooperative Soil Survey (Appendix B). The WSS was used to identify the mapped soil types at the site, the relative percentages of each soil type present at the surface, soil erosion factors, and to determine the extent of severely erodible soils as designated by the USDA.

Erodibility data as supplied by the WSS does not take anthropogenic activity and recent natural events into consideration. Human activity such as grading, devegetation, modifications to natural runoff, etc., can all increase or decrease the erodibility of site soils. Similarly, recent natural events such as wildfire or extreme weather can alter erodibility of soils.

3.2.1 Wind Erosion

Soil erodibility due to wind is expressed in two ways: as a numerical designation known as the wind erodibility group (WEG) and as the quantitative wind erodibility index (WEI) expressed in tons per acre per year. As WEI increases, erodibility increases. The WEG ranges from 1 to 8 with soils in group 1 being the most susceptible to erosion and those assigned to group 8 being the least susceptible. These values for soils mapped over more than 1% of the site surface are listed in Table 1.

Table 1. Wind Erodibility

Map Unit Name	Percent Exposed at Site Surface	Wind Erodibility Index (tons/acre/year)	Wind Erodibility Group
Burke Silt Loam (BnB) Shallow, 0 to 5% Slopes	4.1	56	5
Finley Stony Fine Sandy Loam (FfE) 0 to 30% Slopes	2.5	56	5
Kiona Very Stony Silt Loam (KnE) 0 to 30% Slopes	7.6	38	7
Kiona Very Stony Silt Loam (KnF) 30 to 65% Slopes	2.8	38	7
Ritzville Silt Loam (ReB) 0 to 5% Slopes	12.9	56	5
Ritzville Silt Loam (ReE3) 15 to 30% Slopes, Severely Eroded	2.7	56	5
Ritzville Silt Loam (ReF) 30 to 65% Slopes	1.6	56	5
Scooteney Silt Loam (ScAB) 0 to 5% Slopes	1.2	56	5
Shano Silt Loam (ShAB) 0 to 5% Slopes	1.4	56	5
Willis Silt Loam (WsB) 0 to 5% Slopes	5.7	56	5
Willis Silt Loam (WsE3) 15 to 30% Slopes, Severely Eroded	4.5	56	5
Willis Silt Loam, Shallow (WtD) 0 to 15% Slopes	51.0	56	5

Based on review of the USDA data for this site, we believe the risk of wind erosion is low to moderate, with the lowest value wind erodibility group of 5 and the highest of 7. Note that site grading or devegetation are expected during future site development and can increase the risk of wind erosion. Natural events such as wildfire, extended periods of low precipitation, and high winds can also increase wind erosion.

3.2.2 Water Erosion

A soil's susceptibility to sheet or rill erosion due to water is indicated by a K factor and is further subdivided into the rock free and the whole soil components. Estimated K factors are based on the percentage of silt, sand, and organic matter; the soil structure; slope angle; saturated hydraulic conductivity; and other factors. Generally, the higher the K factor, the greater the risk of erodibility. Values range from 0.02 for the least erodible soils to 0.64 for the most erodible soils. The whole soil K factor indicates the erodibility of the entire soil, and the rock free K factor indicates the erodibility of the component of the soil less than 2 millimeters in size. K factors for soils mapped over more than 1% of the site surface are listed in Table 2.

Review of USDA soils data indicates two soil units (highlighted orange in Table 2) are mapped as severely eroded: the Ritzville Silt Loam and Willis Silt Loam (Figure 8). These soils are mapped within site drainages and are presented on Figure 6. LiDAR review of site slopes mapped as severely eroded did not indicate the presence of geomorphic indicators of severe erosion such as extensive rills and gullies, nor were these indicators observed at the time of our reconnaissance. As such, severe erosion hazards are likely limited to extreme weather events and a small percentage of site slopes.

Table 2. Site Soil K Factors

Map Unit Name	Percent Exposed at Site Surface	K Factor Whole Soil	K Factor Rock Free
Burke Silt Loam (BnB) Shallow, 0 to 5% Slopes	4.1	0.64	0.64
Finley Stony Fine Sandy Loam (FfE) 0 to 30% Slopes	2.5	0.17	0.32
Kiona Very Stony Silt Loam (KnE) 0 to 30% Slopes	7.6	0.20	0.49
Kiona Very Stony Silt Loam (KnF) 30 to 65% Slopes	2.8	0.20	0.49
Ritzville Silt Loam (ReB) 0 to 5% Slopes	12.9	0.55	0.55
Ritzville Silt Loam (ReE3) 15 to 30% Slopes, Severely Eroded	2.7	0.55	0.55
Ritzville Silt Loam (ReF) 30 to 65% Slopes	1.6	0.55	0.55
Scooteney Silt Loam (ScAB) 0 to 5% Slopes	1.2	0.55	0.55
Shano Silt Loam (ShAB) 0 to 5% Slopes	1.4	0.55	0.55
Willis Silt Loam (WsB) 0 to 5% Slopes	5.7	0.55	0.55
Willis Silt Loam (WsE3) 15 to 30% Slopes, Severely Eroded	4.5	0.55	0.55
Willis Silt Loam, (WtD) Shallow, 0 to 15% Slopes	51.0	0.64	0.64

3.3 Landslide Hazards

PBS generated a slopeshade and classified slope inclinations as percent slope with the approximate horizontal to vertical slope correlation presented on Figures 4 and 5. The purpose of this is to provide a visual aid to understand the current site slope inclinations and to draw attention to slopes of concern from a slope stability standpoint. The crest of the drainage slopes is poorly defined, as the transition from the piedmont to the drainages is gradual. For the purpose of discussion, we define the crest of slopes as the distal upslope extent of the 15 to 33% slope category displayed on Figure 5.

All slopes are typically subjected to varying amounts of soil creep (the slow process of soil gradually moving downslope under the influence of gravity), and the rate of soil creep typically increases as slope inclination increases. Slopes composed of bare soil are typically subjected to higher rates of erosion and soil creep when compared to vegetated or artificially stabilized slopes.

As a general guideline, slopes less than 33% (or less than 3H:1V) have the lowest risk of failure, as they are generally inclined flatter than the angle of repose (approximately 66.7% slope or 1.5H:1V) and less likely to fail without influence from an extreme weather event, upslope failures, or seismic shaking. Slopes between 33% and 66.7% (3H:1V to 1.5H:1V) are a low risk and may be subjected to a higher rate of soil creep and shallow failures by changes in groundwater conditions, geologic conditions (impermeable layers directing water to the surface of a slope), or extreme weather events (high intensity rainfall or rapid snow melt), or due to seismic shaking. Slopes greater than 66.7% (>1.5H:1V) are of moderate to high risk to shallow and deep-seated failures. Slopes greater than 100% (1H:1V) are a high risk of shallow and deep-seated failures.

Typically, slopes exceeding 66.7% that are prone to failure have existing indications of past failures such as scarps, slide deposits, debris fields, hummocks, or scallops within a slope crest; all of which are typically visible within LiDAR DEMs, especially when reviewing a large area with similar geologic conditions. To provide context for this site, review of available LiDAR did not indicate evidence of past failures throughout the drainage slopes. The lack of historical failures may be due to (1) the lack of precipitation necessary to increase the amount of porewater pressure needed to mobilize soils, (2) the frequency and size of failures being small enough to be overprinted by typical soil creep deposition, or (3) overprinting by disturbance from livestock.

Review of the slope shade generated for the site indicates slopes exceeding 15% are found throughout the site and primarily located along the drainage slopes and Sage Brush Ridge. However, these slopes are absent of key geomorphic indicators of previous or recent slope failures based on LiDAR review and field observations.

Bedrock outcrops observed during our field reconnaissance were typically parallel to drainage slopes where slopes exceed 50%. Cliff-forming vertical bedrock outcrops of basalt were observed and are typically less than 5 feet in height. This is further corroborated by measurements made from the LiDAR DEM.

Slope heights were estimated by measuring the DEM from the toe of the slope to the maximum upslope extent of areas identified as 15 to 33% slope (crest). Slope heights typically decrease from north to south within the drainages, with a maximum slope height of 182 feet near the project boundary in Spring Water Creek (Figure 5).

Changes in groundwater elevations, rainfall, snowmelt, wildfire, etc., can increase the potential for slope movements and erosion, in addition to site grading and surface modifications during construction. Seismic loading can further destabilize slopes.

3.4 Seismic Hazards

Seismic hazards and faulting for the site were evaluated by review of the USGS Quaternary Faults and Fold database.

3.4.1 Seismic Sources

Several types of seismic sources exist in the Pacific Northwest, including Cascadia Subduction Zone (CSZ) interface earthquakes, intraslab earthquakes, crustal faults, and volcanic sources. For the purpose of this study, CSZ earthquakes, intraslab earthquakes, and volcanic sources are not considered as seismic sources due to their distant proximity to the site.

3.4.2 Crustal Earthquakes and Faults

Faults within the US Geological Survey Quaternary Fault and Fold Database within close proximity to the site (less than 25 km), with numerous fault traces of undifferentiated Quaternary age (<1.6 million years) belonging to the Rattlesnake Hills structures and Horse Heaven Hills Structures, are summarized in Table 3 and on Figure 9 (USGS, 2022). The closest fault traces are located approximately 10 km north of the site.

Table 3. Faults within the Site Vicinity

Fault Zone Name	Fault ID	Approximate Distance to Site (Surface Projection in km)
Rattlesnake Hills Structures	565	10
Horse Heaven Hills Structures	567	15

These faults are class A faults, meaning that their existence is demonstrated through offsets of Quaternary age geologic units, geomorphic expression, liquefaction, and other deformational features. While the age of these faults is poorly constrained, they are on strike with other crustal faults, such as the Wallula fault system (USGS fault id 846) and Toppenish Ridge (USGS fault id 566), identified as latest Quaternary age (<15,000 years), which is approaching the age of a Holocene-active fault (11,700 years) as recognized by the state of California. It should be assumed that the identified faults can produce local seismicity and ground shaking that could impact the site.

3.4.3 Fault Surface Rupture

Fault surface rupture is the expression of surface deformation generated from an earthquake at the surface of a fault generated at the time of an earthquake. Surface rupture can result in vertical offsets, lateral offsets, or both. Fault traces are not mapped within the project boundary, and as such, fault surface rupture is unlikely.

3.4.4 Historical Seismicity

Regional historical seismicity information was acquired from the Advanced National Seismic System (ANSS) Comprehensive Catalog, hosted by the Northern California Earthquake Data Center (NCEDC), and is presented on Figure 10. These data include earthquakes with magnitudes exceeding M 2.5, within a 150-km radius of the site and recorded between 1963 and 2017 (NCEDC, 2017). Magnitudes within the ANSS dataset are recorded as local magnitude, surface-wave magnitude, body-wave magnitude, moment magnitude, and magnitude of completeness.

3.5 Liquefaction Hazards

Liquefaction is defined as a decrease in the shear resistance of loose, saturated, cohesionless soil (e.g., sand) or low plasticity silt soils, due to the buildup of excess pore pressures generated during an earthquake. This results in a temporary transformation of the soil deposit into a viscous fluid. Liquefaction can result in ground settlement, foundation bearing capacity failure, and lateral spreading of ground.

Based on a review of the Washington Division of Geology and Earth Resources, the majority of the site is mapped as having either no susceptibility due to the presence of shallow bedrock, or low to moderate susceptibility (Figure 11). Some areas of high liquefaction susceptibility are present within some drainages, mostly in the southeastern portion of the site. Based on the shallow bedrock observed and lack of groundwater within site soils, our current opinion is that the risk of structurally damaging liquefaction settlement at the site is low to none outside of the site drainages.

4 GEOLOGIC HAZARD CONCLUSIONS AND RECOMMENDATIONS

PBS has summarized our findings and provided comments regarding how site-specific geotechnical hazards present at the site can be addressed based on review of Benton County Code (BCC) as adopted from WAC 365-190-120.

BCC 15.12.020 (b) Erosion Hazard Areas	PBS Comments
(1) Slopes between 15% and 39%.	• Primarily located within drainages, drainage crests, and Sage Brush Ridge. • Avoid these areas to limit disturbance and an reduce erosion potential or implement erosion control.
(2) Slopes 40% or greater.	• Primarily located within drainages, drainage crests, and Sage Brush Ridge. • Avoid these areas to limit disturbance and reduce erosion potential or implement erosion control.
(3) Slopes 15% or greater that contain soils or soil complexes identified by the US Department of Agriculture's Natural Resource Conservation Service or the Soil Survey for Benton County as having "severe" or "very severe" erosion hazard potential.	• Applies to site drainages consisting of the Ritzville Silt Loam and Willis Silt Loam, as depicted on Figure 8. • Soil erosion is likely limited due to shallow bedrock conditions, as observed within the LiDAR DEM and field reconnaissance.

BCC 15.12.020 (b) Landslide Hazard Areas	PBS Comments
(1) Slopes 15% or greater that have a relatively permeable geologic unit overlying a relatively impermeable unit and have springs or groundwater seeps.	• Site slopes predominately consist of shallow bedrock, which should be considered an impermeable layer, overlain by a thin veneer of soil, which should be considered permeable. • Springs and seepage were not observed at the time of our reconnaissance, ephemeral streams had no flow, and depth to water is estimated as greater than 100 feet bgs due to the lack of seepage and springs located within drainage slopes at the time of reconnaissance. • Shallow bedrock conditions are likely persistent throughout slope drainages, as noted at the time of our reconnaissance. Shallow failures may occur within drainages, but review of LiDAR and our field reconnaissance did not indicate the presences of previous failure morphology.
(2) Slopes 40% or greater with a vertical relief of 10 or more feet except areas composed of competent rock and properly engineered slopes designed and approved by a geotechnical engineer licensed in the state of Washington and experienced with the site.	• Primarily located within drainages. • Review of LiDAR does not indicate the presences of rockfall talus nor was it observed during our field reconnaissance. • Hazard is likely low due to the lack of exposed rock faces.

BCC 15.12.020 (b) Landslide Hazard Areas	PBS Comments
(3) Potentially unstable slopes resulting from rapid river or stream incision, river or stream bank erosion, or undercutting by wave action. These include slopes exceeding 10 feet in height adjacent to rivers, streams, lakes, and shorelines with more than a 35% gradient.	• Given the shallow bedrock conditions, scouring would likely only remove soil colluvium accumulated at the toe of drainage slopes.
(4) Areas that have shown evidence of historical failure or instability, including, but not limited to, back-rotated benches on slopes; areas with structures that exhibit structural damage, such as settling and racking of building foundations; and areas that have toppling, leaning, or bowed trees caused by ground surface movement.	• Evidence of previous failures not observed within LiDAR DEM or at time of field reconnaissance.
(5) Slopes having gradients steeper than 80% subject to rock fall during seismic shaking.	• Primarily located within drainages. • Does not apply due to limited exposures of rock mass.
(6) Areas that are at risk of mass wasting due to seismic forces.	• Shallow failures may occur within soils along drainage slopes and Sage Brush Hill due to local seismicity. Previous failures not observed within LiDAR DEM.
(7) Areas of historical landslide movement.	• Does not apply to site slopes.
(8) Areas mapped by the State of Washington Department of Natural Resources as landslides or landslide deposits.	• Does not apply to site slopes.
(9) Areas identified as landslide runout areas or areas at the top and sides of landslide hazards likely to slide.	• Does not apply to site slopes.

PBS has summarized our assessment of geologic hazards as follows:

- Our current opinion from observing site slopes in the field and reviewing the LiDAR DEM did not observe signs of recent or historical instability under current conditions. As such, the risk of slope instability to the development is low, considering the PV array will target areas with slope inclinations of less than 15 to 33%, which is outside of the defined slope crest.
- Common indicators of unstable slopes were not observed within the LiDAR DEM or during our field reconnaissance. While site slopes exhibit a height of greater than 100 feet in some areas, shallow bedrock will likely limit slope movement to shallow failures unlikely to impact the PV array or site structures.
- The shallow bedrock encountered throughout the site slopes would likely limit slope movements to shallow failures if they were to occur. Affected areas are generally limited to site drainages and Sage Brush Hill.
- Seismic shaking may induce shallow failures; however, previous/historical failures were not observed within the LiDAR DEM or at the time of our reconnaissance.

- The USDA erosion hazard for this site is variable. Site slopes are currently vegetated and unlikely to erode due to typical wind or water without removal of vegetation. We anticipate most construction activity will occur within areas with slope inclinations of less than 30% and outside of the drainages that consist of severely erodible soils.
- Liquefaction susceptibility is low due to the presence of shallow bedrock throughout the piedmont, and undetermined within the drainages mapped as having a moderate to high liquefaction susceptibility by WADNR. As site structures and PV arrays will not be placed within these drainages, additional assessment within the drainages is unnecessary.

4.1 Geotechnical Exploration Considerations

4.1.1 Slope Stability Analyses

Slope stability is influenced by various factors, including: (1) the geometry of the soil mass and subsurface materials, (2) the weight of soils overlying the failure surface, (3) the shear strength of soils and/or rock along the observed or potential failure surface, and (4) the hydrostatic pressure (groundwater levels) along that surface. The stability of a slope is expressed in terms of factor of safety (FS), which is defined as the ratio of resisting forces to driving forces. At equilibrium, or incipient failure, the FS is equal to 1.0 and the driving forces are balanced by the resisting forces. Failure occurs when the driving forces exceed the resisting forces, i.e., FS less than 1.0. An increase in the FS above 1.0, whether by increasing the resisting forces and/or decreasing the driving forces, reflects a corresponding increase in the stability of the slope. The actual FS may differ from the calculated FS due to uncertainty in soil strengths, subsurface geometry, failure surface location and orientation, groundwater levels, and other factors that are not completely known or understood.

Indications of historical slope failures, including scarps, tension cracks, etc., were not observed within the LiDAR DEM or at the time of our reconnaissance, suggesting that the slopes are generally stable under the current conditions. In addition, shallow bedrock conditions are likely persistent throughout the drainage slopes; as such, a slope stability analysis was not performed, as the results would yield little value to assessing slope hazards. Slope failures will likely be superficial based on the depth to bedrock observed in explorations and limited to drainages.

4.2 Preliminary Geotechnical Design Considerations

Subsurface conditions encountered in our explorations generally consist of 1 to 8 feet of a variable mixture of silt and fine-grained sand overlying basalt bedrock. Based on our observations and analyses, conventional foundation support on shallow spread footings is feasible for the proposed structures. Excavation with conventional equipment is limited to the depth of the overlying silt and sand soils. Excavating utility trenches through bedrock will likely require, at a minimum, use of a 30,000-pound or larger excavator equipped with rock teeth and an excavator-mounted pneumatic hammer. Typically, we recommend using two excavators and operators simultaneously for these operations to limit lost time due to switching between the bucket and hammer. Blasting may be required if project plans include excavations that penetrate more than a few feet into bedrock.

Solar arrays are commonly anchored in soils using driven, small-diameter pipe piles, drilled shafts, or helical piles. In general, these piles have limited application at this site due to shallow bedrock generally encountered in our explorations. Drilled shafts are practically feasible, but may not be economically feasible. Anchorage in bedrock, which will require use of a down-the-hole (DTH) hammer or other specialty equipment, will likely be required.

The grading and final development plans for the project had not been completed when this report was prepared. Once completed, PBS should be engaged to review the project plans and update our considerations, as necessary.

4.3 Future Geotechnical Work

PBS understands additional geotechnical support will be required to advance this project. Future geotechnical work is expected to include:

- Additional exploration within areas where solar arrays will be installed
- Engineering analyses to develop recommendations for PV array foundations and site grading
- Additional exploration intended to support design and construction of transmission lines and other infrastructure
- Following additional explorations and engineering analyses, PBS should review project plans for conformance with geotechnical recommendations

5 LIMITATIONS

This report has been prepared for the exclusive use of the addressee, and their architects and engineers, for aiding in the design and construction of the proposed development and is not to be relied upon by other parties. It is not to be photographed, photocopied, or similarly reproduced, in total or in part, without express written consent of the client and PBS. It is the addressee's responsibility to provide this report to the appropriate design professionals, building officials, and contractors to ensure correct implementation of the recommendations.

The opinions, comments, and conclusions presented in this report are based upon information derived from our literature review and field explorations. It is possible that soil, rock, or groundwater conditions could vary between or beyond the points explored. If soil, rock, or groundwater conditions are encountered during construction that differ from those described herein, the client is responsible for ensuring that PBS is notified immediately so that we may reevaluate the recommendations of this report.

Unanticipated fill, soil and rock conditions, and seasonal soil moisture and groundwater variations are commonly encountered and cannot be fully determined by merely taking soil samples or completing explorations such as test pits. Such variations may result in changes to our recommendations and may require additional funds for expenses to attain a properly constructed project; therefore, we recommend a contingency fund to accommodate such potential extra costs.

The scope of work for this subsurface exploration and geologically hazardous areas assessment report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.

If there is a substantial lapse of time between the submission of this report and the start of work at the site, if conditions have changed due to natural causes or construction operations at or adjacent to the site, or if the basic project scheme is significantly modified from that assumed, this report should be reviewed to determine the applicability of the conclusions and recommendations presented herein. Land use, site conditions (both on and off site), or other factors may change over time and could materially affect our findings; therefore, this report should not be relied upon after three years from its issue, or in the event that the site conditions change.

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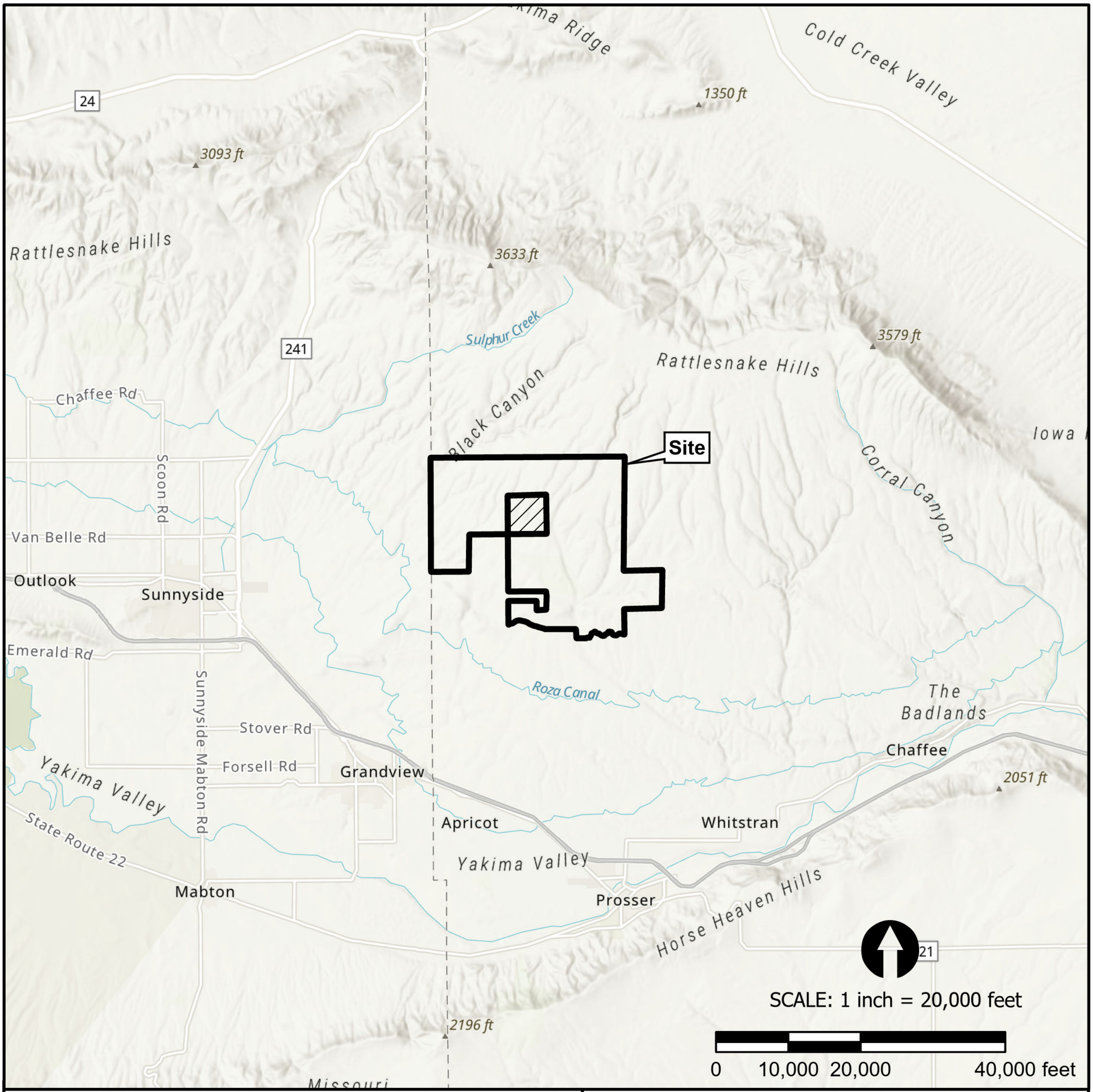
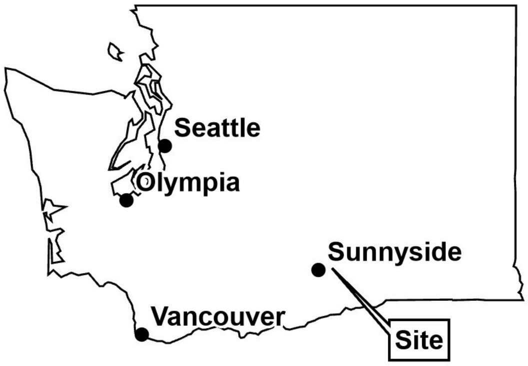
Figures





VICINITY MAP

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

DATE: JULY 2022 · PROJECT: 66388.000

PBS

FIGURE

1

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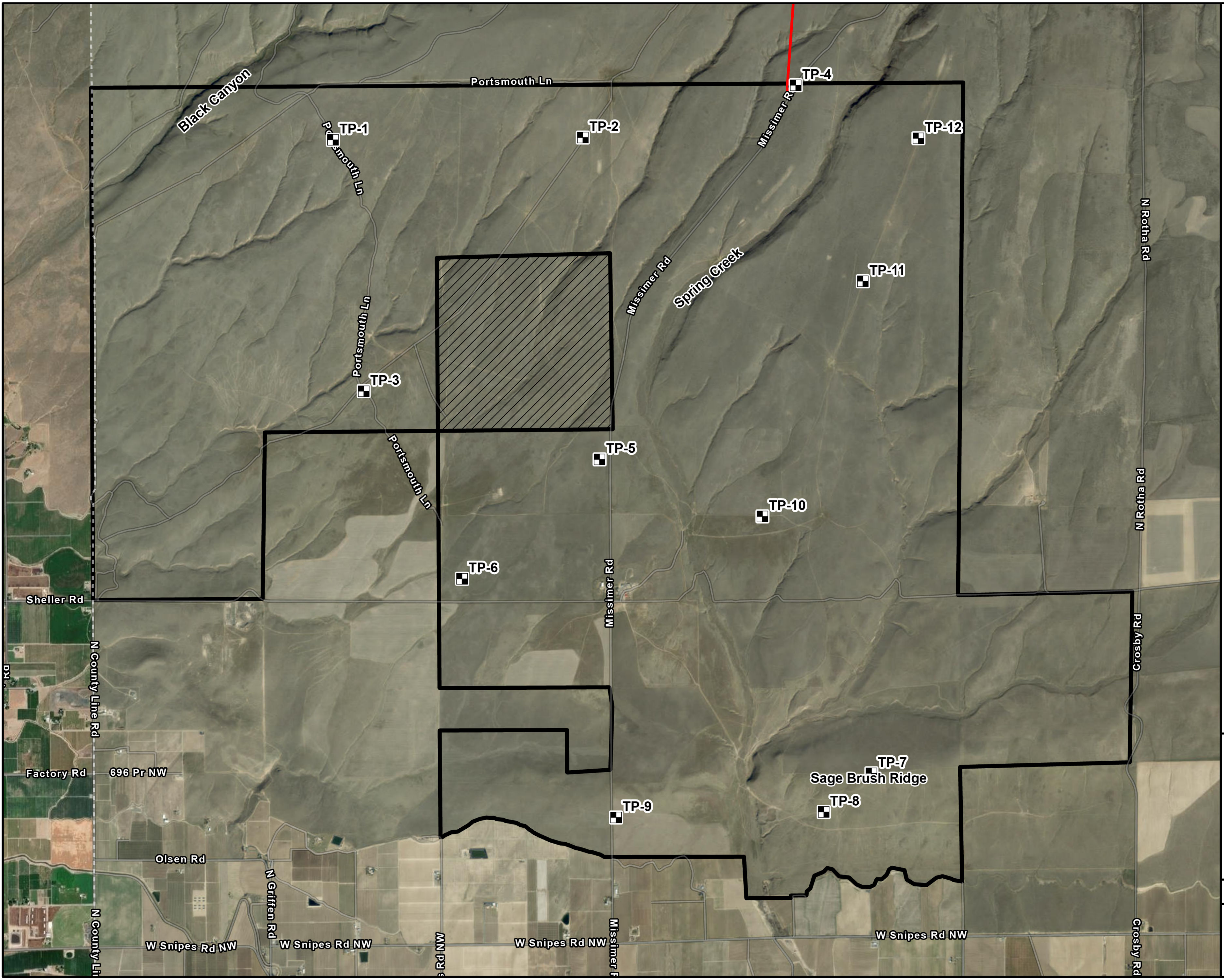

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EXPLANATION

- ▭ Approximate site boundary
- — Approximate location of proposed transmission line
- ▨ Approximate excluded area
- ▚ TP-1 - Test pit name and approximate location

Notes: ESRI World Imagery basemap

Coordinate System: NAD 1983 2011 StatePlane Washington South FIPS 4602 Ft US

SCALE: 1 inch = 3,000 feet

0 1,500 3,000 6,000 feet

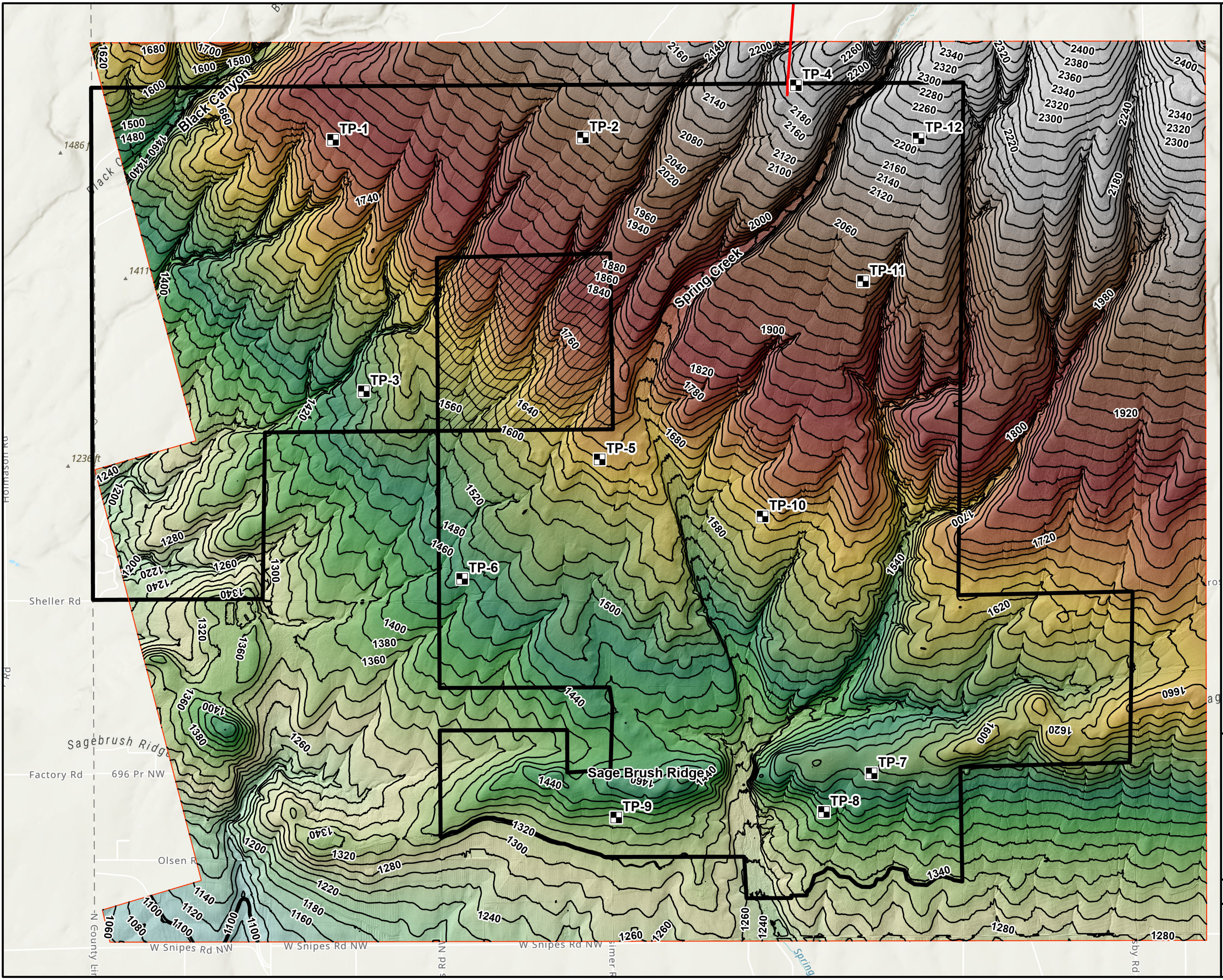
SITE PLAN

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

DATE: JULY 2022 · PROJECT: 66388.000

FIGURE

2



EXPLANATION

- ▣ TP-1 - Test pit name and approximate location
- — 20-foot contour (NAVD 88)
- — Approximate location of proposed transmission line
- ▨ Approximate excluded area
- ☐ Extent of LiDAR DEM
- ▭ Approximate site boundary

LiDAR DEM (ft; NAVD 88)

2440

1049

Notes: USGS 3DEP LiDAR DEM basemap, contours and hillshade derived from DEM

Coordinate System: NAD 1983 2011 StatePlane Washington South FIPS 4602 Ft US

SCALE: 1 inch = 3,000 feet

0 1,500 3,000 6,000 feet

SITE TOPOGRAPHIC MAP

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

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FIGURE

3

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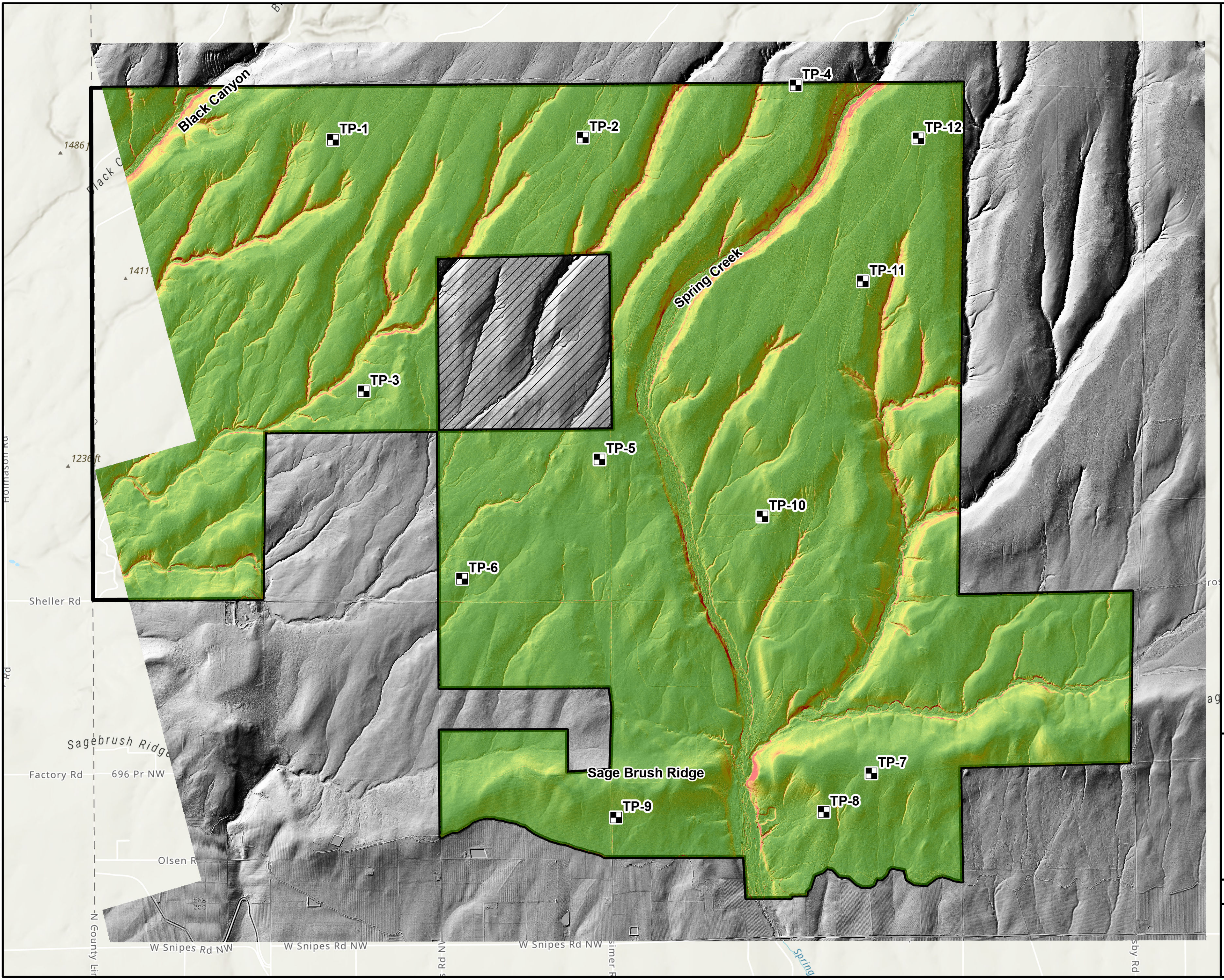

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EXPLANATION

▣ TP-1 - Test pit name and approximate location

▭ Approximate site boundary

▨ Approximate excluded area

Slope inclinations (percent slope)

- 🟩 <5%
- 🟩 5 - 10%
- 🟩 10 - 15%
- 🟨 15 - 20%
- 🟨 20 - 25%
- 🟨 25 - 30%
- 🟧 30 - 45%
- 🟧 45 - 50%
- 🟥 50 - 55%
- 🟥 >55%

Notes: Hillshade and slopeshade derived from USGS 3DEP DEM

Coordinate System: NAD 1983 2011 StatePlane Washington South FIPS 4602 Ft US

SCALE: 1 inch = 3,000 feet

0 1,500 3,000 6,000 feet

SLOPE MAP

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

DATE: JULY 2022 · PROJECT: 66388.000

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FIGURE

4

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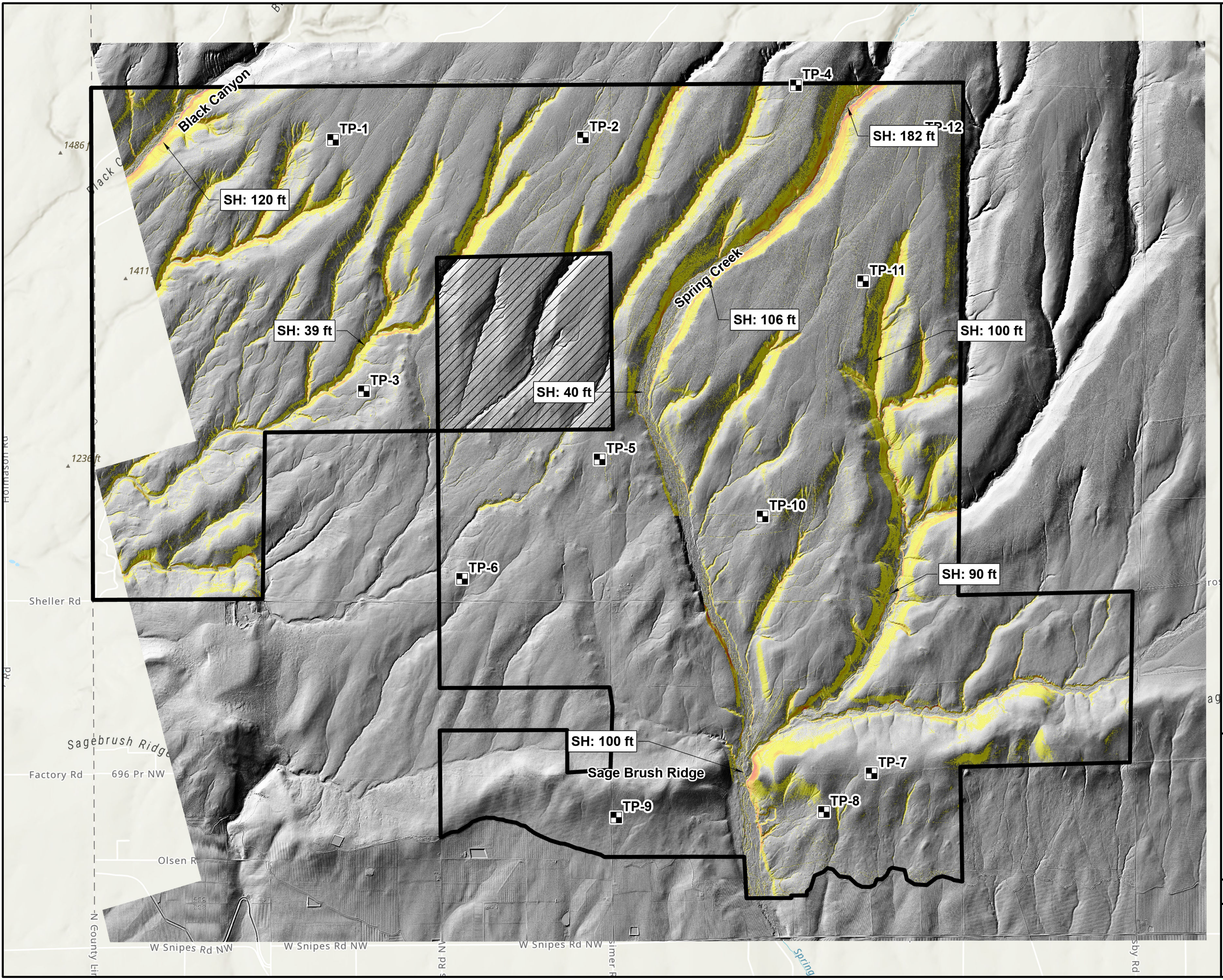

EXPLANATION

▣	TP-1 - Test pit name and approximate location
▭	Approximate site boundary
▨	Approximate excluded area

Slope inclinations (percent slope)

🟨	15 - 33% (<3:1)
🟨	33 - 50% (3:1 - 2:1)
🟧	50 - 66.7% (2:1 - 1.5:1)
🟥	66.7 - 100% (1.5:1 - 1:1)
🟪	>100% (>1:1)

SH: 100 ft Approximate slope height in feet

Notes: Hillshade and slopeshade derived from USGS 3DEP DEM

Coordinate System: NAD 1983 2011 StatePlane Washington South FIPS 4602 Ft US

SCALE: 1 inch = 3,000 feet

0 1,500 3,000 6,000 feet

SLOPE HAZARD MAP

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

DATE: JULY 2022 · PROJECT: 66388.000

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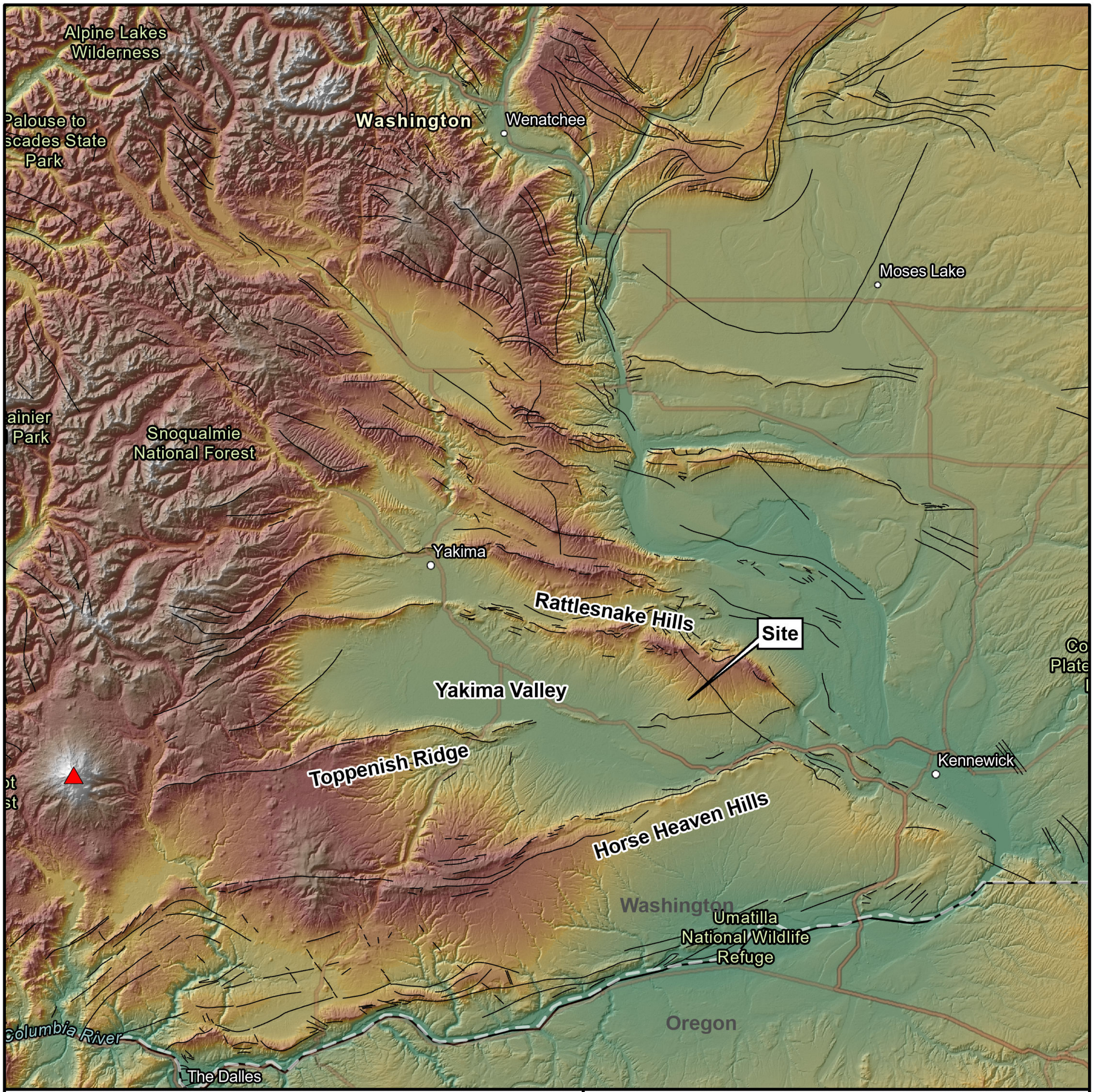
FIGURE

5



EXPLANATION

▲ Mount Adams (active volcano)

— Undifferentiated seismogenic folds (known and suspected)

Notes: SRTM 30-meter DEM with elevation color ramp,
Seismogenic fold layer compiled by WADNR

TECTONIC SETTING

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

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FIGURE

6

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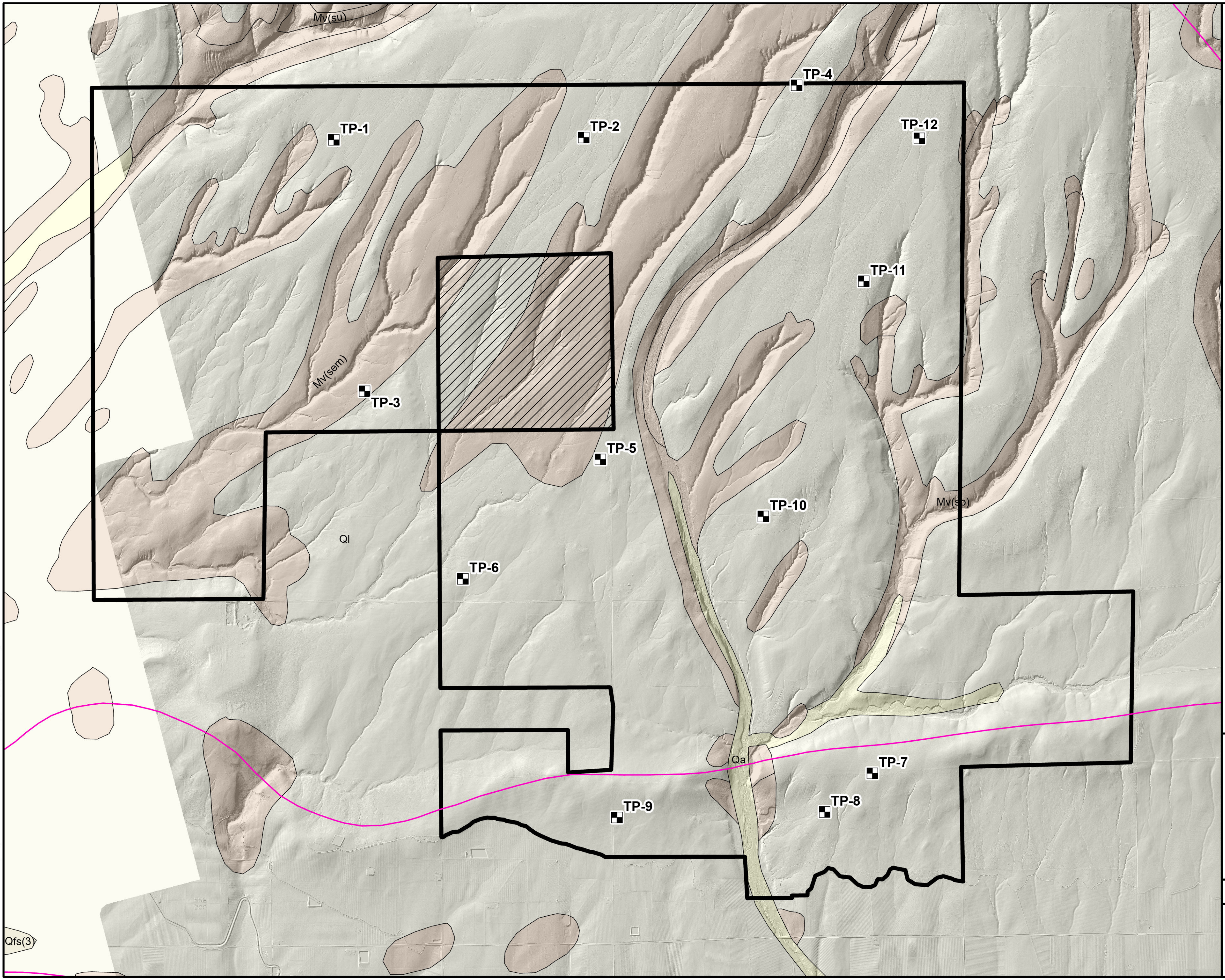

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EXPLANATION

▣	TP-1 - Test pit name and approximate location
▭	ProjectArea
▨	Approximate excluded area
—	Undifferentiated folds
—	Contact - Identity and existence certain, location accurate
■	Quaternary alluvium
■	Quaternary eolian deposits, loess
■	Pleistocene outburst flood deposits
■	Miocene Columbia River Basalt Group, Saddle Mountains Basalt

Notes: WADNR geologic units and undifferentiated folds compiled from Reidel and Fecht (1994) and obtained from WADNR Geologic Information Portal

Coordinate System: NAD 1983 2011 StatePlane Washington South FIPS 4602 Ft US

SCALE: 1 inch = 3,000 feet

0 1,500 3,000 6,000 feet

GEOLOGIC MAP

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

DATE: JULY 2022 · PROJECT: 67910.000

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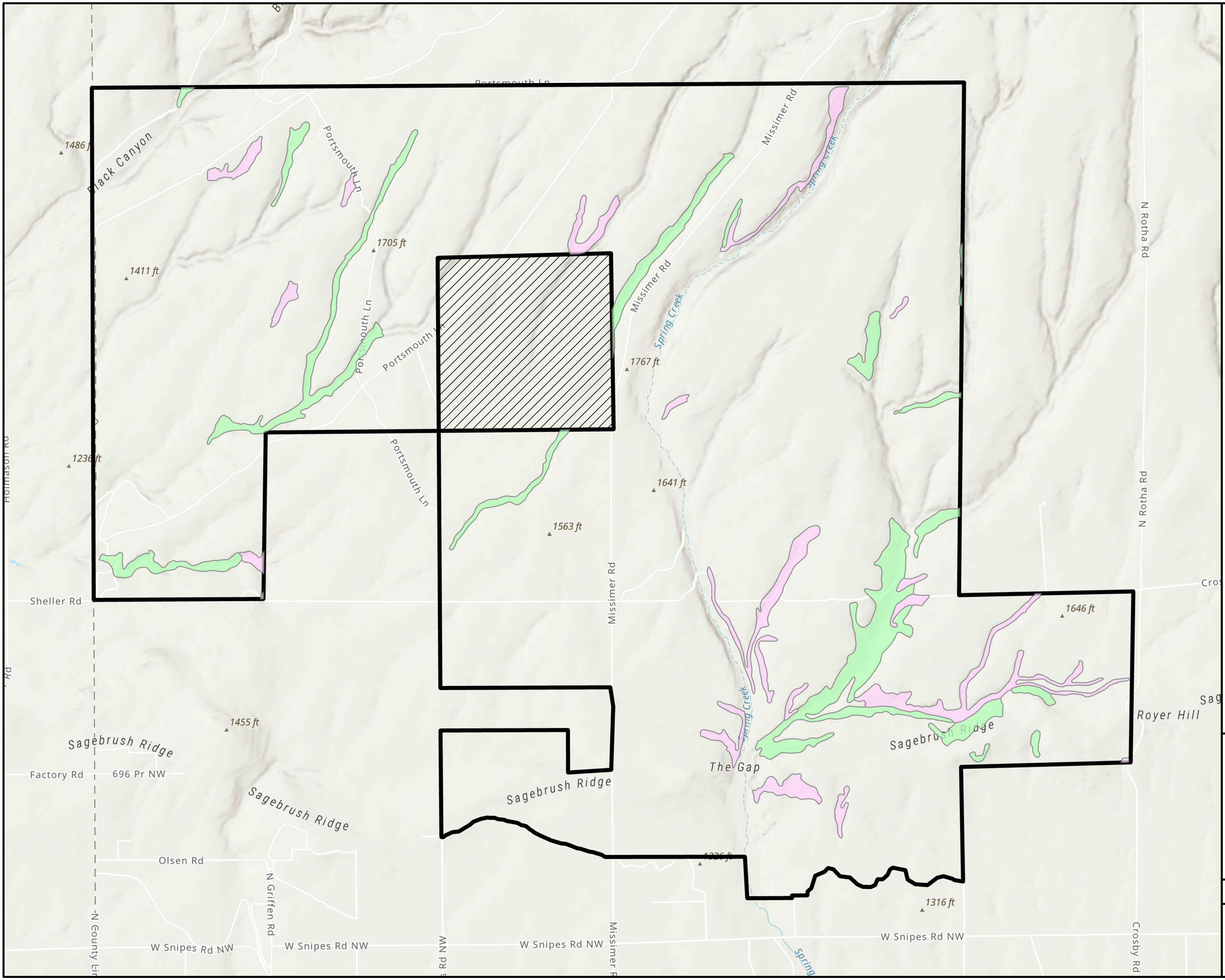
FIGURE

7



EXPLANATION

☐ ProjectArea

▨ Approximate excluded area

USDA Soils

🟪 ReE3 - Ritzville Silt Loam

🟩 WsE3 - Willis Silt Loam

Notes: ESRI World Topographic Map, soil boundaries obtained the the USDA WSS web portal

Coordinate System: NAD 1983 2011 StatePlane Washington South FIPS 4602 Ft US

SCALE: 1 inch = 3,000 feet

0 1,500 3,000 6,000 feet

USDA SEVERELY ERODED SOILS

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

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FIGURE

8

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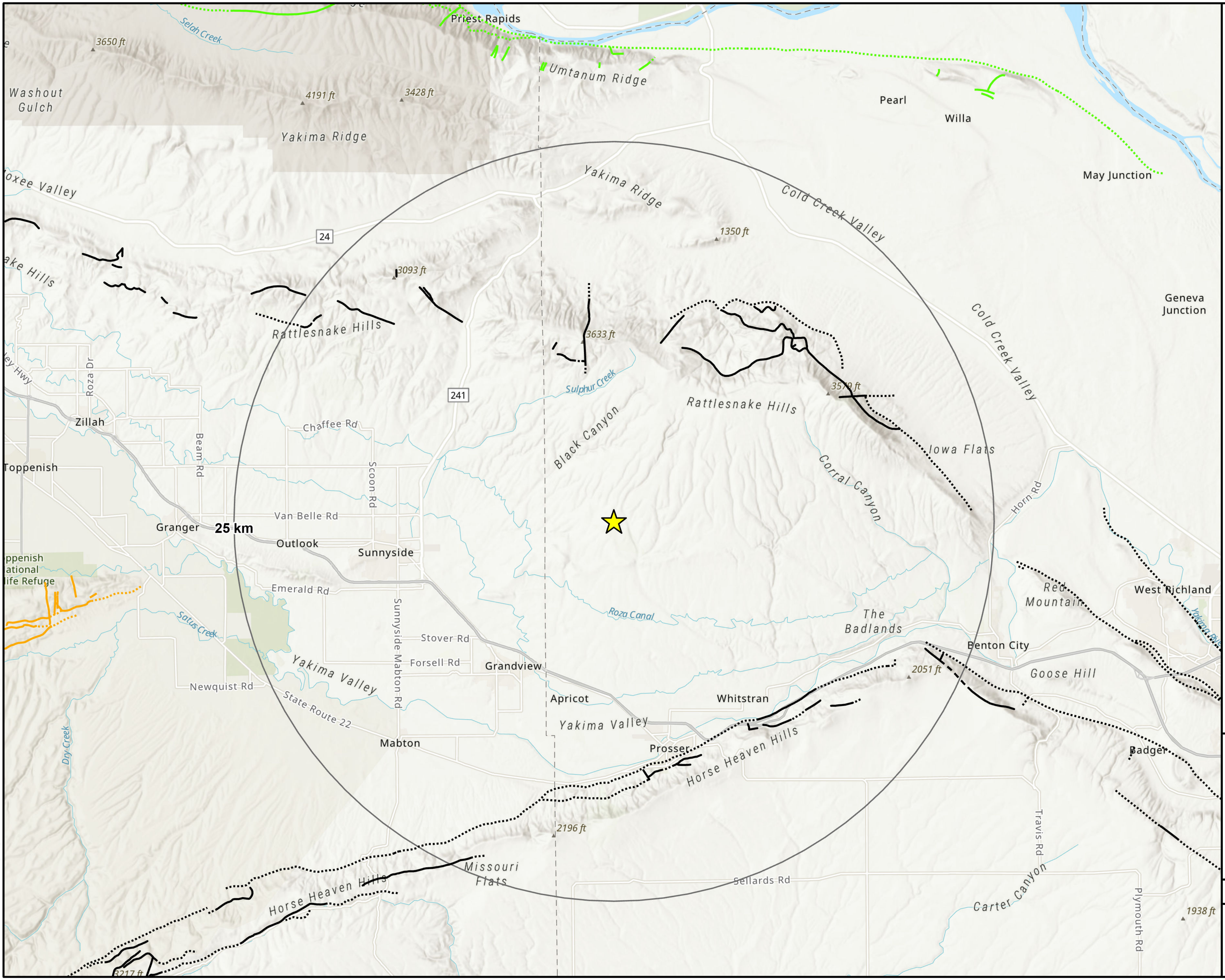

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EXPLANATION

☆ Site location

○ Site proximity buffer (km)

Fault trace - solid where well constrained, dashed where moderately constrained, and dotted where inferred

- <15,000 years - latest Quaternary
- <130,000 years - late Quaternary
- <750,000 years - middle and late Quaternary
- <1.6 million years - undifferentiated Quaternary

Notes: ESRI World Topographic basemap, USGS Quaternary Faults and Fold Database

Coordinate System: NAD 1983 2011 StatePlane Washington South FIPS 4602 Ft US

SCALE: 1 inch = 6 km

0 3 6 12 km

REGIONAL FAULT MAP

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

DATE: JULY 2022 · PROJECT: 66388.000

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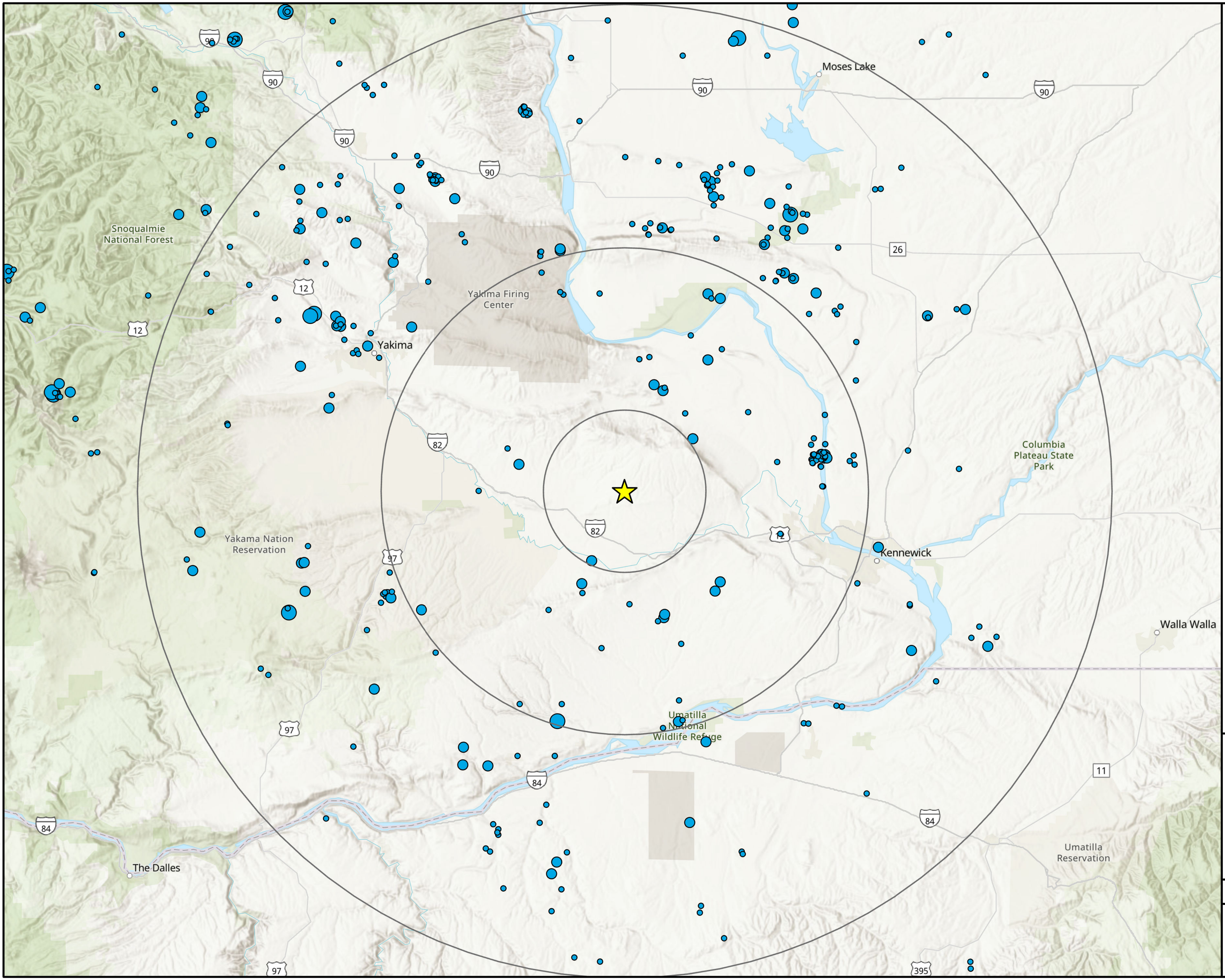
FIGURE
9



EXPLANATION

☆	Site location
○	Site proximity buffer (km)

Independent seismicity (1963 - 2017)

●	M 2.5 - 3.0
●	M 3.1 - 4.0
●	M 4.1 - 5.0
●	M >5.1

Notes: Historical seismicity compiled from ANSS Comprehensive Earthquake Catalog

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere

SCALE: 1 inch = 30 km

0 15 30 60 km

HISTORICAL SEISMICITY

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

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FIGURE
10

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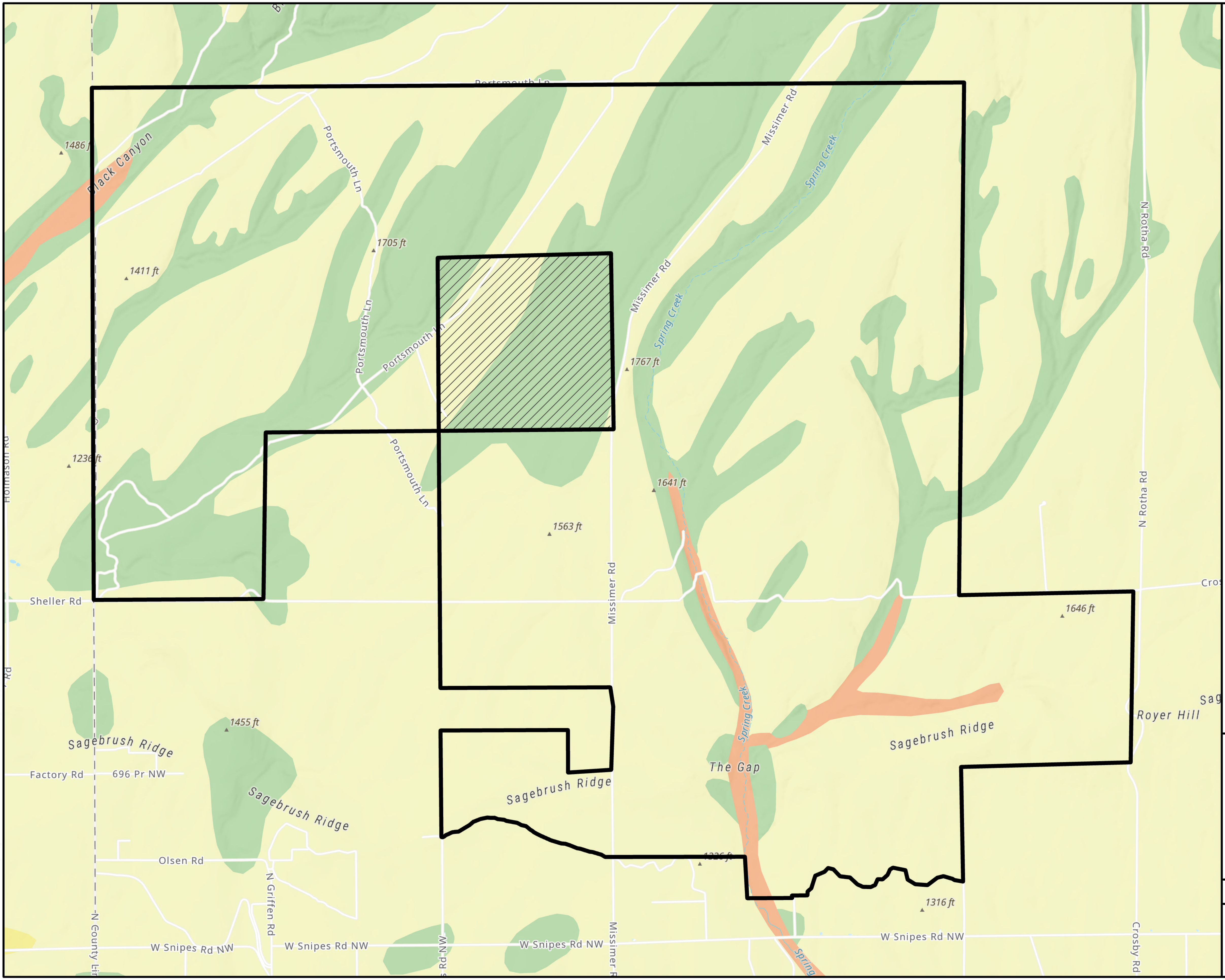

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EXPLANATION

▭ ProjectArea

▨ Approximate excluded area

Liquefaction Susceptibility

🟩 Bedrock

🟨 Low

🟨 Low to moderate

🟧 Moderate to high

Notes: ESRI World Topographic Map, liquefaction susceptibility layers obtained from WADNR Geologic Information Portal

Coordinate System: NAD 1983 2011 StatePlane Washington South FIPS 4602 Ft US

SCALE: 1 inch = 3,000 feet

0 1,500 3,000 6,000 feet

LIQUEFACTION SUSCEPTIBILITY

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

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FIGURE

11

Appendix A

Field Explorations

Table A-1
Terminology Used to Describe Soil

Soil Descriptions

Soils exist in mixtures with varying proportions of components. The predominant soil, i.e., greater than 50 percent based on total dry weight, is the primary soil type and is capitalized in our log descriptions (SAND, GRAVEL, SILT, or CLAY). Smaller percentages of other constituents in the soil mixture are indicated by use of modifier words in general accordance with the ASTM D2488-06 Visual-Manual Procedure. “General Accordance” means that certain local and common descriptive practices may have been followed. In accordance with ASTM D2488-06, group symbols (such as GP or CH) are applied on the portion of soil passing the 3-inch (75mm) sieve based on visual examination. The following describes the use of soil names and modifying terms used to describe fine- and coarse-grained soils.

Fine-Grained Soils (50% or greater fines passing 0.075 mm, No. 200 sieve)

The primary soil type, i.e., SILT or CLAY is designated through visual-manual procedures to evaluate soil toughness, dilatency, dry strength, and plasticity. The following outlines the terminology used to describe fine-grained soils, and varies from ASTM D2488 terminology in the use of some common terms.

Primary soil NAME, Symbols, and Adjectives			Plasticity Description	Plasticity Index (PI)
SILT (ML & MH)	**CLAY (CL & CH)**	**ORGANIC SOIL (OL & OH)**		
SILT		Organic SILT	Non-plastic	0 – 3
SILT		Organic SILT	Low plasticity	4 – 10
SILT/Elastic SILT	Lean CLAY	Organic SILT/ Organic CLAY	Medium Plasticity	10 – 20
Elastic SILT	Lean/Fat CLAY	Organic CLAY	High Plasticity	20 – 40
Elastic SILT	Fat CLAY	Organic CLAY	Very Plastic	>40

Modifying terms describing secondary constituents, estimated to 5 percent increments, are applied as follows:

Description	% Composition	
With Sand	% Sand ≥ % Gravel	15% to 25% plus No. 200
With Gravel	% Sand < % Gravel	
Sandy	% Sand ≥ % Gravel	≤30% to 50% plus No. 200
Gravelly	% Sand < % Gravel	

Borderline Symbols, for example CH/MH, are used when soils are not distinctly in one category or when variable soil units contain more than one soil type. **Dual Symbols,** for example CL-ML, are used when two symbols are required in accordance with ASTM D2488.

Soil Consistency terms are applied to fine-grained, plastic soils (i.e., PI ≥ 7). Descriptive terms are based on direct measure or correlation to the Standard Penetration Test N-value as determined by ASTM D1586-84, as follows. SILT soils with low to non-plastic behavior (i.e., PI < 7) may be classified using relative density.

Consistency Term	SPT N-value	Unconfined Compressive Strength	
		tsf	kPa
Very soft	Less than 2	Less than 0.25	Less than 24
Soft	2 – 4	0.25 – 0.5	24 – 48
Medium stiff	5 – 8	0.5 – 1.0	48 – 96
Stiff	9 – 15	1.0 – 2.0	96 – 192
Very stiff	16 – 30	2.0 – 4.0	192 – 383
Hard	Over 30	Over 4.0	Over 383

Soil Descriptions

Coarse - Grained Soils (less than 50% fines)

Coarse-grained soil descriptions, i.e., SAND or GRAVEL, are based on the portion of materials passing a 3-inch (75mm) sieve. Coarse-grained soil group symbols are applied in accordance with ASTM D2488-06 based on the degree of grading, or distribution of grain sizes of the soil. For example, well-graded sand containing a wide range of grain sizes is designated SW; poorly graded gravel, GP, contains high percentages of only certain grain sizes. Terms applied to grain sizes follow.

Material NAME	**Particle Diameter**	
	Inches	**Millimeters**
SAND (SW or SP)	0.003 – 0.19	0.075 – 4.8
GRAVEL (GW or GP)	0.19 – 3	4.8 – 75
Additional Constituents:		
Cobble	3 – 12	75 – 300
Boulder	12 – 120	300 – 3050

The primary soil type is capitalized, and the fines content in the soil are described as indicated by the following examples. Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 percent. Other soil mixtures will have similar descriptive names.

Example: Coarse-Grained Soil Descriptions with Fines

>5% to < 15% fines (Dual Symbols)	**≥15% to < 50% fines**
Well graded GRAVEL with silt: GW-GM	Silty GRAVEL: GM
Poorly graded SAND with clay: SP-SC	Silty SAND: SM

Additional descriptive terminology applied to coarse-grained soils follow.

Example: Coarse-Grained Soil Descriptions with Other Coarse-Grained Constituents

Coarse-Grained Soil Containing Secondary Constituents	
With sand or with gravel	≥ 15% sand or gravel
With cobbles; with boulders	Any amount of cobbles or boulders.

Cobble and boulder deposits may include a description of the matrix soils, as defined above.

Relative Density terms are applied to granular, non-plastic soils based on direct measure or correlation to the Standard Penetration Test N-value as determined by ASTM D1586-84.

Relative Density Term	**SPT N-value**
Very loose	0 – 4
Loose	5 – 10
Medium dense	11 – 30
Dense	31 – 50
Very dense	> 50

Appendix A: Field Explorations

A1 GENERAL

PBS explored subsurface conditions at the project site by excavating 12 test pits to depths of up to 8.5 feet bgs on June 9 and June 10, 2022. The approximate locations of the explorations are shown on Figure 2, Site Plan. The procedures used to advance the test pits, collect samples, and other field techniques are described in detail in the following paragraphs. Unless otherwise noted, all soil sampling and classification procedures followed engineering practices in general accordance with relevant ASTM procedures. "General accordance" means that certain local drilling/excavation and descriptive practices and methodologies have been followed.

A2 TEST PITS

A2.1 Excavation

Test pits were excavated using a Deere 50G excavator equipped with a 24-inch-wide, toothed bucket provided and operated by Van Belle Excavating, LLC, of Grandview, Washington. The test pits were observed by a member of the PBS geotechnical staff, who maintained a detailed log of the subsurface conditions and materials encountered during the course of the work.

A2.2 Sampling

Representative disturbed samples were taken at selected depths in the test pits. The disturbed soil samples were examined by a member of the PBS geotechnical staff and sealed in plastic bags for further examination.

A2.3 Test Pit Logs

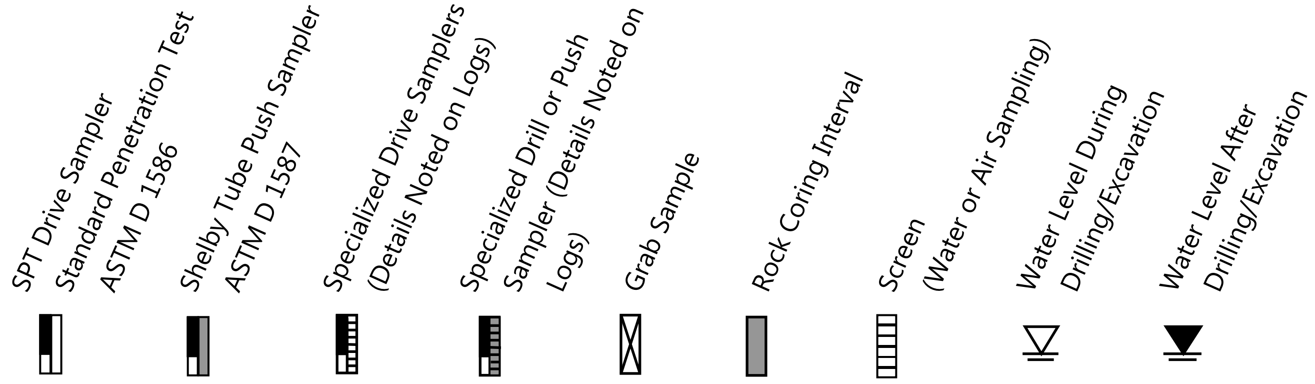
The test pit logs show the various types of materials that were encountered in the excavations and the depths where the materials and/or characteristics of these materials changed, although the changes may be gradual. Where material types and descriptions changed between samples, the contacts were interpreted. The types of samples taken during excavation, along with their sample identification number, are shown to the right of the classification of materials. Measured seepage levels, if observed, are noted in the column to the right.

A3 MATERIAL DESCRIPTION

Initially, samples were classified visually in the field. Consistency, color, relative moisture, degree of plasticity, and other distinguishing characteristics of the soil samples were noted. Afterward, the samples were reexamined in the PBS laboratory and the field classifications were modified where necessary. The terminology used in the soil classifications and other modifiers are defined in Table A-1, Terminology Used to Describe Soil.

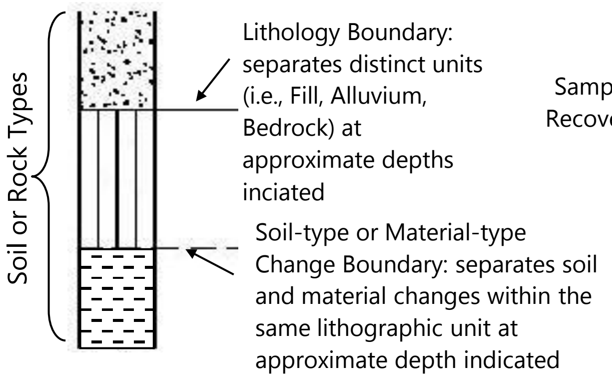
Table A-2
Key To Test Pit and Boring Log Symbols

SAMPLING DESCRIPTIONS

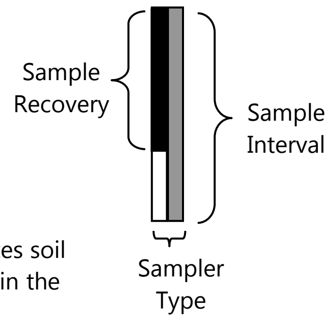


LOG GRAPHICS

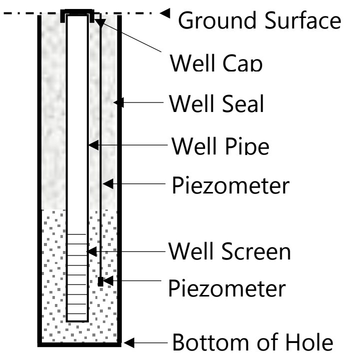
Soil and Rock



Sampling Symbols



Instrumentation Detail



Geotechnical Testing Acronym Explanations

PP	Pocket Penetrometer	HYD	Hydrometer Gradation
TOR	Torvane	SIEV	Sieve Gradation
DCP	Dynamic Cone Penetrometer	DS	Direct Shear
ATT	Atterberg Limits	DD	Dry Density
PL	Plasticity Limit	CBR	California Bearing Ratio
LL	Liquid Limit	RES	Resilient Modulus
PI	Plasticity Index	VS	Vane Shear
P200	Percent Passing US Standard No. 200 Sieve	bgs	Below ground surface
OC	Organic Content	MSL	Mean Sea Level
CON	Consolidation	HCL	Hydrochloric Acid
UC	Unconfined Compressive Strength		

Details of soil and rock classification systems are available on request.

Rev. 02/2017

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

TEST PIT TP-1

PBS PROJECT NUMBER:
66388.000

APPROX. TEST PIT TP-1 LOCATION:
(See Site Plan)
Lat: 46.37030 Long: -119.84389

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID	◆ DYNAMIC CONE PENETROMETER ☒ STATIC PENETROMETER ● MOISTURE CONTENT % 0 50 100	COMMENTS Surface Conditions: Native Vegetation
0.0		Brown, sandy SILT (ML); non-plastic; fine sand; moist fine roots to 3 inches bgs	0.0				
1.0					☒ S-1		
		BASALT; white crust; occasional vesicles	1.5		☒ S-2		
2.0		Final depth 2.0 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	2.0				
3.0							
4.0							
5.0							
6.0							
7.0							
8.0							
9.0							
10.0						0 50 100	

LOGGED BY: C. Nealey
COMPLETED: 6/09/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A1
Page 1 of 1

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

TEST PIT TP-2

PBS PROJECT NUMBER:
66388.000

APPROX. TEST PIT TP-2 LOCATION:
(See Site Plan)
Lat: 46.37026 Long: -119.31335

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID	◆ DYNAMIC CONE PENETROMETER ☒ STATIC PENETROMETER ● MOISTURE CONTENT % 0 50 100	COMMENTS Surface Conditions: Native Vegetation
0.0		Brown SILT (ML) with sand; non-plastic; fine sand; moist	0.0				
1.0					☒ S-1		
		Fractured BASALT; white crust; 3-inch cobbles to 12-inch boulders hard at 2 feet bgs	1.5		☒ S-2		
2.0		Final depth 2.0 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	2.0				
3.0							
4.0							
5.0							
6.0							
7.0							
8.0							
9.0							
10.0						0 50 100	

LOGGED BY: C. Nealey
COMPLETED: 6/09/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A1
Page 1 of 1

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

TEST PIT TP-3

PBS PROJECT NUMBER:
66388.000

APPROX. TEST PIT TP-3 LOCATION:
(See Site Plan)
Lat: 46.34916 Long: -119.84026

DEPTH FEET	MATERIAL DESCRIPTION Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID	◆ DYNAMIC CONE PENETROMETER ☒ STATIC PENETROMETER ● MOISTURE CONTENT % 0 50 100	COMMENTS Surface Conditions: Native Vegetation
0.0	Brown, sandy SILT (ML); non-plastic; fine sand; dry fine roots to 3 inches bgs; occasional fine roots to 12 inches bgs	0.0		S-1		
1.0	BASALT; white crust; vesicular	1.0		S-2		
	Final depth 1.5 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	1.5				
2.0						
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0					0 50 100	

LOGGED BY: C. Nealey
COMPLETED: 6/09/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A2

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

TEST PIT TP-4

PBS PROJECT NUMBER:
66388.000

APPROX. TEST PIT TP-4 LOCATION:
(See Site Plan)
Lat: 46.37456 Long: -119.78733

MATERIAL DESCRIPTION

Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.

❖ DYNAMIC CONE PENETROMETER
☒ STATIC PENETROMETER
● MOISTURE CONTENT %
0 50 100

COMMENTS

Surface Conditions: Native Vegetation

DEPTH FEET	MATERIAL DESCRIPTION	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID
0.0	Brown SILT (ML) with sand and trace fine roots; low plasticity; fine to coarse sand; moist	0.0		☒ S-1 ☒ S-2
	BASALT; white crust; occasional vesicles	1.3		
	Final depth 1.5 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	1.5		

0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0

0 50 100

LOGGED BY: C. Nealey
COMPLETED: 6/09/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A2

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

TEST PIT TP-5

PBS PROJECT NUMBER:
66388.000

APPROX. TEST PIT TP-5 LOCATION:
(See Site Plan)
Lat: 46.34345 Long: -119.81027

Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.

◆ DYNAMIC CONE PENETROMETER
☒ STATIC PENETROMETER
● MOISTURE CONTENT %
0 50 100

COMMENTS

Surface Conditions: Native Vegetation

DEPTH FEET	MATERIAL DESCRIPTION	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID
0.0	Brown SILT (ML) with sand and trace fine roots; low plasticity; fine sand; dry	0.0		☒ S-1 ☒ S-2
1.3	BASALT; white crust; occasional vesicles	1.3		
1.5	Final depth 1.5 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	1.5		

DEPTH FEET: 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0

LOGGED BY: C. Nealey
COMPLETED: 6/09/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A3
Page 1 of 1

	HOP HILL SOLAR DEVELOPMENT BENTON COUNTY, WASHINGTON	**TEST PIT TP-6**
	PBS PROJECT NUMBER: 66388.000	APPROX. TEST PIT TP-6 LOCATION: (See Site Plan) Lat: 46.33308 Long: -119.82865

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID	◆ DYNAMIC CONE PENETROMETER ☒ STATIC PENETROMETER ● MOISTURE CONTENT % 0 50 100	COMMENTS Surface Conditions: Native Vegetation
0.0		Brown, sandy SILT (ML); low plasticity; fine sand; dry occasional fine roots to 3 inches bgs	0.0				
3.0					☒ S-1		
6.0		strong cementation					
8.0		BASALT; white crust	8.0				
8.5		Final depth 8.5 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	8.5				
10.0						0 50 100	

LOGGED BY: C. Nealey
COMPLETED: 6/09/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A3

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

TEST PIT TP-7

PBS PROJECT NUMBER:
66388.000

APPROX. TEST PIT TP-7 LOCATION:
(See Site Plan)
Lat: 46.31638 Long: -119.77851

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID	◆ DYNAMIC CONE PENETROMETER ⊠ STATIC PENETROMETER ● MOISTURE CONTENT % 0 50 100	COMMENTS Surface Conditions: Native Vegetation
0.0		Brown, sandy SILT (ML); low plasticity; fine sand; dry occasional fine roots to 12 inches bgs	0.0				
1.0					☒ S-1		
		weak cementation					
2.0							
		BASALT; white crust; vesicular	2.8		☒ S-2		
3.0		Final depth 3.0 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	3.0				
4.0							
5.0							
6.0							
7.0							
8.0							
9.0							
10.0						0 50 100	

LOGGED BY: C. Nealey
COMPLETED: 6/10/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A4
Page 1 of 1

PBS

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

PBS PROJECT NUMBER:
66388.000

TEST PIT TP-8

APPROX. TEST PIT TP-8 LOCATION:
(See Site Plan)
Lat: 46.31319 Long: -119.78480

DEPTH FEET	MATERIAL DESCRIPTION	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID	COMMENTS
0.0	Brown SILT (ML) with sand; low plasticity; fine sand; dry occasional fine roots to 12 inches bgs; weak cementation	0.0			Surface Conditions: Native Vegetation
1.0				☒ S-1	
3.8	BASALT; white crust	3.8		☒ S-2	
4.0	Final depth 4.0 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	4.0			

Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.

◆ DYNAMIC CONE PENETROMETER
☒ STATIC PENETROMETER
● MOISTURE CONTENT %
0 50 100

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0

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COMPLETED: 6/10/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A4
Page 1 of 1

TEST PIT LOG - 1 PER PAGE 66388.000 TP1-12 20220616.GPJ PBS DATATMPL GEO.GDT PRINT DATE: 7/20/22:RPG

PBS

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

PBS PROJECT NUMBER:
66388.000

TEST PIT TP-9

APPROX. TEST PIT TP-9 LOCATION:
(See Site Plan)

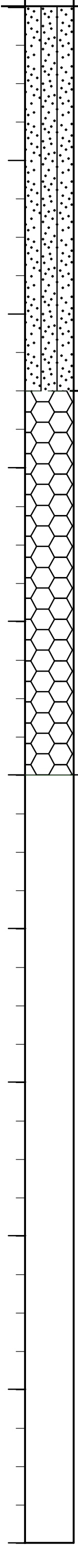
Lat: 46.31279 Long: -119.80998

COMMENTS

Surface Conditions: Native Vegetation

◆ DYNAMIC CONE PENETROMETER
☒ STATIC PENETROMETER
● MOISTURE CONTENT %
(scale 0 – 50 – 100)

Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.



DEPTH FEET	MATERIAL DESCRIPTION	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID
0.0	Brown silty SAND (SM); non-plastic; fine sand; dry	0.0		
1.0				S-1
2.0				
2.5	Fractured BASALT; white crust; vesicular	2.5		
3.0				
4.0				
	hard at 5 feet bgs			S-2
5.0	Final depth 5.0 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	5.0		
6.0				
7.0				
8.0				
9.0				
10.0				

LOGGED BY: C. Nealey
COMPLETED: 6/10/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

TEST PIT TP-10

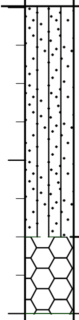
PBS PROJECT NUMBER:
66388.000

APPROX. TEST PIT TP-10 LOCATION:
(See Site Plan)
Lat: 46.33824 Long: -119.79198

Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.

◆ DYNAMIC CONE PENETROMETER
☒ STATIC PENETROMETER
● MOISTURE CONTENT %
0 50 100

Surface Conditions: Native Vegetation



DEPTH FEET	MATERIAL DESCRIPTION	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID	COMMENTS
0.0	Brown SILT (ML) with sand; low plasticity; fine sand; moist	0.0			
1.0	occasional fine roots to 12 inches bgs			☒ S-1	
	Fractured BASALT; white crust; vesicular	1.5		☒ S-2	
2.0	Final depth 2.0 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	2.0			
3.0					
4.0					
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					

LOGGED BY: C. Nealey
COMPLETED: 6/09/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A5

HOP HILL SOLAR DEVELOPMENT
BENTON COUNTY, WASHINGTON

TEST PIT TP-11

PBS PROJECT NUMBER:
66388.000

APPROX. TEST PIT TP-11 LOCATION:
(See Site Plan)
Lat: 46.35779 Long: -119.77940

◆ DYNAMIC CONE PENETROMETER
☒ STATIC PENETROMETER
● MOISTURE CONTENT %
0 50 100

COMMENTS

Surface Conditions: Native Vegetation

Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.

DEPTH FEET	MATERIAL DESCRIPTION	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID	COMMENTS
0.0	Brown, sandy SILT (ML) with occasional fine roots; low plasticity; fine sand; moist	0.0			
1.0	Fractured BASALT; white crust; vesicular	1.0		S-1 S-2	
2.0	Final depth 2.0 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	2.0			
3.0					
4.0					
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					

0 50 100

LOGGED BY: C. Nealey
COMPLETED: 6/09/2022

EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A6
Page 1 of 1

HOP HILL SOLAR DEVELOPMENT BENTON COUNTY, WASHINGTON	**TEST PIT TP-12**	
PBS PROJECT NUMBER: 66388.000	APPROX. TEST PIT TP-12 LOCATION: (See Site Plan) Lat: 46.37015 Long: -119.77226	

DEPTH FEET	MATERIAL DESCRIPTION Lines representing the interface between soil/rock units of differing description are approximate only, inferred where between samples, and may indicate gradual transition.	DEPTH	TESTING	SAMPLE TYPE SAMPLE ID	❖ DYNAMIC CONE PENETROMETER ⊠ STATIC PENETROMETER ● MOISTURE CONTENT % 0 50 100	COMMENTS Surface Conditions: Native Vegetation
0.0	Brown SILT (ML) with sand and trace fine roots; low plasticity; fine sand; dry	0.0				
1.0				⊠ S-1		
	BASALT; white crust; occasional vesicles	1.8		⊠ S-2		
2.0	Final depth 2.0 feet bgs due to refusal in basalt; test pit backfilled with excavated material to existing ground surface. Groundwater not encountered at time of exploration.	2.0				
3.0						
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0					0 50 100	

LOGGED BY: C. Nealey
COMPLETED: 6/09/2022

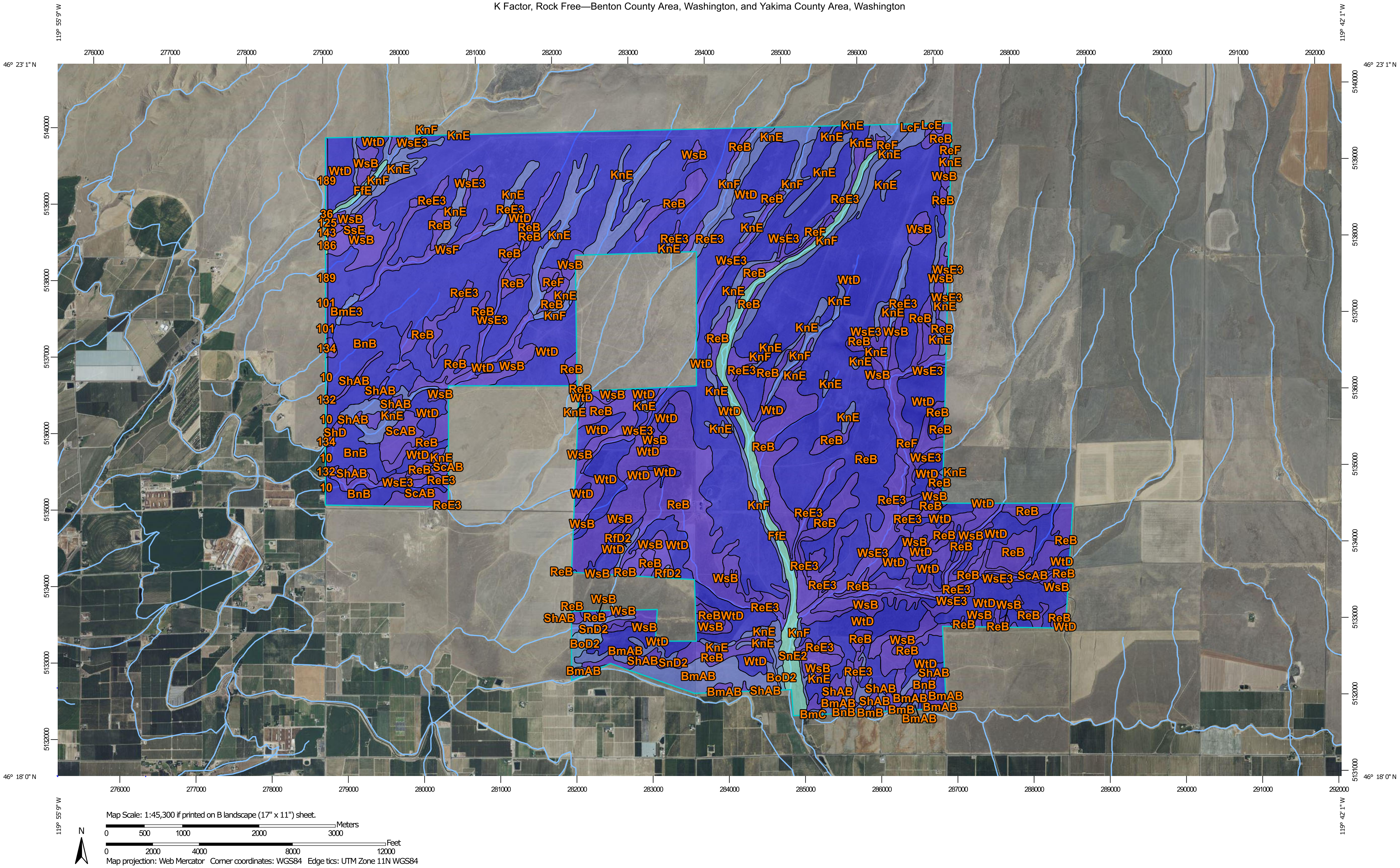
EXCAVATED BY: Van Belle Excavating, LLC
EXCAVATION METHOD: Deere 50G with Toothed Bucket

FIGURE A6

Appendix B

USDA Erodibility Data

K Factor, Rock Free—Benton County Area, Washington, and Yakima County Area, Washington



Map Scale: 1:45,300 if printed on B landscape (17" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

▭ Area of Interest (AOI)

Soils

Soil Rating Polygons

■ .02
■ .05
■ .10
■ .15
■ .17
■ .20
■ .24
■ .28
■ .32
■ .37
■ .43
■ .49
■ .55
■ .64
□ Not rated or not available

Soil Rating Lines

〰 .02
〰 .05
〰 .10
〰 .15
〰 .17
〰 .20
〰 .24
〰 .28
〰 .32
〰 .37
〰 .43
〰 .49
〰 .55
〰 .64
〰 Not rated or not available

Soil Rating Points

■ .02
■ .05
■ .10
■ .15
■ .17
■ .20
■ .24
■ .28
■ .32
■ .37
■ .43
■ .49
■ .55
■ .64
□ Not rated or not available

Water Features

〰 Streams and Canals

Transportation

┿ Rails
〰 Interstate Highways
〰 US Routes
〰 Major Roads
〰 Local Roads

Background

■ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

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

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

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

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

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

Soil Survey Area: Yakima County Area, Washington
Survey Area Data: Version 21, Aug 31, 2021

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Nov 21, 2021—Nov 29, 2021

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

K Factor, Rock Free

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BmAB	Burke silt loam, 0 to 5 percent slopes	.49	241.7	2.0%
BmB	Burke silt loam, 2 to 5 percent slopes	.49	0.3	0.0%
BmC	Burke silt loam, 5 to 8 percent slopes	.49	0.2	0.0%
BmE3	Burke silt loam, 15 to 30 percent slopes, severely eroded	.49	9.3	0.1%
BnB	Burke silt loam, shallow, 0 to 5 percent slopes	.64	419.2	3.5%
BoD2	Burke very fine sandy loam, 0 to 15 percent slopes, eroded	.43	35.4	0.3%
EoE	Endicott variant silt loam, 0 to 40 percent slopes	.55	6.9	0.1%
FfE	Finley stony fine sandy loam, 0 to 30 percent slopes	.32	252.0	2.1%
KnE	Kiona very stony silt loam, 0 to 30 percent slopes	.49	829.1	6.9%
KnF	Kiona very stony silt loam, 30 to 65 percent slopes	.49	310.7	2.6%
LcE	Lickskillet very stony silt loam, 0 to 30 percent slopes	.43	0.6	0.0%
LcF	Lickskillet very stony silt loam, 30 to 65 percent slopes	.43	2.6	0.0%
ReB	Ritzville silt loam, 0 to 5 percent slopes	.55	1,818.2	15.2%
ReE3	Ritzville silt loam, 15 to 30 percent slopes, severely eroded	.55	278.6	2.3%
ReF	Ritzville silt loam, 30 to 65 percent slopes	.55	157.9	1.3%
RfD2	Ritzville very fine sandy loam, 0 to 15 percent slopes, eroded	.49	14.3	0.1%
ScAB	Scooteney silt loam, 0 to 5 percent slopes	.55	119.5	1.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ShAB	Shano silt loam, 0 to 5 percent slopes	.55	181.7	1.5%
ShB	Shano silt loam, 2 to 5 percent slopes	.55	0.9	0.0%
ShD	Shano silt loam, 8 to 15 percent slopes	.55	15.5	0.1%
SmB	Shano silt loam, deep, 2 to 5 percent slopes	.55	0.2	0.0%
SmC	Shano silt loam, deep, 5 to 8 percent slopes	.55	0.5	0.0%
SnD2	Shano very fine sandy loam, 0 to 15 percent slopes, eroded	.49	22.2	0.2%
SnE2	Shano very fine sandy loam, 15 to 30 percent slopes, eroded	.49	9.0	0.1%
SsE	Starbuck rocky silt loam, 5 to 45 percent slopes	.55	9.2	0.1%
W	Water		0.1	0.0%
WsB	Willis silt loam, 0 to 5 percent slopes	.55	822.1	6.9%
WsE3	Willis silt loam, 15 to 30 percent slopes, severely eroded	.55	456.1	3.8%
WsF	Willis silt loam, 30 to 65 percent slopes	.55	71.2	0.6%
WtD	Willis silt loam, shallow, 0 to 15 percent slopes	.64	5,876.4	49.0%
Subtotals for Soil Survey Area			**11,961.5**	**99.7%**
Totals for Area of Interest			**11,994.7**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10	Burke silt loam, 2 to 5 percent slopes	.49	7.8	0.1%
36	Finley cobbly fine sandy loam, 0 to 5 percent slopes	.32	0.6	0.0%
101	Ritzville silt loam, 8 to 15 percent slopes	.55	0.3	0.0%
125	Scooteney silt loam, 2 to 5 percent slopes	.49	1.2	0.0%
132	Shano silt loam, 2 to 5 percent slopes	.55	0.9	0.0%
134	Shano silt loam, 8 to 15 percent slopes	.55	2.6	0.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
143	Starbuck-Rock outcrop complex, 0 to 45 percent slopes	.55	0.8	0.0%
186	Willis fine sandy loam, 2 to 5 percent slopes	.28	1.9	0.0%
189	Willis silt loam, 8 to 15 percent slopes	.55	15.4	0.1%
Subtotals for Soil Survey Area			**31.5**	**0.3%**
Totals for Area of Interest			**11,994.7**	**100.0%**

Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kf (rock free)" indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Factor K does not apply to organic horizons and is not reported for those layers.

Rating Options

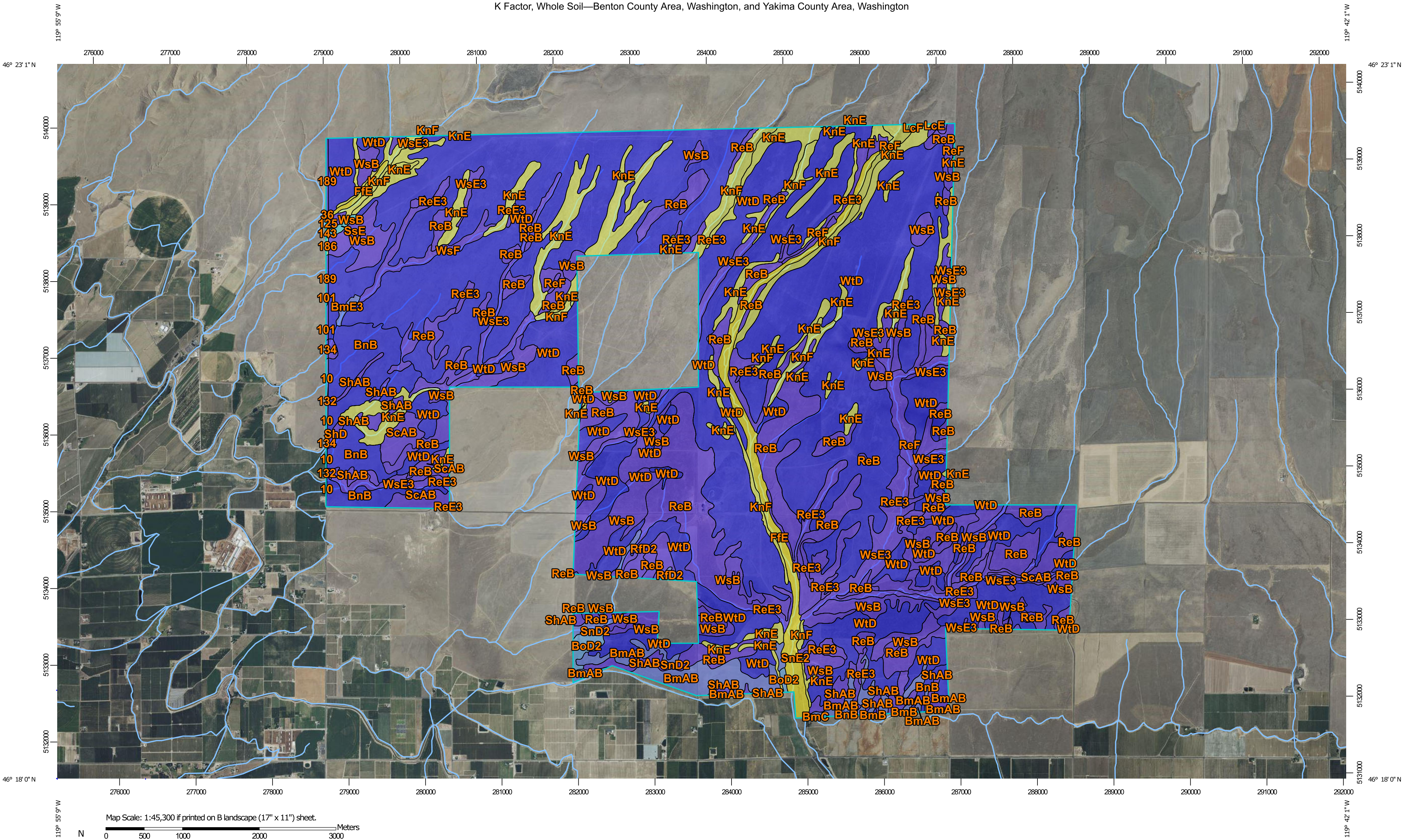
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

K Factor, Whole Soil—Benton County Area, Washington, and Yakima County Area, Washington



Map Scale: 1:45,300 if printed on B landscape (17" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

⬜ Area of Interest (AOI)

Soils

Soil Rating Polygons

🟥 .02
🟧 .05
🟧 .10
🟨 .15
🟨 .17
🟨 .20
🟩 .24
🟩 .28
🟦 .32
🟦 .37
🟦 .43
🟪 .49
🟪 .55
🟪 .64
⬜ Not rated or not available

Soil Rating Lines

〰 .02
〰 .05
〰 .10
〰 .15
〰 .17
〰 .20
〰 .24
〰 .28
〰 .32
〰 .37
〰 .43
〰 .49
〰 .55
〰 .64
〰 Not rated or not available

Soil Rating Points

■ .02
■ .05
■ .10
■ .15
■ .17
■ .20
■ .24
■ .28
■ .32
■ .37
■ .43
■ .49
■ .55
■ .64
□ Not rated or not available

Water Features

〰 Streams and Canals

Transportation

┼┼┼ Rails
〰 Interstate Highways
〰 US Routes
〰 Major Roads
〰 Local Roads

Background

▨ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

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

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

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

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

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

Soil Survey Area: Yakima County Area, Washington
Survey Area Data: Version 21, Aug 31, 2021

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Nov 21, 2021—Nov 29, 2021

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

K Factor, Whole Soil

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BmAB	Burke silt loam, 0 to 5 percent slopes	.49	241.7	2.0%
BmB	Burke silt loam, 2 to 5 percent slopes	.49	0.3	0.0%
BmC	Burke silt loam, 5 to 8 percent slopes	.49	0.2	0.0%
BmE3	Burke silt loam, 15 to 30 percent slopes, severely eroded	.49	9.3	0.1%
BnB	Burke silt loam, shallow, 0 to 5 percent slopes	.64	419.2	3.5%
BoD2	Burke very fine sandy loam, 0 to 15 percent slopes, eroded	.43	35.4	0.3%
EoE	Endicott variant silt loam, 0 to 40 percent slopes	.55	6.9	0.1%
FfE	Finley stony fine sandy loam, 0 to 30 percent slopes	.17	252.0	2.1%
KnE	Kiona very stony silt loam, 0 to 30 percent slopes	.20	829.1	6.9%
KnF	Kiona very stony silt loam, 30 to 65 percent slopes	.20	310.7	2.6%
LcE	Lickskillet very stony silt loam, 0 to 30 percent slopes	.24	0.6	0.0%
LcF	Lickskillet very stony silt loam, 30 to 65 percent slopes	.24	2.6	0.0%
ReB	Ritzville silt loam, 0 to 5 percent slopes	.55	1,818.2	15.2%
ReE3	Ritzville silt loam, 15 to 30 percent slopes, severely eroded	.55	278.6	2.3%
ReF	Ritzville silt loam, 30 to 65 percent slopes	.55	157.9	1.3%
RfD2	Ritzville very fine sandy loam, 0 to 15 percent slopes, eroded	.49	14.3	0.1%
ScAB	Scooteney silt loam, 0 to 5 percent slopes	.55	119.5	1.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ShAB	Shano silt loam, 0 to 5 percent slopes	.55	181.7	1.5%
ShB	Shano silt loam, 2 to 5 percent slopes	.55	0.9	0.0%
ShD	Shano silt loam, 8 to 15 percent slopes	.55	15.5	0.1%
SmB	Shano silt loam, deep, 2 to 5 percent slopes	.55	0.2	0.0%
SmC	Shano silt loam, deep, 5 to 8 percent slopes	.55	0.5	0.0%
SnD2	Shano very fine sandy loam, 0 to 15 percent slopes, eroded	.49	22.2	0.2%
SnE2	Shano very fine sandy loam, 15 to 30 percent slopes, eroded	.49	9.0	0.1%
SsE	Starbuck rocky silt loam, 5 to 45 percent slopes	.37	9.2	0.1%
W	Water		0.1	0.0%
WsB	Willis silt loam, 0 to 5 percent slopes	.55	822.1	6.9%
WsE3	Willis silt loam, 15 to 30 percent slopes, severely eroded	.55	456.1	3.8%
WsF	Willis silt loam, 30 to 65 percent slopes	.55	71.2	0.6%
WtD	Willis silt loam, shallow, 0 to 15 percent slopes	.64	5,876.4	49.0%
Subtotals for Soil Survey Area			**11,961.5**	**99.7%**
Totals for Area of Interest			**11,994.7**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10	Burke silt loam, 2 to 5 percent slopes	.49	7.8	0.1%
36	Finley cobbly fine sandy loam, 0 to 5 percent slopes	.17	0.6	0.0%
101	Ritzville silt loam, 8 to 15 percent slopes	.55	0.3	0.0%
125	Scooteney silt loam, 2 to 5 percent slopes	.49	1.2	0.0%
132	Shano silt loam, 2 to 5 percent slopes	.55	0.9	0.0%
134	Shano silt loam, 8 to 15 percent slopes	.55	2.6	0.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
143	Starbuck-Rock outcrop complex, 0 to 45 percent slopes	.55	0.8	0.0%
186	Willis fine sandy loam, 2 to 5 percent slopes	.28	1.9	0.0%
189	Willis silt loam, 8 to 15 percent slopes	.55	15.4	0.1%
Subtotals for Soil Survey Area			**31.5**	**0.3%**
Totals for Area of Interest			**11,994.7**	**100.0%**

Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Factor K does not apply to organic horizons and is not reported for those layers.

Rating Options

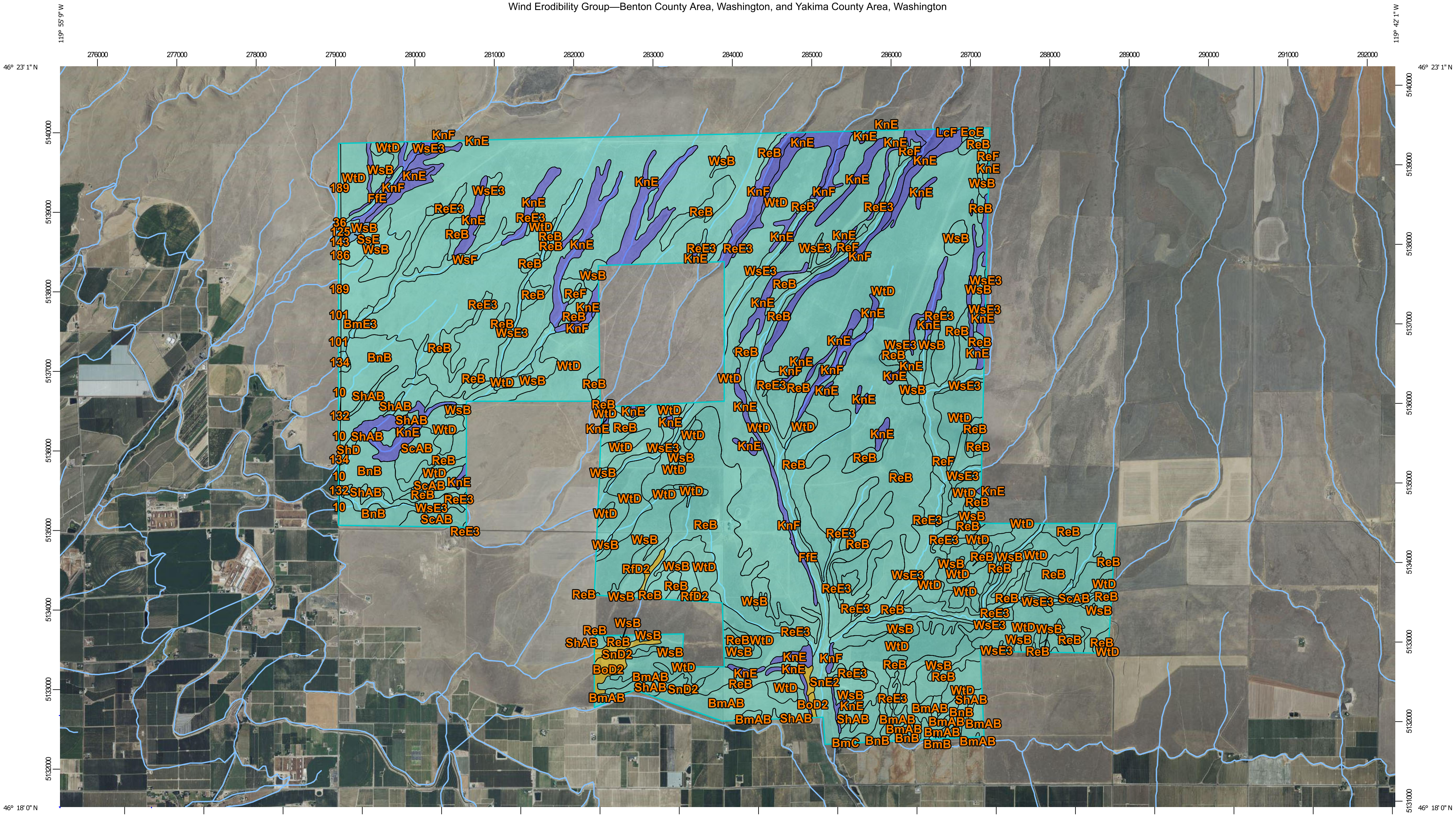
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Wind Erodibility Group—Benton County Area, Washington, and Yakima County Area, Washington



Map Scale: 1:45,300 if printed on B landscape (17" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- ⬜ Area of Interest (AOI)

Soils

Soil Rating Polygons

- 🟥 1
- 🟧 2
- 🟨 3
- 🟨 4
- 🟩 4L
- 🟦 5
- 🟦 6
- 🟪 7
- 🟪 8
- ⬜ Not rated or not available

Soil Rating Lines

- 〰 1
- 〰 2
- 〰 3
- 〰 4
- 〰 4L
- 〰 5
- 〰 6
- 〰 7
- 〰 8
- 〰 Not rated or not available

Soil Rating Points

- 🟥 1
- 🟧 2
- 🟨 3
- 🟨 4
- 🟩 4L
- 🟦 5
- 🟦 6
- 🟪 7
- 🟦 8
- ⬜ Not rated or not available

Water Features

- 〰 Streams and Canals

Transportation

- ┼┼┼ Rails
- 〰 Interstate Highways
- 〰 US Routes
- 〰 Major Roads
- 〰 Local Roads

Background

- 🟩 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

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

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

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

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

Soil Survey Area: Yakima County Area, Washington
Survey Area Data: Version 21, Aug 31, 2021

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Nov 21, 2021—Nov 29, 2021

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

Wind Erodibility Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BmAB	Burke silt loam, 0 to 5 percent slopes	5	241.7	2.0%
BmB	Burke silt loam, 2 to 5 percent slopes	5	0.3	0.0%
BmC	Burke silt loam, 5 to 8 percent slopes	5	0.2	0.0%
BmE3	Burke silt loam, 15 to 30 percent slopes, severely eroded	5	9.3	0.1%
BnB	Burke silt loam, shallow, 0 to 5 percent slopes	5	419.2	3.5%
BoD2	Burke very fine sandy loam, 0 to 15 percent slopes, eroded	3	35.4	0.3%
EoE	Endicott variant silt loam, 0 to 40 percent slopes	5	6.9	0.1%
FfE	Finley stony fine sandy loam, 0 to 30 percent slopes	5	252.0	2.1%
KnE	Kiona very stony silt loam, 0 to 30 percent slopes	7	829.1	6.9%
KnF	Kiona very stony silt loam, 30 to 65 percent slopes	7	310.7	2.6%
LcE	Lickskillet very stony silt loam, 0 to 30 percent slopes	7	0.6	0.0%
LcF	Lickskillet very stony silt loam, 30 to 65 percent slopes	7	2.6	0.0%
ReB	Ritzville silt loam, 0 to 5 percent slopes	5	1,818.2	15.2%
ReE3	Ritzville silt loam, 15 to 30 percent slopes, severely eroded	5	278.6	2.3%
ReF	Ritzville silt loam, 30 to 65 percent slopes	5	157.9	1.3%
RfD2	Ritzville very fine sandy loam, 0 to 15 percent slopes, eroded	3	14.3	0.1%
ScAB	Scooteney silt loam, 0 to 5 percent slopes	5	119.5	1.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ShAB	Shano silt loam, 0 to 5 percent slopes	5	181.7	1.5%
ShB	Shano silt loam, 2 to 5 percent slopes	5	0.9	0.0%
ShD	Shano silt loam, 8 to 15 percent slopes	5	15.5	0.1%
SmB	Shano silt loam, deep, 2 to 5 percent slopes	5	0.2	0.0%
SmC	Shano silt loam, deep, 5 to 8 percent slopes	5	0.5	0.0%
SnD2	Shano very fine sandy loam, 0 to 15 percent slopes, eroded	3	22.2	0.2%
SnE2	Shano very fine sandy loam, 15 to 30 percent slopes, eroded	3	9.0	0.1%
SsE	Starbuck rocky silt loam, 5 to 45 percent slopes	6	9.2	0.1%
W	Water		0.1	0.0%
WsB	Willis silt loam, 0 to 5 percent slopes	5	822.1	6.9%
WsE3	Willis silt loam, 15 to 30 percent slopes, severely eroded	5	456.1	3.8%
WsF	Willis silt loam, 30 to 65 percent slopes	5	71.2	0.6%
WtD	Willis silt loam, shallow, 0 to 15 percent slopes	5	5,876.4	49.0%
Subtotals for Soil Survey Area			**11,961.5**	**99.7%**
Totals for Area of Interest			**11,994.7**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10	Burke silt loam, 2 to 5 percent slopes	5	7.8	0.1%
36	Finley cobbly fine sandy loam, 0 to 5 percent slopes	5	0.6	0.0%
101	Ritzville silt loam, 8 to 15 percent slopes	5	0.3	0.0%
125	Scooteney silt loam, 2 to 5 percent slopes	5	1.2	0.0%
132	Shano silt loam, 2 to 5 percent slopes	5	0.9	0.0%
134	Shano silt loam, 8 to 15 percent slopes	5	2.6	0.0%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
143	Starbuck-Rock outcrop complex, 0 to 45 percent slopes	5	0.8	0.0%
186	Willis fine sandy loam, 2 to 5 percent slopes	3	1.9	0.0%
189	Willis silt loam, 8 to 15 percent slopes	5	15.4	0.1%
Subtotals for Soil Survey Area			**31.5**	**0.3%**
Totals for Area of Interest			**11,994.7**	**100.0%**

Description

A wind erodibility group (WEG) consists of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible.

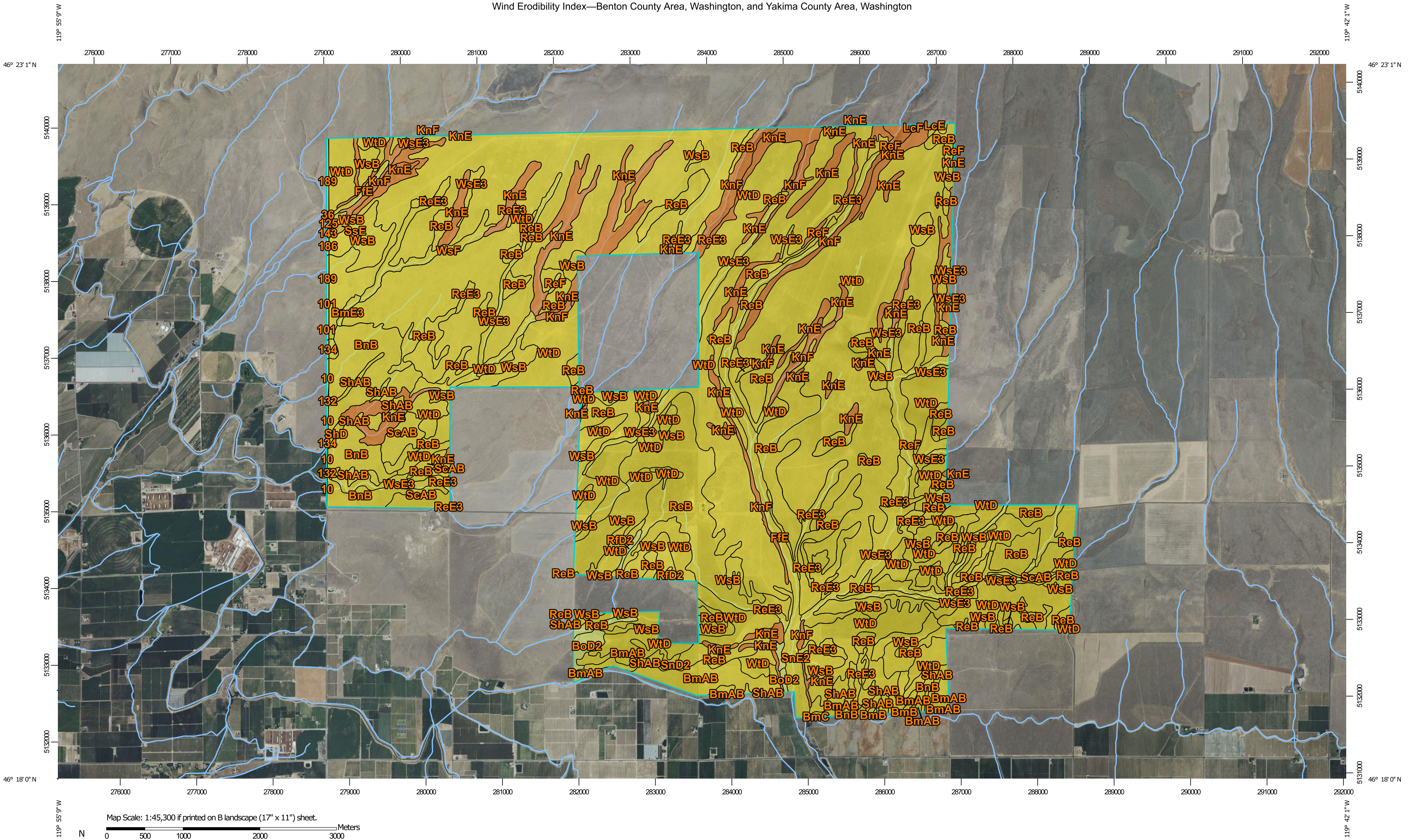
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Wind Erodibility Index—Benton County Area, Washington, and Yakima County Area, Washington



Map Scale: 1:45,300 if printed on B landscape (17" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- ☐ Area of Interest (AOI)

Soils

Soil Rating Polygons

- 🟥 0
- 🟧 38
- 🟧 48
- 🟨 56
- 🟨 86
- 🟩 134
- 🟩 160
- 🟦 180
- 🟦 220
- 🟪 250
- 🟪 310
- ⬜ Not rated or not available

Soil Rating Lines

- 〰 0
- 〰 38
- 〰 48
- 〰 56
- 〰 86
- 〰 134
- 〰 160
- 〰 180
- 〰 220
- 〰 250
- 〰 310
- 〰 Not rated or not available

Soil Rating Points

- ■ 0
- ■ 38
- ■ 48
- ■ 56
- ■ 86
- ■ 134
- ■ 160
- ■ 180
- ■ 220
- ■ 250
- ■ 310
- ■ Not rated or not available

Water Features

- 〰 Streams and Canals

Transportation

- ┼┼┼ Rails
- 〰 Interstate Highways
- 〰 US Routes
- 〰 Major Roads
- 〰 Local Roads

Background

- ▨ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

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

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

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

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

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

Soil Survey Area: Yakima County Area, Washington
Survey Area Data: Version 21, Aug 31, 2021

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Nov 21, 2021—Nov 29, 2021

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

Wind Erodibility Index

Map unit symbol	Map unit name	Rating (tons per acre per year)	Acres in AOI	Percent of AOI
BmAB	Burke silt loam, 0 to 5 percent slopes	56	241.7	2.0%
BmB	Burke silt loam, 2 to 5 percent slopes	56	0.3	0.0%
BmC	Burke silt loam, 5 to 8 percent slopes	56	0.2	0.0%
BmE3	Burke silt loam, 15 to 30 percent slopes, severely eroded	56	9.3	0.1%
BnB	Burke silt loam, shallow, 0 to 5 percent slopes	56	419.2	3.5%
BoD2	Burke very fine sandy loam, 0 to 15 percent slopes, eroded	86	35.4	0.3%
EoE	Endicott variant silt loam, 0 to 40 percent slopes	56	6.9	0.1%
FfE	Finley stony fine sandy loam, 0 to 30 percent slopes	56	252.0	2.1%
KnE	Kiona very stony silt loam, 0 to 30 percent slopes	38	829.1	6.9%
KnF	Kiona very stony silt loam, 30 to 65 percent slopes	38	310.7	2.6%
LcE	Lickskillet very stony silt loam, 0 to 30 percent slopes	38	0.6	0.0%
LcF	Lickskillet very stony silt loam, 30 to 65 percent slopes	38	2.6	0.0%
ReB	Ritzville silt loam, 0 to 5 percent slopes	56	1,818.2	15.2%
ReE3	Ritzville silt loam, 15 to 30 percent slopes, severely eroded	56	278.6	2.3%
ReF	Ritzville silt loam, 30 to 65 percent slopes	56	157.9	1.3%
RfD2	Ritzville very fine sandy loam, 0 to 15 percent slopes, eroded	86	14.3	0.1%
ScAB	Scooteney silt loam, 0 to 5 percent slopes	56	119.5	1.0%

Map unit symbol	Map unit name	Rating (tons per acre per year)	Acres in AOI	Percent of AOI
ShAB	Shano silt loam, 0 to 5 percent slopes	56	181.7	1.5%
ShB	Shano silt loam, 2 to 5 percent slopes	56	0.9	0.0%
ShD	Shano silt loam, 8 to 15 percent slopes	56	15.5	0.1%
SmB	Shano silt loam, deep, 2 to 5 percent slopes	56	0.2	0.0%
SmC	Shano silt loam, deep, 5 to 8 percent slopes	56	0.5	0.0%
SnD2	Shano very fine sandy loam, 0 to 15 percent slopes, eroded	86	22.2	0.2%
SnE2	Shano very fine sandy loam, 15 to 30 percent slopes, eroded	86	9.0	0.1%
SsE	Starbuck rocky silt loam, 5 to 45 percent slopes	48	9.2	0.1%
W	Water		0.1	0.0%
WsB	Willis silt loam, 0 to 5 percent slopes	56	822.1	6.9%
WsE3	Willis silt loam, 15 to 30 percent slopes, severely eroded	56	456.1	3.8%
WsF	Willis silt loam, 30 to 65 percent slopes	56	71.2	0.6%
WtD	Willis silt loam, shallow, 0 to 15 percent slopes	56	5,876.4	49.0%
Subtotals for Soil Survey Area			**11,961.5**	**99.7%**
Totals for Area of Interest			**11,994.7**	**100.0%**

Map unit symbol	Map unit name	Rating (tons per acre per year)	Acres in AOI	Percent of AOI
10	Burke silt loam, 2 to 5 percent slopes	56	7.8	0.1%
36	Finley cobbly fine sandy loam, 0 to 5 percent slopes	56	0.6	0.0%
101	Ritzville silt loam, 8 to 15 percent slopes	56	0.3	0.0%
125	Scooteney silt loam, 2 to 5 percent slopes	56	1.2	0.0%
132	Shano silt loam, 2 to 5 percent slopes	56	0.9	0.0%
134	Shano silt loam, 8 to 15 percent slopes	56	2.6	0.0%

Map unit symbol	Map unit name	Rating (tons per acre per year)	Acres in AOI	Percent of AOI
143	Starbuck-Rock outcrop complex, 0 to 45 percent slopes	56	0.8	0.0%
186	Willis fine sandy loam, 2 to 5 percent slopes	86	1.9	0.0%
189	Willis silt loam, 8 to 15 percent slopes	56	15.4	0.1%
Subtotals for Soil Survey Area			**31.5**	**0.3%**
Totals for Area of Interest			**11,994.7**	**100.0%**

Description

The wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Rating Options

Units of Measure: tons per acre per year

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher