Preliminary Application for Site Certificate for the Muddy Creek Energy Park

Exhibit B. Structural Standard

Submitted to the
Oregon Energy Facility Siting Council

Prepared for
Muddy Creek Energy Park, LLC

Prepared by

TETRA TECH

1750 S Harbor Way, Suite 400 | Portland, OR 97201

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
Applicant	Muddy Creek Energy Park, LLC
ASC	Application for Site Certificate
ASCE	American Society of Civil Engineers
BMP	Best Management Practices
DOGAMI	Oregon Department of Geology and Mineral Industries
ESCP	Erosion and Sediment Control Plan
Facility	Muddy Creek Energy Park
FEMA	Federal Emergency Management Agency
Geotech Report	Preliminary Geotechnical Engineering Report
IBC	International Building Code
kV	kilovolt
O&M	operations and maintenance
OAR	Oregon Administrative Rules
ODOE	Oregon Department of Energy
OSSC	Oregon Structural Specialty Code
USGS	U.S. Geological Survey

1.0 Introduction

Muddy Creek Energy Park, LLC (Applicant) seeks to develop the Muddy Creek Energy Park (Facility), consisting of a 150-megawatt (MW) solar energy generation facility, a 150-MW battery energy storage system (BESS) project, and related or supporting facilities on approximately 1,590 acres of private land in Linn County, Oregon. This Application for Site Certificate (ASC) demonstrates that the proposed Facility will be designed, constructed, and operated consistent with the relevant Oregon Energy Facility Siting Council (EFSC) siting criteria and standards. In addition to meeting the minimum required EFSC criteria, the Applicant proposes to design, construct, and operate the Facility using agrivoltaics. Agrivoltaics co-locates the Facility with active farm operations to retain agricultural production and minimize agricultural impacts within the Facility Site Boundary.

The information contained herein supports the Facility's demonstration of compliance with the Structural Standard approval standard for Oregon Administrative Rules (OAR) 345-022-0020.

2.0 Analysis Area

The Analysis Area for geologic and soil stability is the area within the proposed Site Boundary. The Analysis Area for historical seismic and potentially active faults included a 50-mile buffer around the proposed Site Boundary. The Site Boundary is defined in detail in the Background Information Exhibit and is shown on Figure B-1.

3.0 Geologic Report – OAR 345-022-0020(4)(a)

> *(4) To assist the Council in determining whether the standard outlined in (1) through (3) has been met, the Applicant must submit information from reasonably available sources regarding the geological and soil stability within the analysis area, including:*
>
> > *(a) A geologic report meeting the Oregon State Board of Geologist Examiners geologic report guidelines. Current guidelines must be determined based on consultation with the Oregon Department of Geology and Mineral Industries, as described in paragraph (B) of this subsection;*

The analysis area for geologic and soil stability is the area within the proposed Site Boundary. The analysis area for historical seismic and potentially active faults included a 50-mile buffer around the proposed Site Boundary. The Site Boundary is defined in detail in the Background Information Exhibit and is shown on Figure B-1.

OAR 345-022-0020(4)(a) requires submission of a geological report meeting the Oregon State Board of Geologist Examiners geologic report guidelines. Current guidelines shall be determined based on consultation with the Oregon Department of Geology and Mineral Industries (DOGAMI).

The Applicant has reviewed and used existing published information to characterize the geologic conditions and potential seismic hazards in the vicinity of the Facility site. These materials included local, state, and federal government aerial photography, site photographs, published geologic maps, and geotechnical data reports. The findings are described in the following sections. Subsurface explorations, testing, and engineering analysis will be conducted prior to design and construction as described in Section 5.0.

3.1 Topographic Setting

The Site Boundary is in Linn County, approximately 8 miles north of Eugene and Springfield, Oregon. The Site Boundary is bordered by Interstate 5 to the west and the Coburg Hills of the Cascade Mountain Range to the east. The proposed Site Boundary occupies slopes from 0 to 13.7 percent, with an average of 0.4 percent. Elevations within the Site Boundary range from approximately 328 feet to 381 feet above mean sea level.

3.2 Geologic Setting

The geologic setting of the proposed Facility is located in the Willamette Valley. The Willamette Valley is a broad alluvial plain in northwestern Oregon flanked on the west by early Tertiary marine sediment and volcanic rocks of the Coast Range, and on the east by Tertiary and Quaternary volcanic of the Cascade Range (O'Connor et al. 2001). The Willamette Valley has been a topographic low for at least 15 million years and the lowlands and tributary valleys are mapped as the Quaternary Missoula Flood deposits. The deposits range from deeply weathered sands and gravels from 2.5 to 0.5 million years ago to multiple flood deposits from the Glacial Lake Missoula. The Missoula flood deposits include over 40 beds of sand, silt, and clay derived primarily from the Columbia River Basin.

The geology of the Site Boundary and vicinity are represented on the geologic map Figure B-1 (DOGAMI 2026a, McClaughry et. al. 2010). The northeastern portion of the Site Boundary is mapped as the Eocene/Oligocene Eugene Formation sandstone and siltstone. Large portions of the eastern portions of the Site Boundary are mapped as Quaternary alluvial fan deposits; and western portions of the Site Boundary are mapped as Upper Pleistocene Willamette silt, Holocene alluvium and older alluvium, and Pleistocene and upper Pliocene weathered terrace gravels in the very southern portion, The geologic deposits are summarized below generally from east to west across the Site Boundary.

- **Lower Oligocene to middle Eocene Eugene Formation -** Thin to moderately thick bedded, coarse- to fine-grained arkosic and micaceous sandstone and siltstone, with minor volcaniclastic conglomerate.
- **Quaternary alluvial fans -** Unconsolidated deposits of gravel, sand, silt, clay and woody debris deposited in alluvial fans. Alluvial fans accumulate near the mouth of steep source drainages through normal fluvial deposition and debris flows as streams flow from upland settings and the gradient falls below the threshold for further sediment transport.

- **Upper Pleistocene Willamette Silt -** Mainly unconsolidated deposits of silt, with minor clay and sand deposited by repeated Missoula Floods.
- **Holocene older alluvium -** Unconsolidated deposits of gravel, sand, silt, and clay that formed on low terraces, on high river benches along major streams, and along abandoned stream channels that post-date withdrawal of the last Missoula Flood.
- **Holocene alluvium -** Unconsolidated sand, gravel, and silt forming flood plains and filling channels of present streams. In places includes talus and slope wash. Locally includes soils containing abundant organic material, and thin peat beds. The unit may be as thick as 50 feet.
- **Pleistocene and upper Pliocene weathered terrace gravels -** Unconsolidated to semi-consolidated deposits of clay, silt, and sand and volcanic-clast gravel preserved as incised terrace remnants along the margins of the southern Willamette Valley. Units may be as much as 140 feet thick.

Quaternary geologic units within the Site Boundary were also reviewed based on a 2001 U.S. Geological Survey (USGS) Professional Paper (O'Connor et. al. 2001). The publication map indicates the southern portion of the Site Boundary is mapped as Holocene and Pleistocene fine-grained alluvium and the remaining Site Boundary is mapped within the main body of fine-grained Missoula Flood deposits. The thickness of the alluvium is not determined. The Missoula Flood deposits are composed of stratified silt and clay with minor sand and up to 40 individual layers from 0.3 to 3 feet thick.

Exhibit C describes properties of the site surficial soils based on Natural Resources Conservation Service (NRCS 2026) data within the Facility Site Boundary. Exhibit C also includes soils characteristics including the approximate thickness, formation setting, permeability, runoff potential, and potential hazard for erosion.

A Preliminary Geotechnical Engineering Report (Terracon 2023) that was conducted within the Site Boundary included test borings with the following site-specific soil and geologic characteristics:

- Top soil thickness ranged from 0.5 to 2.5 feet.
- Topsoil was underlain by medium to high plasticity fine-grained alluvium ranging from 2.5 to over 20 feet in thickness.
- Coarse-grained alluvium consisting of clayey gravels to coarse sands were encountered to depths ranging from 2.5 to 20 feet.
- Underlying the alluvium, residual soils (Clayey Sand to Fat Clay) and weathered sandstone were encountered, mostly on the far eastern and northern portions of the overall development.
- Groundwater encountered in some of the borings between 5 to 15 feet below ground surface.

4.0 Consultation with DOGAMI – OAR 345-022-0020(4)(b)

(b) A summary of consultation with the Oregon Department of Geology and Mineral Industries regarding the appropriate methodology and scope of the seismic hazards and geology and soil-related hazards assessments, and the appropriate site-specific geotechnical work that must be performed before submitting the application for the Department to determine that the application is complete;

A meeting with DOGAMI was held on December 7, 2023. The meeting memorandum is included in Attachment B-1. Meeting attendees included representatives of DOGAMI, Oregon Department of Energy (ODOE), QCells, and Tetra Tech. DOGAMI staff generally noted that the existing analysis used the correct data; however, DOGAMI provided feedback regarding additional resources for inclusion in Exhibit B. In response to DOGAMI direction, an additional geologic publication was included in the geologic mapping information and discussion. DOGAMI also requested additional information regarding earthquake epicenters and liquefaction susceptibility be included and mapped. DOGAMI acknowledged that earthquake epicenter data and liquefaction susceptibility data were not accessible for downloading and mapping; however, Tetra Tech reviewed the information online and included relevant discussion in Exhibit B. In addition, ODOE requested that the ASC include a scope and outline of the anticipated site-specific geotechnical studies that will be conducted prior to construction.

5.0 Site-Specific Geotechnical Work – OAR 345-022-0020(4)(c)

(c) A description and schedule of site-specific geotechnical work that will be performed before construction for inclusion in the site certificate as conditions;

A Preliminary Geotechnical Engineering Report (Geotech Report; Terracon 2023) was conducted in January 2023 that included 31 borings to depths of 10.5 to 25.25 feet below existing ground surface, 15 test pits to depths of 8 to 11 feet below existing ground surface, laboratory testing, engineering analysis, and preparation of a report. Information from the Geotech Report is included in relevant sections of this exhibit.

The Geotech Report includes recommendations for the appropriate design of Facility components to account for the soils and geology within the Site Boundary, and geologic hazards that generally include the following:

- Earthwork associated with the Facility will likely consist of grading to develop array access roads and primary roads, plus minor cutting and filling for laydown and staging areas. Subgrade stabilization is recommended for roadways and surface supported structures.
- Onsite soils are not recommended to be used for structural fill. Silt and clay soils are sensitive to moisture variation and easily disturbed when overly moist.

- Panel arrays would be supported on small H-piles or C-piles. Transformers, inverters, and other equipment in the photovoltaic fields may also be supported on these piles. Restrictive layers would influence the type of piles and specific design.
- Shallow foundations would require ground improved soil including removal of unstable materials and replacement with granular fill.
- Access roads would require planning for subgrades including earthwork stabilization.
- Mat foundations might be necessary for some of the inverters.
- Substation foundation and design considerations and recommendations are discussed in detail.

A full discussion of the design recommendations and considerations is provided in the Preliminary Geotechnical Engineering Report. The Report did not identify any geotechnical concerns that might constitute constraints for Project implementation.

At an appropriate stage in the development, additional subsurface explorations will be completed to confirm the anticipated soil conditions and provide final design recommendations. The site-specific geological and geotechnical investigation will address subsurface exploration plans, and testing plans. The geotechnical investigation will consist primarily of the following tasks:

- Reviewing available data from previous geotechnical explorations near the Facility site;
- Reviewing available geologic information from published sources;
- Reviewing data for evidence of active faults and landslides;
- Conducting a geotechnical field exploration, such as soil borings, test pits, and possibly geophysical testing.
- Collecting additional soil samples for classification and laboratory testing, if necessary.

Geotechnical analyses will be used to calculate bearing capacity of the soils, conduct stability analyses, and provide engineering recommendations for construction of the structures.

6.0 Transmission Lines and Pipelines – OAR 345-022-0020(4)(d)

(d) For all transmission lines, and for all pipelines that would carry explosive, flammable or hazardous materials, a description of locations along the proposed route where the applicant proposes to perform site specific geotechnical work, including but not limited to railroad crossings, major road crossings, river crossings, dead ends (for transmission lines), corners (for transmission lines), and portions of the proposed route where geologic reconnaissance and other site specific studies provide evidence of existing landslides, marginally stable slopes or potentially liquefiable soils that could be made unstable by the planned construction or experience impacts during the facility's operation;

The proposed Facility includes a 0.65-mile, 230-kilovolt (kV) overhead transmission line to connect the collector substations to the existing 230-kV Diamond Hill Substation located between the northern and southern portions of the Facility Site Boundary (see Figure 1 in the Background Information Exhibit).

The Applicant will perform site-specific geotechnical work along the transmission line where potential geologic hazards have been identified to inform the final design of the proposed Facility. The preliminary Geotech Report (Terracon 2023) was conducted within the Site Boundary as described in Section 5.0.

The 230-kV line will be supported either by H-frame structures with two galvanized steel or wood poles or by a galvanized steel or wood monopole structure. The structures will rise to a height of approximately 60 to 80 feet above grade, depending on the terrain. The transmission line corridor is approximately 80 feet in width centered on the line.

The proposed Facility does not include pipelines carrying hazardous substances as described in OAR 345-022-0020(4)(d).

7.0 Seismic Hazard Assessment – OAR 345-022-0020(4)(e)

> *(e) An assessment of seismic hazards, in accordance with standard-of-practice methods and best practices, that addresses all issues relating to the consultation with the Oregon Department of Geology and Mineral Industries described in paragraph (B) of this subsection, and an explanation of how the applicant will design, engineer, construct, and operate the facility to avoid dangers to human safety and the environment from these seismic hazards. Furthermore, an explanation of how the applicant will design, engineer, construct and operate the facility to integrate disaster resilience design to ensure recovery of operations after major disasters. The applicant must include proposed design and engineering features, applicable construction codes, and any monitoring and emergency measures for seismic hazards, including tsunami safety measures if the site is located in the DOGAMI-defined tsunami evacuation zone; and*

7.1 Methods

Available reference materials were reviewed, and a desktop seismic-hazard assessment was performed for the ASC. Topographic and geologic conditions and hazards within the Site Boundary were evaluated using topographic and geologic maps, aerial photographs, existing geologic reports, and data from DOGAMI, the Oregon Water Resources Department, the USGS, and the Natural Resources Conservation Service.

A desktop seismic-hazard analysis characterized seismicity in the Facility's vicinity to evaluate potential seismic impacts. This work was based on the potential regional and local seismic activity described in the existing scientific literature and on subsurface soil and groundwater conditions found in the desktop evaluations. The seismic-hazard analysis consisted of the following tasks:

1. Detailed review of USGS, National Geophysical Data Center, and DOGAMI literature and databases.
2. Identification of potential seismic events and characterization of those events in terms of a series of design events.
3. Evaluation of seismic hazards, including potential fault rupture, earthquake-induced landslides, liquefaction and lateral spread, settlement, and subsidence.
4. Mitigation recommendations based on the characteristics of the subsurface soils and design earthquakes, including specific seismic events that might have a significant effect on the site, potential for seismic energy amplification at the site, and the site-specific acceleration response spectrum.

As described in Section 5.0, the preliminary Geotech Report (Terracon 2023) was completed and a site-specific geotechnical investigation will be conducted by a qualified engineer using current code requirements and state-of-practice methods to inform the final design. It will be reported to DOGAMI and ODOE following the 2014 Oregon State Board of Engineering Geology Reports guidelines.

7.2 Maximum Considered Earthquake Ground Motion under IBC 2012

Overall, the DOGAMI HazView mapping tool (DOGAMI 2026b) indicates that the Cascadia earthquake hazard is very strong to severe within the Site Boundary with the severe rating located along the eastern half where the alluvial fan deposits are located (Figure B-1). The USGS Unified Hazard Tool (USGS 2026a) developed ground motions using a probabilistic seismic hazard analysis that covered the proposed Facility site. Though these motions are not site-specific, they reasonably estimate the ground motions within the Site Boundary. For new construction, the site should be designed for the maximum considered earthquake, according to the most recently updated International Building Code (IBC; ICC 2024) supplemented by the Oregon Structural Specialty Code (OSSC; State of Oregon 2025). The USGS unified hazard tool analysis was run for the Site Boundary, and the design event has a 2 percent probability of exceedance in 50 years (or a 2,475-year return period). This event has a peak ground acceleration of 0.4853 acceleration from gravity for the Site Boundary. The values of peak ground acceleration are an average representation of the acceleration most likely to occur at the site for all seismic events (crustal, intraplate, or subduction).

In accordance with American Society of Civil Engineers (ASCE) Standard 7 (ASCE 2022), the Site Boundary is classified as Seismic Design Category "D." Seismic design parameters were developed following IBC 2024 and ASCE/SEI-7. Using current information, the Facility would be designed for Site Class D, according to IBC requirements (Table B-1). Some areas within the Site Boundary generally have characteristics that meet Site Classes B and C. However, Site Class D characteristics are present in large portions of the Site Boundary and therefore Site Class D is the most conservative Site Class for Facility design. The preliminary Geotech Report (Terracon 2023) also states that Site Class D is appropriate for seismic design.

Table B-1. Seismic Design Parameters—Maximum Considered Earthquake

Location	Site Class	Earthquake Magnitude	Peak Horizontal Ground Acceleration	Return Period
Facility Site Boundary	D	8.45	0.485g	2,475 years
Facility Site Boundary	C	8.40	0.412g	2,475 years
Facility Site Boundary	D	8.10	0.176g	475 years
Facility Site Boundary	C	8.07	0.137g	475 years
Source: USGS 2026a.				

7.2.1 Earthquake Sources

In northern Oregon, seismicity is generated when the Juan de Fuca Plate and the North American Plate converge at the Cascadia Subduction Zone. These plates converge at a rate of 1 to 2 inches per year, accumulating large amounts of stress that release abruptly in earthquake events. The four sources of earthquakes and seismic activity in this region are crustal, intraplate, volcanic, and the deep subduction zone (DOGAMI 2010).

Overall, earthquakes in Oregon are associated with active faults in four regional seismicity zones: the Cascade seismic zone, the Portland Hills zone (the Portland, Oregon and Vancouver, Washington metropolitan area), the south-central zone (Klamath Falls), and northeastern Oregon zone (Niewendorp and Neuhaus 2003). Faults are considered active if there has been displacement in the last 10,000 years, and potentially active if there has been movement over the last Quaternary Period (1.6 million years). Regionally, seismicity has been attributed to crustal deformation from the Cascadia Subduction Zone and volcanism.

Earthquakes caused by movements along crustal faults, generally in the upper 10 to 15 miles of the earth's crust. In the vicinity of the Site Boundary, earthquakes occur within the crust of the North American tectonic plate when built-up stresses near the surface are released through fault rupture.

The DOGAMI Oregon HazVu: Statewide Geohazards Viewer earthquake hazard layer (DOGAMI 2026b) and the USGS Geologic Hazards Science Center (Figure B-2; USGS 2026b) show potentially active faults near the Facility area. These faults depicted on Figure B-2, which are mapped within 50 miles of the Site Boundary, present the largest potential for seismic contribution to the Facility. No potentially active faults are mapped within the Site Boundary (Figure B-2; USGS 2026c). The Pierce Creek Fault is mapped crossing a portion of the northwestern Site Boundary as shown in Figure B-1 (DOGAMI 2026a). However, there is no evidence of recent (Quaternary) rupture of this fault. A number of middle- and late- Quaternary-age faults, Class B faults, and Undifferentiated Quaternary faults are mapped within 50 miles of the Site Boundary, as shown in Figure B-2. The closest potentially active fault is a Middle and Late Quaternary fault located approximately 17 miles north/northwest of the Site Boundary.

The preliminary Geotech Report (Terracon 2023) provides an evaluation of fault activity for the Facility and Site Boundary. The report concludes that based on the available fault information, the depth to bedrock, and the nearest active faults, the risk of surface rupture within the Site Boundary is low.

The site-specific geotechnical investigation will include a description of any potentially active faults, their potential risk to the proposed Facility, and any additional mitigation measures the Applicant will employ to design, construct, and operate the proposed Facility safely.

The 2013 Oregon Resilience Plan by the Oregon Seismic Safety Policy Advisory Commission (OSSPAC 2013) simulated the impact of a magnitude 9.0 Cascadia earthquake scenario. This plan places the Site Boundary into the "strong to very strong" shaking category. The Site Boundary is located in the Valley Zone, where widespread moderate damage would severely disrupt daily life and commerce. This means that a magnitude 9.0 Cascadia scenario earthquake would produce a strong shaking event with the following characteristics: it would be difficult to stand or walk; furniture broken; damage to poorly built masonry buildings; weak chimneys break; plaster, loose bricks, cornices, unbraced parapets and porches fall; some cracks in better masonry buildings. (OSSPAC 2013).

Probabilistic seismic-hazard disaggregation at 475-year intervals is shown in Attachment B-2 and at 2,475-year intervals in Attachment B-3.

7.2.2 Recorded Earthquakes

Figure B-2 displays the location and approximate magnitude of all recorded earthquakes within approximately 50 miles of the Site Boundary. The seismic events are grouped by magnitude and displayed with differently sized symbols based on the event's strength.

Table B-2 summarizes the earthquakes greater than magnitude 3.0 recorded within 50 miles of the Site Boundary. Most of these earthquakes were between magnitude 3 and 4 that generally is associated with a Modified Mercalli Intensity III characterized by shaking that is "noticeable indoors but may not be recognized as an earthquake" (USGS 2023b).

Table B-2. Significant Historical Earthquakes within 50 Miles of the Facility

Year	Month	Day	Latitude	Longitude	Moment Magnitude	Miles from Site Boundary
2022	10	7	44.5403	-122.5508	4.39	29.39
2018	4	15	44.9455	-122.7558	3.08	48.44
2015	7	4	44.0895	-122.8310	4.14	14.10
2006	3	4	44.7520	-123.7170	3.30	47.05
2000	12	30	44.7380	-123.1897	3.10	33.55
1995	3	13	44.6170	-122.8070	3.02	26.09
1963	3	7	44.8770	-122.7380	4.60	44.14

Year	Month	Day	Latitude	Longitude	Moment Magnitude	Miles from Site Boundary
1961	8	19	44.7000	-122.5000	4.50	38.98
Source: USGS 2026b. Note that "significant" in this case means earthquakes greater than magnitude 3.0.						

DOGAMI (2026b) also provides earthquake data that includes information from numerous seismograph stations across the State of Oregon. Although the data is not currently available for download, the data was reviewed in the vicinity of the Site Boundary. Additional earthquakes greater than magnitude 3.0 were not apparent within 25 miles of the Site Boundary, although a 5-6 magnitude earthquake was mapped southwest of Eugene, Oregon within 50 miles of the Site Boundary.

The Ground Response Spectra Assessment (Attachment B-4) assessed the design response spectrum using the latest ASCE Hazard Tool (ASCE 2026). Response spectra are provided for the maximum considered earthquake at the Facility location. For the maximum considered earthquake, separate response spectra modified by the amplification factors for Site Class D are provided. Due to the presence of unconsolidated alluvial fan deposits in the Site Boundary, the Facility should be designed for the most conservative Site Class D.

7.2.3 Hazards Resulting from Seismic Events

Potential seismic hazards from a design seismic event for this Facility include seismic shaking or ground motion, fault displacement, instability from landslides or subsurface movement, and adverse effects from groundwater or surface water. These risks are anticipated to be high, as discussed below. Since the Facility is moderately far from the Oregon coast, and not in a DOGAMI-defined tsunami evacuation zone (DOGAMI 2022), tsunami inundation is not considered a hazard.

7.2.4 Seismic Shaking or Ground Motion

The Facility will be designed to withstand the maximum risk-based design earthquake ground motions developed for the Facility site. The design seismic event has a 2,475-year recurrence interval. The State of Oregon has adopted the IBC 2024 code for structural design. Specifically, this is Chapter 16, Section 1613 (Earthquake Loads) of the 2025 OSSC (State of Oregon 2025). Building codes are frequently updated; the IBC is updated every 3 years. The Applicant will design, engineer, and construct the Facility following the latest IBC, OSSC, and building codes adopted by the State of Oregon at the time of construction.

Based on geotechnical and geological information the soil/bedrock in the Site Boundary is "Site Class D." As described in Section 7.2.1, Site Class D (very dense stiff soil) is appropriate for the proposed Facility.

Based on site-specific analyses, the original equipment manufacturer will provide the structural engineer with site-specific foundation loads and requirements. The structural engineer then completes the foundation analyses based on the design site-specific parameters. The geotechnical studies and analyses provide site-specific parameters, including but not limited to moisture content and density, soil/bedrock bearing capacity, bedrock depth, settlement characteristics, structural backfill characteristics, soil improvement (if required), and dynamic soil/bedrock properties, including shear modulus and Poisson's Ratio of the subgrade. The foundation design engineer will use these parameters to design a suitable foundation and verify that the foundation/soil interaction meets or exceeds the original equipment manufacturer's site-specific, minimum requirements.

7.2.5 Fault Rupture

Fault displacement is unlikely because there are no active faults within the Site Boundary, and the nearest known or potentially active faults are over 20 miles from the Site Boundary (Figure B-2). Unknown faults could exist, or new fault ruptures could form during a significant seismic event, but geologic investigations indicate that the likelihood is low to moderate.

Available DOGAMI Highest Hit LiDAR hillshade and slope data were reviewed for the area. No obvious evidence of fault rupture was observed (DOGAMI 2026c).

7.2.6 Liquefaction

Liquefaction is a phenomenon in which saturated, cohesionless soils temporarily lose their strength and liquefy when subjected to dynamic forces such as intense and prolonged ground shaking and seismic activity. The soils in the Site Boundary are generally alluvium material consisting of silts and clays. Unsaturated silts and clays generally do not liquefy during earthquakes. Depth to groundwater, with the exception of areas immediately surrounding streams and creeks, is generally greater than 40 feet below ground surface (OWRD 2026). However, the preliminary Geotech Report (Terracon 2023) encountered groundwater from 3 to 15 feet in many of the boreholes during drilling. The DOGAMI liquefaction susceptibility map indicates that liquefaction hazards are rated low to high within the Site Boundary, with significant portions of the Site Boundary located in moderate to high liquefaction hazard susceptibility as shown in Figure B-3 (DOGAMI 2026b). However, the preliminary Geotech Report (Terracon 2023) concluded that based on the plastic nature of the shallow soils, the risks associated with liquefaction are considered very low. The geotechnical investigation will include specific studies and fieldwork to evaluate and mitigate liquefaction hazards.

7.2.7 Seismically Induced Landslides

While regional seismicity could potentially trigger landslides and mass wasting processes in the Site Boundary, the risk is considered low to moderate for expected shaking in a Cascadia 9.0 magnitude event (DOGAMI 2026b). Figure B-1 shows a large alluvial fan deposit covering much of the eastern Site Boundary; however, no landslides or talus colluvium are mapped within the Site Boundary. Construction will avoid historic landslides and steep slopes. In addition, a review of

HazView mapping (DOGAMI 2026b) indicates that most of the Site Boundary is within an area of low landslide susceptibility with only the northeastern area that has a moderate susceptibility (Figure B-3). A large area mapped as landslide and talus colluvium slope is located east of the Site Boundary on Figure B-1. This landslide area can be traced back to a large Cascadia earthquake that occurred in 1700 (DOGAMI 2026a, McClaughry et. al. 2010). The preliminary Geotech Report (Terracon 2023) did not find any evidence of faults that would induce landslides. The site-specific geotechnical investigation will review evidence of active faults and landslides, which will inform the final Facility design and layout. More detailed discussion on the location and type of landslides is included in Section 7.1.

7.2.8 Subsidence

Subsidence is the sudden sinking or the gradual downward settling of the land surface, and is often related to groundwater drawdown, compaction, tectonic movements, mining, or explosive activity. Subsidence due to a seismic event is unlikely. In most areas of the Site Boundary with the exception of mapped floodplains shown in Figure B-3, the overlying soils are not saturated and groundwater is generally greater than 40 feet below ground surface. However, bedrock is expected to be relatively deep and the geotechnical investigation will include specific studies and fieldwork to evaluate and mitigate potential subsidence hazards. The preliminary Geotech Report (Terracon 2023) includes recommendations for soil preparation and stabilization including fill materials and recompaction; however, specific subsidence concerns were not identified.

7.2.9 Seismic Hazard Mitigation

The State of Oregon uses the 2024 IBC, with current amendments by the OSSC. Pertinent design codes relating to geology, seismicity, and near-surface soil are found in OSSC Chapter 16, Section 1613 (State of Oregon 2025). Facility infrastructure will be designed to meet or exceed all current design code standards. Substation equipment will meet all requirements in the latest version of the Institute of Electrical and Electronics Engineers 693-2018 standard (which directs the design and qualification of equipment installed in substations and its ability to withstand a seismic event.). Although the region has only a moderate seismicity potential, the solar arrays will be designed to resist seismic loads.

As discussed in Section 5.0, site-specific geotechnical exploration will provide data that will guide the proposed Facility infrastructure design to mitigate potential seismic-event hazards. The hazard of a surficial rupture along a fault is low, given the seismic history of the site displayed in geologic mapping, and the low probability that a fault rupture would actually displace the ground surface at the location of one of the transmission line structures. Because the Facility will be in a sparsely populated area, there is minimal human safety and environmental risk. Mitigation for potential fault rupture is not needed. No structures will be built on steep slopes prone to instability, thus avoiding potential impacts. Disaster resilience design guidelines are further described in Section 9.0.

8.0 Non-Seismic Geological Hazards – OAR 345-022-0020(4)(f)

(f) An assessment of geology and soil-related hazards which could, in the absence of a seismic event, adversely affect or be aggravated by the construction or operation of the facility, in accordance with standard-of-practice methods and best practices, that address all issues relating to the consultation with the Oregon Department of Geology and Mineral Industries described in paragraph (B) of this subsection. An explanation of how the applicant will design, engineer, construct and operate the facility to adequately avoid dangers to human safety and the environment presented by these hazards, as well as:

8.1 Landslides

In 2021, DOGAMI released an update to the Oregon Statewide Landslide Database (SLIDO; SLIDO-4.4) (DOGAMI 2026d). SLIDO is a statewide database of known landslides compiled from published maps. The database includes landslides, debris flows, alluvial fans, and colluvium or talus. The primary sources of this historical landslide information are published geologic reports and geologic hazard studies by the USGS and DOGAMI. The SLIDO-4.4 landslide database was used to overlay landslide areas or landslide-related features on Figure B-2. The closest mapped landslides on the SLIDO database are located a few miles east of the eastern Site Boundary. A large portion of the eastern half of the site is located in a historic alluvial fan. A review of HazView mapping (DOGAMI 2026b) indicates that most of the Site Boundary is located in a low landslide susceptibility area while areas of moderate landslide susceptibility hazard are mapped along portions of the eastern and northeastern Site Boundary (Figure B-3).

Available DOGAMI Highest Hit LiDAR hillshade and slope data were reviewed for the area (DOGAMI 2026c). Slopes appeared steeper in the eastern portions of the Facility although no obvious potential landslide areas were indicated.

Slopes within the vicinity of the Site Boundary range from approximately zero to 13.7 percent, with an average slope of 0.4 percent. The preliminary Geotech Report (Terracon 2023) did not identify any specific slope stability concerns; however, it is noted that the report did not specifically evaluate slope stability. If slope stability issues are identified during the geotechnical investigation, the final design will incorporate relocation of structures during the micrositing process, or remedial measures to improve slope stability will be implemented.

8.2 Volcanic Activity

Volcanic activity in the Cascade Range is driven by the subduction of the Juan de Fuca Plate beneath the North American Plate. The closest volcanoes to the Site Boundary are Three Sisters located approximately 63 miles away to the east. Most of the potential volcanic hazard impacts would occur within a 50-mile radius of the erupting volcano. Depending on the prevailing wind direction at the time of the eruption and the source of the eruption, ash fallout in the region surrounding the Facility may occur. Because of the distance to the nearest volcanoes, the Facility's impacts from volcanic activity would be indirect and likely limited to ash fallout. In addition, the Facility is not located near any streams that would be subject to pyroclastic flows from a volcanic eruption from these close volcanoes (DOGAMI 2026b). It is unlikely that there would be any adverse effects from volcanic activity on the construction or operation of the Facility.

8.3 Erosion

As discussed in Exhibit I, erosion can occur when soils are increasingly exposed to wind or water. Wind erosion is influenced by wind intensity, vegetative cover, soil texture, soil moisture, the grain size of the unprotected soil surface, topography, and the frequency of soil disturbance. Control measures will be implemented to mitigate wind erosion potential as identified in Exhibit I. Water erosion is primarily a function of soil type, vegetative cover, precipitation, and slope inclination. If left unmitigated, erosion from rainfall would be a hazard during construction. The runoff potential and water erosion hazard for site soils ranges from low to high. The average slope within the Site Boundary is 0.4 percent and slopes are not expected to contribute to erosion potential for the Facility. A draft Erosion and Sediment Control Plan (ESCP) has been developed to reduce the potential for soil erosion (see Exhibit C). The ESCP includes structural and nonstructural best management practices (BMPs). Structural BMPs include the installation of silt fences or other physical controls to divert flows from exposed soils or otherwise limit runoff and pollutants from exposed areas. Nonstructural BMPs include the implementation of materials handling procedures, disposal requirements, and spill prevention methods.

The Certificate Holder will apply for a National Pollutant Discharge Elimination System stormwater construction permit though the Your DEQ Online platform. In addition, Exhibit C contains a comprehensive list of mitigation measures to avoid wind and water erosion and soil impacts.

8.4 Flooding

Federal Emergency Management Agency (FEMA) National Flood Hazard data (FEMA 2026) were compared to the temporary and permanent disturbance areas in the Site Boundary to evaluate flood hazards. Most of the Site Boundary is mapped as Zone X - area of minimal flood hazard. Portions of the Site Boundary surrounding drainages and creeks are mapped within identified FEMA 100-year floodplains as shown in Figure B-3. No FEMA 500-year floodplains are mapped within the Site Boundary. Permanent impacts to 100-year floodplains include 0.78 miles of access roads in the northwestern Site Boundary that would affect 1.81 acres. A very small corner of the development area (less than 0.01 acre) would also be impacted outside the solar fenceline in the southwestern development area. The final Facility design would avoid 100-year floodplains to the extent possible.

Seasonal thunderstorms can result in concentrated stormwater runoff and localized flooding. The Facility will be designed and engineered to comply with zoning ordinances and building codes that establish flood protection standards for all construction to avoid dangers to the infrastructure, as well as human safety and the environment, including criteria to ensure that the foundation will withstand flood forces. The engineered access roads and drainages will direct stormwater runoff away from structures and into drainage ditches and culverts as required in the ESCP. Therefore, the risks and potential impacts to the Facility, human safety, and the environment from flood hazards are expected to be low. Floodplain permits would be obtained as necessary for temporary and permanent impacts to 100-year floodplains.

8.5 Shrinking and Swelling Soils

The majority of the soils found within the Site Boundary are silty/clayey soils (see Exhibit C). Clayey soils are the most susceptible to shrinking and swelling. Recommendations for design parameters in the preliminary Geotech Report (Terracon 2023) take into account the clayey soils and the potential effects of moisture. The shrink-swell potential of the soils will be evaluated during the site-specific geotechnical investigations and laboratory testing and analysis during the final Facility design phase. If shrinking or swelling soils are present at foundation locations or along road alignments, soil improvement will be necessary. Soil improvement can include reworking and compacting on-site soils, over-excavating soils with shrink-swell potential and replacing with compacted structural fill, constructing impermeable barriers to prevent saturation, or mixing soils to reduce the potential for shrinking and swelling.

8.6 Collapsing Soils

Soil properties were evaluated by laboratory testing and analysis in the preliminary Geotech Report (Terracon 2023). Recommendations for design parameters in the take into account the potential for collapsing soils and generally include structural fill and recompaction. Subsurface soil conditions, such as loess or collapsing soils, will be identified during the site-specific geotechnical investigation and will inform the final design of the Facility. If collapsible soils are found, collapse potential will be mitigated by construction techniques (over-excavating and replacing with structural fill, wetting, and compacting) during subgrade preparation.

8.7 Disaster Resilience

> *(A) An explanation of how the applicant will design, engineer, construct and operate the facility to integrate disaster resilience design to ensure recovery of operations after major disasters; and*

Pertinent design codes related to geology, seismicity, and near-surface soils are contained in OSSC Chapter 16, Section 1613 (Earthquake Loads) (State of Oregon 2025). The Facility will be designed to meet or exceed the minimum standards required by these design codes. The Certificate Holder acknowledges that DOGAMI encourages, but does not require, design and build for disaster resilience and future climate conditions using science, data, and community wisdom to protect against and adapt to risks. With this in mind, the Certificate Holder has extensive experience building energy facilities and designing projects to withstand non-seismic geologic hazards from a structural perspective.

The Facility will be designed, engineered, and constructed to meet all current standards to adequately avoid potential dangers to human safety presented by seismic hazards. A qualified engineer will assess and review the seismic, geologic, and soil hazards associated with the Facility infrastructure construction. Construction requirements will be modified, as needed, based on the site-specific characterization of seismic, geologic, and soil hazards. Substation structures will be designed under the current version of the OSSC. Substation, transmission lines, and collector line equipment will be specified by the latest version of the Institute of Electrical and Electronics Engineers (currently IEEE 693-2018). The Facility infrastructure will be in sparsely populated areas; therefore, the risks to human safety and the environment due to seismic hazards will be minimal.

The Facility infrastructure will be designed, engineered, and constructed to meet or exceed all current standards. The Certificate Holder proposes to design, engineer, and construct the Facility to avoid dangers to human safety-related and non-seismic hazards in many ways, including conducting site-specific geotechnical evaluations (see Section 5.0). Typical mitigation measures for non-seismic hazards include avoiding potential hazards, conducting subsurface investigations to characterize the soils to adequately plan and design appropriate mitigation measures, creating detailed geologic hazard maps to aid in laying out facilities, providing warnings in the event of hazards, and purchasing insurance to cover the Facility in the event of hazards. Should Facility elements like access roads be damaged, they will be assessed and repairs made quickly to ensure recovery of operations after a major storm event.

8.8 Climate Change

> *(B) An assessment of future climate conditions for the expected life span of the proposed facility and the potential impacts of those conditions on the proposed facility.*

The University of Washington conducted a study to assess climate vulnerability and adaptation in the Columbia River Plateau, where the Facility is located (Michalak et al. 2014). The study involved downscaling five climate models (CCM3, CGM3.1, GISS-ER, MIROC3.2, and Hadley). Climate projections were downscaled to approximately a 1-kilometer resolution for over 40 different direct (mean annual temperature/precipitation) and derived (number of growing-degree days, actual and potential evapotranspiration) climate variables (Michalak et al. 2014). The downscaling of the climate models for this area led to future projections of greater annual average and summer temperatures, and more severe storm events and wildfires, among other changes. These specific changes are expected to increase stress on power lines in the region.

Reinforcing the local electric grid with wind power and new transmission lines increases energy grid resilience in this part of Oregon. This reinforcement will be direct, by upgrading a system that is anticipated to experience higher loads under rising temperatures and related increases in power demand for summer cooling. It is also indirect, by supporting the delivery of power generated through various sources, minimizing the potential reduction in hydro power's role under future conditions. All aspects of this Facility support resiliency in the face of future climate change. The Facility will be designed to withstand extreme events as explained above in Section 9.0.

Future climate conditions may include increased variability in precipitation and severity of storm events that will impact landslide risk, erosion hazard, and flooding; however, the severity is difficult to determine and to predict. Greater intensity rainfall events or a reduction in annual precipitation coupled with warmer average temperatures could result in increases in the potential for geologic hazards. Any change in the annual precipitation could impact erosion. Warmer and drier periods can increase fire hazards in forested areas, which could lead to increased erosion and debris flows in steep drainages adjacent to the Facility. Dust during periods of dry weather and high wind can also result in deposition of loess at the Facility. Wetter periods with higher-than-normal precipitation can increase flooding hazards in the drainages.

These potential impacts are not expected to adversely affect the Facility, or they would be mitigated by Facility design and measures (i.e., watering for dust abatement, terracing for slope stability, BMPs). Development of renewable energy sources to displace fossil fuel generation may have a positive impact on climate conditions.

9.0 Conclusions

The risk of seismic hazards to human safety at the Facility is low. The Applicant reviewed regional geologic information and performed a preliminary site-specific analysis of potential seismic, geologic, and soils hazards that also included design recommendations as described in Section 5.0. In addition, another site-specific geotechnical investigation will be conducted, allowing the Applicant to design, engineer, and construct the Facility to the most current standards at the time of construction. A site-specific geotechnical investigation will be conducted prior to construction, allowing the Applicant to design, engineer, and construct the Facility to the most current standards at the time of construction. This exhibit reflects input from DOGAMI and demonstrates that the Applicant can design, engineer, and construct the Facility to avoid dangers to human safety. The following supporting evidence is provided, with the remaining evidence to be provided before construction:

- The risk of seismic hazards to human safety at the Facility is considered low because the Applicant will conduct an additional geotechnical investigation as warranted based on the final design layout of solar photovoltaic arrays, collector substation, and other Facility structures and will follow the required design parameters for the Facility as described in Section 7.0. The Applicant has adequately characterized the seismic hazard risk of the site under OAR 345-022-0020(1)(a) and considered seismic events and amplification for the Facility's site-specific subsurface profile. Facility components include solar modules, inverters, transformers, generators, site access roads, battery energy storage system, and collector substation with equipment.
- The Applicant has demonstrated that the Facility can be designed, engineered, and constructed to avoid dangers to human safety and the environment in case of a design seismic event by adhering to the most recently updated IBC requirements, following OAR 345-022-0020(1)(b). These standards require that for the design seismic event, the factors of safety used in the Facility design exceed specific values. For example, in the case of slope design, a factor of safety of at least 1.1 is usually required during seismic stability

evaluation. This safety factor is introduced to account for uncertainties in the design process and ensure that performance is acceptable. If slope stability safety factors are not met, the Facility components will either be relocated during the micrositing process or remedial measures to improve slope stability will be implemented. For slope stability, the remedial measures could include the use of ground improvement methods (such as retaining structures) to limit the movement to acceptable levels. Given the relatively low level of risk for the Facility, adherence to the IBC requirements will ensure that appropriate protection measures for human safety are taken.

- The Applicant has provided appropriate site-specific information and demonstrated (per OAR 345-022-0020(1)(c)) that the construction and operation of the Facility, in the absence of a seismic event, will not adversely affect or aggravate the geological or soil conditions of the Facility site or vicinity. The risks posed by non-seismic geologic hazards are generally considered low because the Facility can be designed to minimize or avoid the hazards of landslides and soil erosion. Landslide and slope stability issues will be identified during the final design and mitigated. Erosion hazard resulting from soil and wind action will be minimized by implementing erosion control plan. The Applicant will notify ODOE in the event that site investigations or trenching reveal conditions in the foundation rock different from what was evaluated, or if shear zones, artesian aquifers, deformations, or clastic dikes are found in the vicinity of the site.
- The Applicant has demonstrated that the Facility can be designed, engineered, and constructed to avoid human safety and environment impacts from geological and soil hazards, per OAR 345-022-0020(1)(d). Accordingly, given the relatively small risks these hazards pose to human safety, standard methods of practice (including implementation of the current IBC) will be adequate for the design and construction of the Facility. Site-specific studies will be conducted, additional geotechnical work will be completed once the final locations of the structures are selected, and adequate measures will be implemented to control erosion.
- Finally, the Applicant has assessed future climate conditions for the expected life span of the Facility, and the potential impacts of those conditions on the Facility.

Therefore, for the reasons outlined in this exhibit, the construction and operation of the proposed Facility will comply with the structural standards as outlined in OAR 345-022-0020, as well as the standard in OAR 345-021-0010(1)(h).

10.0 References

ASCE (American Society of Civil Engineers). 2022. ASCE/SEI, 7-22. *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, American Society of Civil Engineers/Structural Engineering Institute, Standard 7, 2022.

ASCE. 2026. ASCE 41-23 Hazard Tool. https://asce7hazardtool. online/. Accessed March 2026.

DOGAMI (Oregon Department of Geology and Mineral Industries). 2010. Creating a culture of preparedness–Oregon's earthquake risk and resiliency. *Cascadia,* Winter 2010. DOGAMI, Oregon. https://www.oregongeology.org/pubs//cascadia/CascadiaWinter2010.pdf

DOGAMI. 2022. Tsunami Inundation Map (TIM) Series. https://www.oregongeology.org/pubs/tim/p-TIM-overview.htm Accessed March 2026.

DOGAMI. 2026a. DOGAMI - Digital Data Publication Preview - OGDC-8, Oregon Geologic Data Compilation, release 8: https://www.oregon.gov/dogami/pubs/Pages/dds/p-OGDC-8.aspx Accessed March 2026.

DOGAMI. 2026b. Oregon HazVu: Statewide Geohazards Viewer. https://gis.dogami.oregon.gov/maps/hazvu/ Accessed March 2026.

DOGAMI. 2026c. DOGAMI LiDAR Viewer. https://gis.dogami.oregon.gov/maps/lidarviewer/ Accessed March 2026.

DOGAMI. 2026d. Statewide Landslide Information Database for Oregon (SLIDO-4.4). https://www.oregongeology.org/slido/data.htm Accessed September 2023.

FEMA (Federal Emergency Management Agency). 2026. FEMA National Flood Hazard Layer. https://www.fema.gov/national-flood-hazard-layer-nfhl Accessed March 2026.

ICC (International Code Council). 2024. 2024 International Building Code. International Code Council, Washington D.C. https://blog.ansi.org/ansi/2024-international-building-code-icc-ibc/.

McClaughry, J. D., Wiley, T. J., Ferns, M. L., Madin, I., & McConnell, V. S. 2010. Digital Geologic Map of the Southern Willamette Valley, Benton, Lane, Linn, Marion, and Polk Counties, Oregon. Oregon Department of Geology and Mineral Industries.

Michalak, J., J. Withley, J. Lawler, and T. Nogeire. 2014. Climate Vulnerability and Adaptation in the Columbia Plateau, Wa. Prepared for the Great Northern Landscape Conservation Cooperative, University of Washington, Seattle, Washington. https://www.researchgate.net/publication/267750432_Climate_Vulnerability_and_Adaptation_in_the_Columbia_Plateau_Washington.

Niewendorp, C.A., and M.E. Newhouse. 2003. Map of selected earthquakes for Oregon 1841-2002. Open-File Report O-03-02. DOGAMI, Oregon.

NRCS (Natural Resource Conservation Service). 2026. Web Soil Survey. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed March 2026.

O'Connor, Jim E, Andrei Sarna-Wojcicki, Karl C. Wozniak, Danial J. Polette, and Robert J. Fleck. 2001. "Origin, Extent, and Thickness of Quaternary Geologic Units in the Willamette Valley, Oregon." USGS, pubs.usgs.gov/pp/1620/pdf/pp1620.pdf. Accessed March 19, 2026.

OWRD (Oregon Water Resources Department) 2026. Well Report Mapping Tool. https://apps.wrd.state.or.us/apps/gw/wl_well_report_map/Default.aspx. Accessed March 2026.

OSSPAC (Oregon Seismic Safety Policy Advisory Commission). 2013. The Oregon Resilience Plan. Salem, Oregon. February 2013. https://www.oregon.gov/oem/documents/oregon_resilience_plan_final.pdf

State of Oregon. 2025. 2025 Oregon Structural Specialty Code (OSSC). Building Codes Division, State of Oregon. Salem, Oregon. https://www.oregon.gov/bcd/codes-stand/Pages/adopted-codes.aspx. https://www.oregon.gov/bcd/codes-stand/Documents/25ossc-ch01.pdf

Terracon. 2023. Preliminary Geotechnical Engineering Report – Saturn Solar. Prepared for Hanwha Q Cells USA by Terracon. Terracon Project No. 82225006. January 24, 2023.

USGS (U.S. Geological Survey). 2026a. Earthquake Hazard Toolbox. https://earthquake.usgs.gov/nshmp/hazard/disagg/. Accessed March 2026.

USGS. 2026b. Latest Earthquakes Interactive Map and Catalog. Version 1.3.1. U.S. Geological Survey. https://earthquake.usgs.gov/earthquakes/map. Accessed March 2026.

USGS. 2026c. Quaternary Fault and Fold Database. https://www.usgs.gov/programs/earthquake-hazards/faults. Accessed March 2026.

11.0 Approval Standards and Submittal Requirements

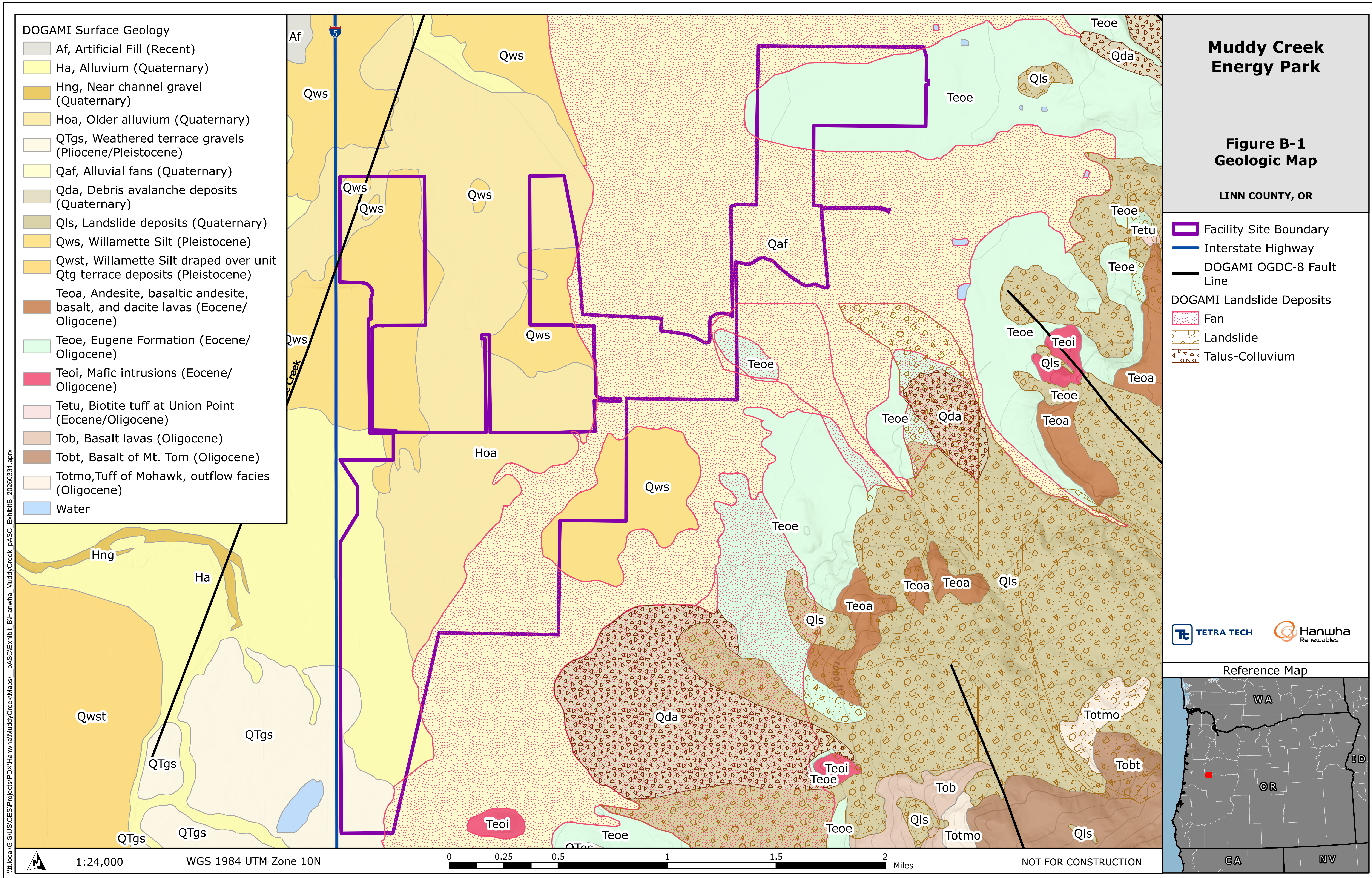
Table B-3. Approval Standards and Submittal Requirements Matrix

Requirement	Location
OAR 345-022-0020 Structural Standard	–
Approval Standards	
(1) Except for facilities described in sections (2) and (3), to issue a site certificate, the Council must find that:	
(a) The applicant, through appropriate site-specific study, has adequately characterized the seismic hazard risk of the site.	
(b) The applicant can design, engineer, and construct the facility to avoid dangers to human safety and the environment presented by seismic hazards affecting the site, as identified in subsection (1)(a).	
(c) The applicant, through appropriate site-specific study, has adequately characterized the potential geological and soils hazards of the site and its vicinity that could, in the absence of a seismic event, adversely affect, or be aggravated by, the construction and operation of the proposed facility; and	
(d) The applicant can design, engineer and construct the facility to avoid dangers to human safety and the environment presented by the hazards identified in subsection (c).	
(2) The Council may not impose the Structural Standard in section (1) to approve or deny an application for an energy facility that would produce power from wind, solar or geothermal energy. However, the Council may, to the extent it determines appropriate, apply the requirements of section (1) to impose conditions on a site certificate issued for such a facility.	

Requirement	Location
(3) The Council may not impose the Structural Standard in section (1) to deny an application for a special criteria facility under OAR345-015-0310. However, the Council may, to the extent it determines appropriate, apply the requirements of section (1) to impose conditions on a site certificate issued for such a facility.	
Submittal Requirements	
(4) To assist the Council in determining whether the standard outlined in (1) through (3) has been met, the Applicant must submit information from reasonably available sources regarding the geological and soil stability within the analysis area, including:	–
(a) A geologic report meeting the Oregon State Board of Geologist Examiners geologic report guidelines. Current guidelines must be determined based on consultation with the Oregon Department of Geology and Mineral Industries, as described in paragraph (B) of this subsection;	Section 3.0
(b) A summary of consultation with the Oregon Department of Geology and Mineral Industries regarding the appropriate methodology and scope of the seismic hazards and geology and soil-related hazards assessments, and the appropriate site-specific geotechnical work that must be performed before submitting the application for the Department to determine that the application is complete;	Section 4.0
(c) A description and schedule of site-specific geotechnical work that will be performed before construction for inclusion in the site certificate as conditions;	Section 5.0
(d) For all transmission lines, and for all pipelines that would carry explosive, flammable or hazardous materials, a description of locations along the proposed route where the applicant proposes to perform site specific geotechnical work, including but not limited to railroad crossings, major road crossings, river crossings, dead ends (for transmission lines), corners (for transmission lines), and portions of the proposed route where geologic reconnaissance and other site specific studies provide evidence of existing landslides, marginally stable slopes or potentially liquefiable soils that could be made unstable by the planned construction or experience impacts during the facility's operation;	Section 6.0
(e) An assessment of seismic hazards, in accordance with standard-of-practice methods and best practices, that addresses all issues relating to the consultation with the Oregon Department of Geology and Mineral Industries described in paragraph (B) of this subsection, and an explanation of how the applicant will design, engineer, construct, and operate the facility to avoid dangers to human safety and the environment from these seismic hazards. Furthermore, an explanation of how the applicant will design, engineer, construct and operate the facility to integrate disaster resilience design to ensure recovery of operations after major disasters. The applicant must include proposed design and engineering features, applicable construction codes, and any monitoring and emergency measures for seismic hazards, including tsunami safety measures if the site is located in the DOGAMI-defined tsunami evacuation zone; and	Section 7.0
(f) An assessment of geology and soil-related hazards which could, in the absence of a seismic event, adversely affect or be aggravated by the construction or operation of the facility, in accordance with standard-of-practice methods and best practices, that address all issues relating to the consultation with the Oregon Department of Geology and Mineral Industries described in paragraph (B) of this subsection. An explanation of how the applicant will design, engineer, construct and operate the facility to adequately avoid dangers to human safety and the environment presented by these hazards, as well as:	Section 8.0
(A) An explanation of how the applicant will design, engineer, construct and operate the facility to integrate disaster resilience design to ensure recovery of operations after major disasters; and	Section 8.7

Requirement	Location
(B) An assessment of future climate conditions for the expected life span of the proposed facility and the potential impacts of those conditions on the proposed facility.	Section 8.8

Figures



Muddy Creek Energy Park
Figure B-1 Geologic Map
LINN COUNTY, OR
DOGAMI Surface Geology
Af, Artificial Fill (Recent)
Ha, Alluvium (Quaternary)
Hng, Near channel gravel (Quaternary)
Hoa, Older alluvium (Quaternary)
QTgs, Weathered terrace gravels (Pliocene/Pleistocene)
Qaf, Alluvial fans (Quaternary)
Qda, Debris avalanche deposits (Quaternary)
Qls, Landslide deposits (Quaternary)
Qws, Willamette Silt (Pleistocene)
Qwst, Willamette Silt draped over unit Qtg terrace deposits (Pleistocene)
Teoa, Andesite, basaltic andesite, basalt, and dacite lavas (Eocene/Oligocene)
Teoe, Eugene Formation (Eocene/Oligocene)
Teoi, Mafic intrusions (Eocene/Oligocene)
Tetu, Biotite tuff at Union Point (Eocene/Oligocene)
Tob, Basalt lavas (Oligocene)
Tobt, Basalt of Mt. Tom (Oligocene)
Totmo, Tuff of Mohawk, outflow facies (Oligocene)
Water
Facility Site Boundary
Interstate Highway
DOGAMI OGDC-8 Fault Line
DOGAMI Landslide Deposits
Fan
Landslide
Talus-Colluvium
Reference Map
WA
ID
OR
CA
NV
TETRA TECH
Hanwha Renewables
1:24,000
WGS 1984 UTM Zone 10N
0 0.25 0.5 1 1.5 2 Miles
NOT FOR CONSTRUCTION
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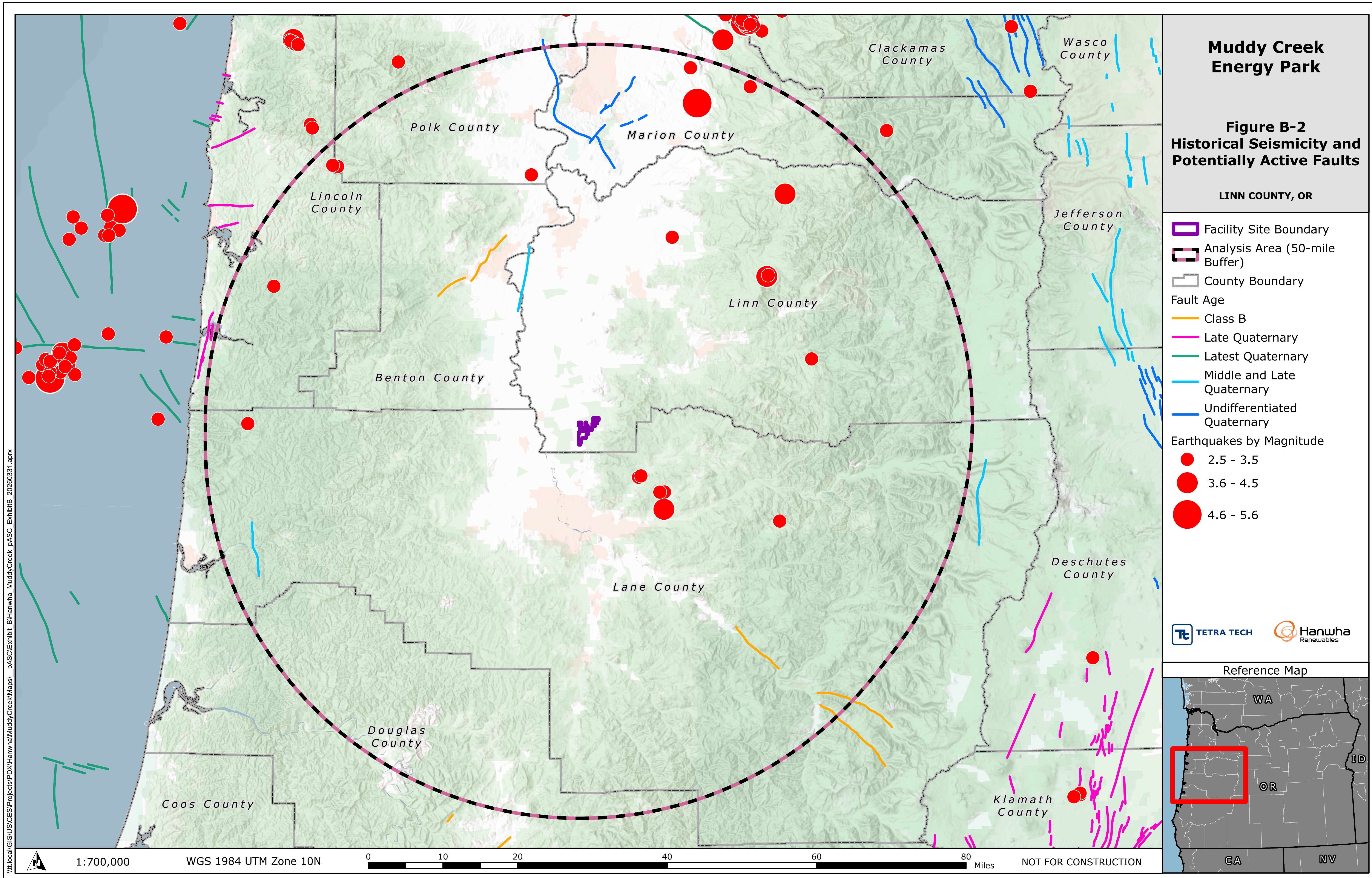

Muddy Creek Energy Park
Figure B-2
Historical Seismicity and Potentially Active Faults
LINN COUNTY, OR
Facility Site Boundary
Analysis Area (50-mile Buffer)
County Boundary
Fault Age
Class B
Late Quaternary
Latest Quaternary
Middle and Late Quaternary
Undifferentiated Quaternary
Earthquakes by Magnitude
2.5 - 3.5
3.6 - 4.5
4.6 - 5.6
TETRA TECH
Hanwha Renewables
Reference Map
WA
ID
OR
CA
NV
Clackamas County
Wasco County
Polk County
Marion County
Lincoln County
Jefferson County
Linn County
Benton County
Lane County
Deschutes County
Douglas County
Klamath County
Coos County
1:700,000
WGS 1984 UTM Zone 10N
0
10
20
40
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80
Miles
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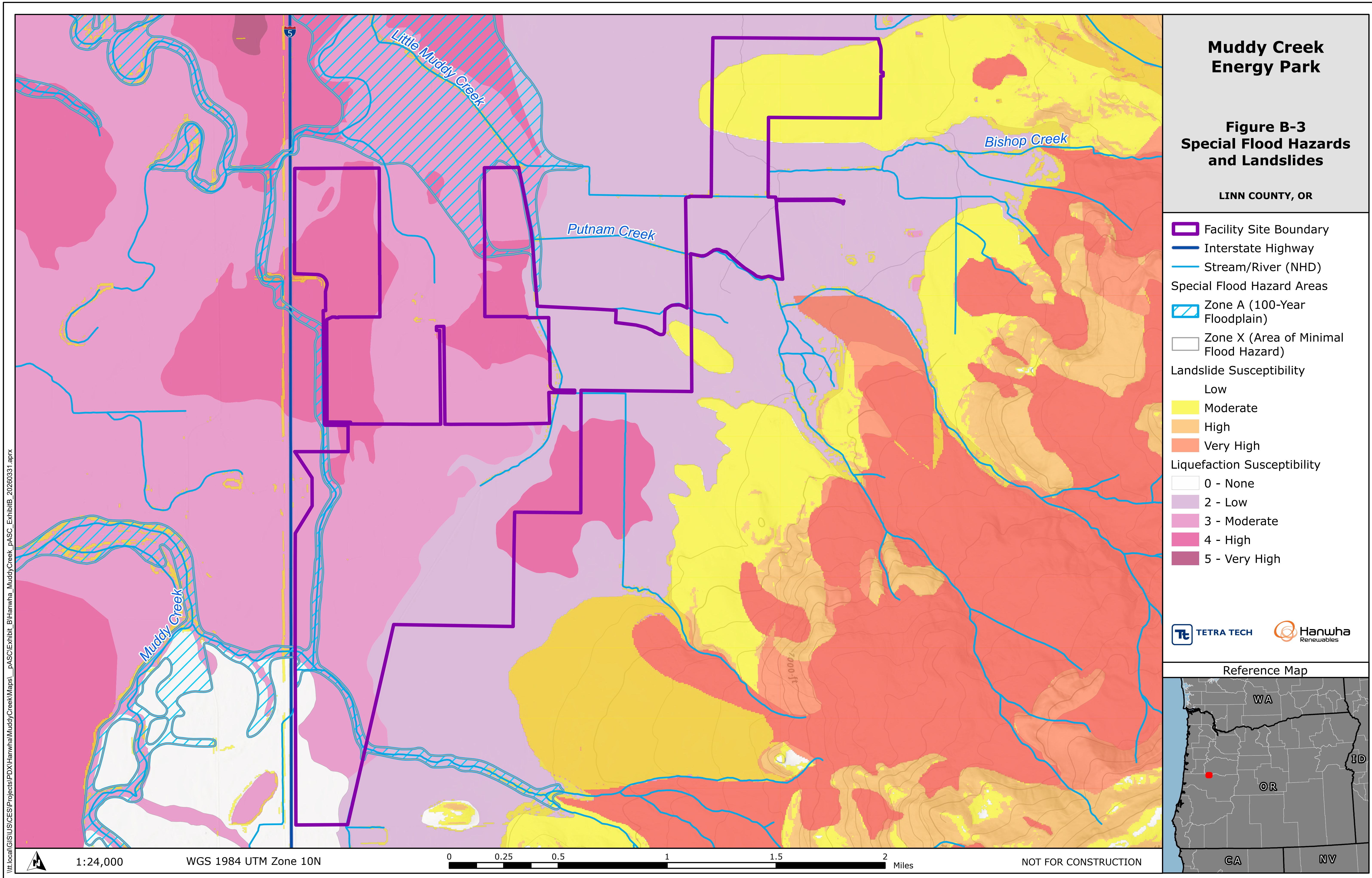


Muddy Creek Energy Park
Figure B-3
Special Flood Hazards and Landslides
LINN COUNTY, OR
Facility Site Boundary
Interstate Highway
Stream/River (NHD)
Special Flood Hazard Areas
Zone A (100-Year Floodplain)
Zone X (Area of Minimal Flood Hazard)
Landslide Susceptibility
Low
Moderate
High
Very High
Liquefaction Susceptibility
0 - None
2 - Low
3 - Moderate
4 - High
5 - Very High
TETRA TECH
Hanwha Renewables
Reference Map
WA
ID
OR
CA
NV
Little Muddy Creek
Bishop Creek
Putnam Creek
Muddy Creek
5
700 ft
1:24,000
WGS 1984 UTM Zone 10N
0
0.25
0.5
1
1.5
2
Miles
NOT FOR CONSTRUCTION

Attachment B-1. Record of Correspondence with DOGAMI

TETRA TECH Memo

Date: December 7, 2023

Project: Muddy Creek Solar

Subject: DOGAMI Consultation for EFSC process

Conference Call Meeting with Oregon Department of Geology and Mineral Industries (DOGAMI) and Oregon Department of Energy (ODOE), December 7, 2023 at 10 am PST

A conference call meeting was held with DOGAMI and ODOE on December 7, 2023, 10 am PST with the following attendees present: Jason McClaughry (DOGAMI), Chase McVeigh-Walker (ODOE), Brian Tran (QCells), Paul Hicks (Tetra Tech), and Rachel Miller (Tetra Tech).

The following Project information was presented (including a Powerpoint presentation) from the draft Exhibit H for the Muddy Creek Solar Project:

- Brian Tran and Paul Hicks provided a Project overview including a map of the overall Project features and vicinity.
- Rachel Miller discussed the resources and methods used for the geology and geologic hazards analyses that included a slide presentation.
- Rachel Miller discussed the geologic hazards studies including maps of the geology of the area, a map of seismic information including earthquakes and faults, and a map of landslide and floodplains hazards.

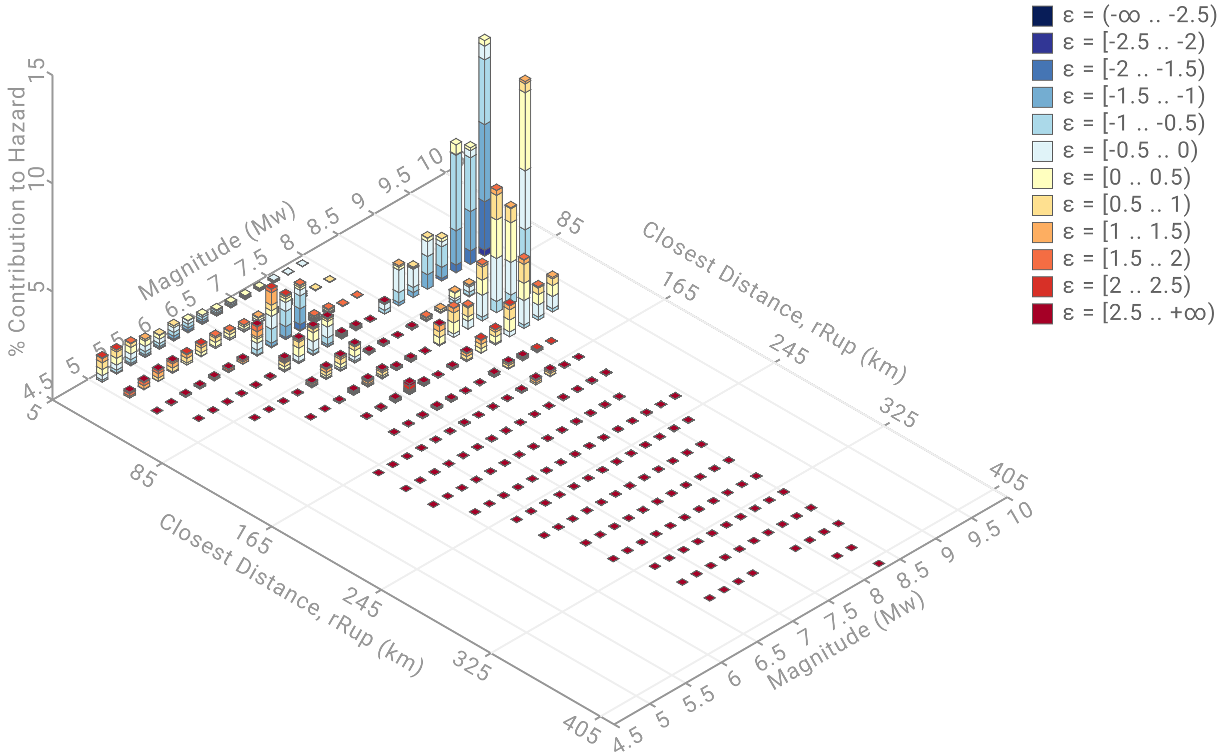
The following feedback was received from ODOE and DOGAMI:

- Jason (DOGAMI) indicated that another geologic map that provides surficial geologic information could be reviewed and relevant information could be included in Exhibit H. He provided a link to the publication during the meeting.
- Jason also indicated that there has been landslide activity during fairly recent time just east of the site boundary as shown on the Geologic map. This is a result of Cascadia Subduction Zone shaking in September 1700. It is good to be aware of this issue.
- Jason also indicated that earthquake data that might be more up to date than what is available from the USGS should be reviewed and included on the earthquake map. This would be DOGAMI data. He indicated that he would provide a link to the data.
- Jason stated that liquefaction hazard is a major concern in the valley area due to the unconsolidated deposits and the relatively shallow groundwater. He will provide a link to liquefaction susceptibility mapping available from DOGAMI.
- Chase (ODOE) stated that the future planned geotechnical work for the Project is an important part of what ODOE and DOGAMI want to see. Brian responded, stating that a geotechnical contractor would put together a scope of work and this should be ready next week sometime.

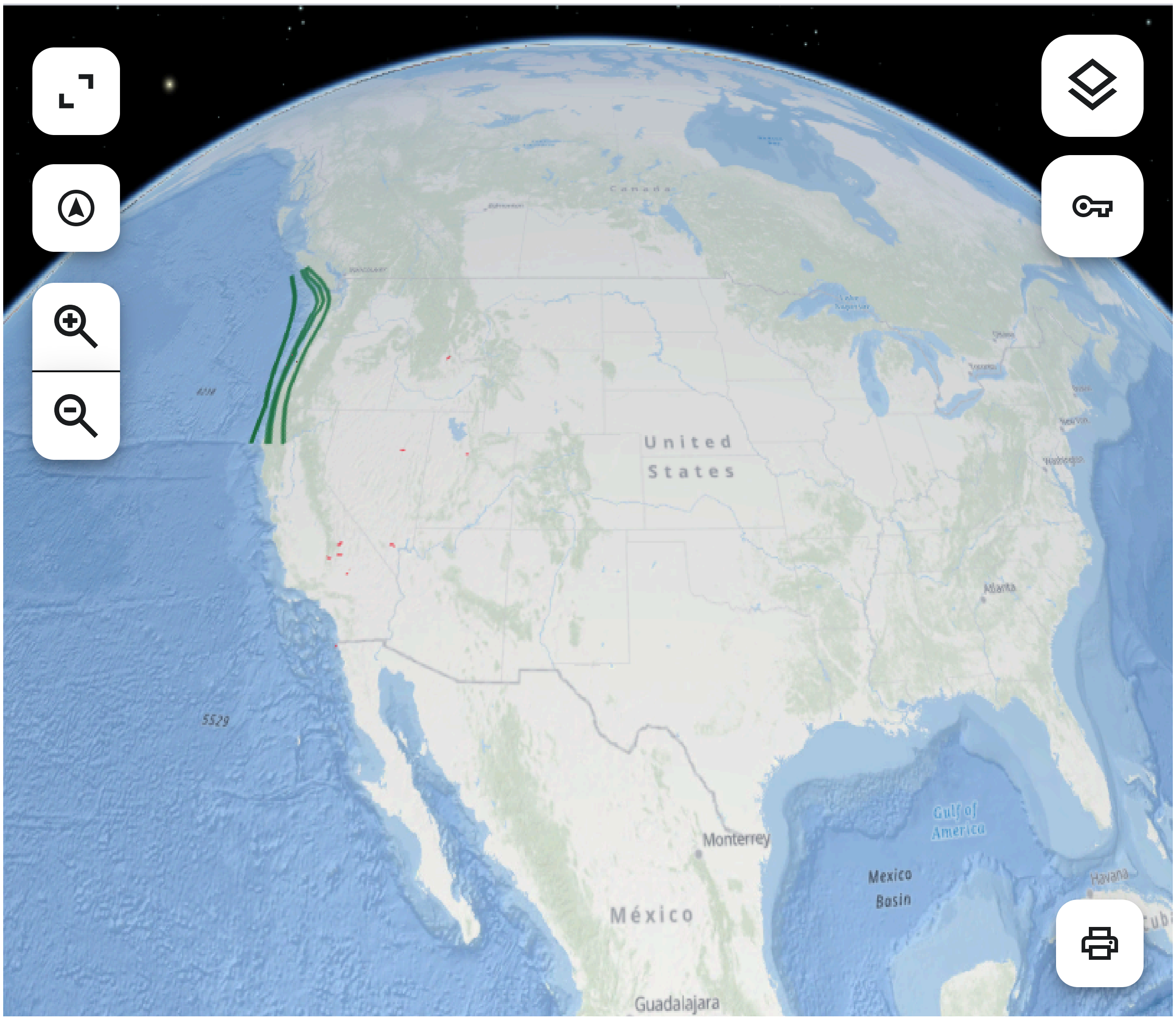
Attachment B-2. Probabilistic Seismic Hazard Deaggregation – 475-Year Return Time

Disaggregation Report

Disaggregation



Geographical Disaggregation



Esri, GEBCO, Garmin, NaturalVue | Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, U... Powered by Esri

Parameter Summary

Model: NSHM Conterminous U.S. 2023

Latitude: 44.242 °

Longitude: -123.035 °

Site Class: C (Vs30 530)

Intensity Measure Type: PGA

Return Period: 475 (10% in 50)

Component: Total

Disaggregation Summary: Total

Disaggregation targets

Return period : 475 yrs

Exceedance rate : 2.105e-3 yr^{-1}

PGA ground motion : 1.368e-1 g

Recovered targets

Return period : 474.30452 yrs

Exceedance rate : 2.108e-3 yr^{-1}

Totals

Binned : 100 %

Residual : 0 %

Trace : 1.49 %

Mean (over all sources)

m : 8.07

r : 80.59 km

ε_0 : -0.14 σ

Mode (largest m-r bin)

m : 9.28

r : 64.83 km

ε_0 : -1.11 σ

Contribution : 9.96 %

Mode (largest m-r-ε_0 bin)

m : 9.08

r : 112.41 km

ε_0 : 0.23 σ

Contribution : 3.61 %

Discretization

r : min = 0.0, max = 1000.0, Δ = 20.0 km

m : min = 4.4, max = 9.4, Δ = 0.2

ε : min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0 : [-∞ .. -2.5)

ε1 : [-2.5 .. -2.0)

ε2 : [-2.0 .. -1.5)

ε3 : [-1.5 .. -1.0)

ε4 : [-1.0 .. -0.5)

ε5 : [-0.5 .. 0.0)

ε6 : [0.0 .. 0.5)

ε7 : [0.5 .. 1.0)

ε8 : [1.0 .. 1.5)

ε9 : [1.5 .. 2.0)

ε10 : [2.0 .. 2.5)

ε11 : [2.5 .. +∞]

Disaggregation Contributions: Total

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
Cascadia (full, bottom)	Interface							19.3
Cascadia (full, bottom)		64.83	9.11	-1.01	123.756°W	44.129°N	257.88	19.3
Cascadia (full, middle)	Interface							18.07
Cascadia (full, middle)		112.41	8.93	-0.08	124.383°W	44.572°N	289.41	18.07
WUS Branch Average (opt)	Grid							14.88
OR Intraslab	Slab							14.15
Cascadia (full, top)	Interface							5.58
Cascadia (full, top)		125.72	8.84	0.16	124.611°W	44.129°N	264.81	5.58
Cascadia (unsegmented, GEA12-B, bottom)	Interface							4.07
Cascadia (unsegmented, GEA12-B, bottom)		69.51	8.36	-0.46	123.756°W	44.129°N	257.88	4.07
Cascadia (unsegmented, GEA12-B, middle)	Interface							3.07
Cascadia (unsegmented, GEA12-B, middle)		116.25	8.38	0.36	124.383°W	44.572°N	289.41	3.07
WUS Branch Average	FaultSystem							2.17
Turner - Mill Creek (0)		51.98	6.58	1.35	123.067°W	44.753°N	357.43	1
Cascadia (unsegmented, GEA12-A, bottom)	Interface							1.45
Cascadia (unsegmented, GEA12-A, bottom)		74.58	8.39	-0.39	123.756°W	44.129°N	257.88	1.45
Cascadia (segmented, GEA12, C, bottom)	Interface							1.28
Cascadia (segmented, GEA12, C, bottom)		64.44	8.75	-0.80	123.756°W	44.129°N	257.88	1.28
Cascadia (unsegmented, GEA12-A, middle)	Interface							1.15
Cascadia (unsegmented, GEA12-A, middle)		120.23	8.41	0.39	124.383°W	44.572°N	289.41	1.15
Cascadia (segmented, GEA12, D, bottom)	Interface							1.01
Cascadia (segmented, GEA12, D, bottom)		88.89	8.61	-0.23	123.780°W	43.700°N	224.95	1.01

Application Metadata

Application: Disaggregation
URL: https://earthquake.usgs.gov/nshmp/hazard/disagg

Repository: nshmp-apps
Version: 21.5.4
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-apps

Repository : nshmp-haz
Version: 2.8.2
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-haz

Repository : nshmp-lib
Version: 1.7.15
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-lib

Repository : nshm-conus
Version: 6.1.3
URL: https://code.usgs.gov/ghsc/nshmp/nshms/nshm-conus.git

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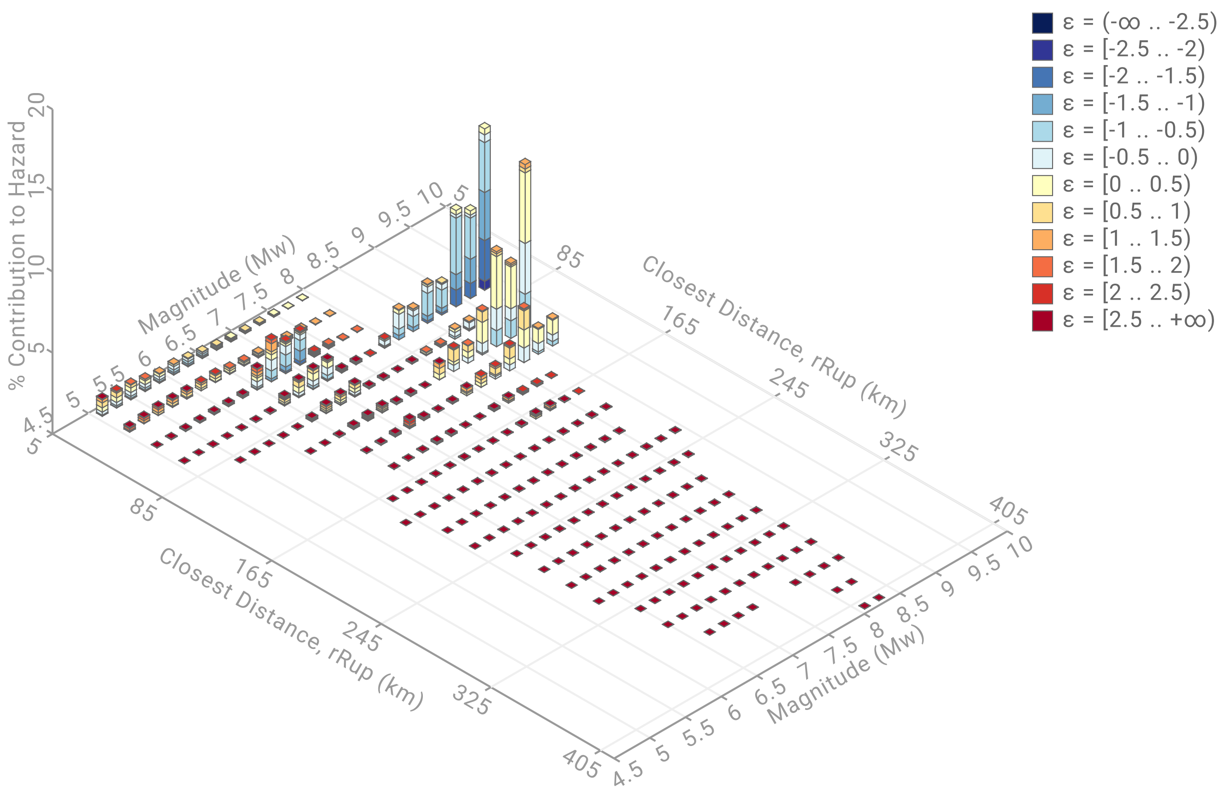
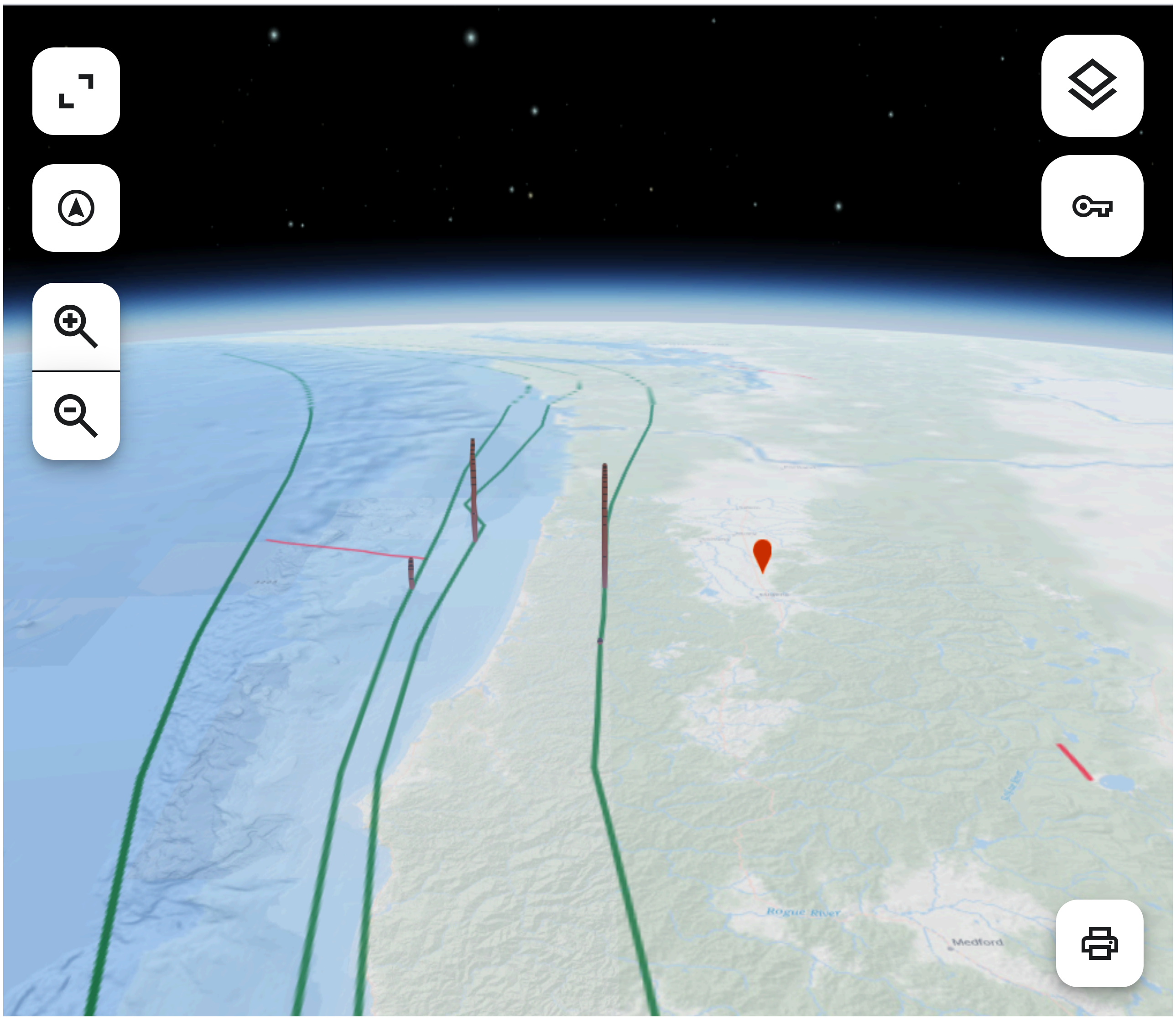
Disaggregation Report

Disaggregation



Geographical Disaggregation



CHS, Esri, GEBCO, Garmin, NaturalVue | Oregon State Parks, State of Oregon GEO, Es... Powered by Esri

Parameter Summary

Model: NSHM Conterminous U.S. 2023

Latitude: 44.242 °

Longitude: -123.035 °

Site Class: D (Vs30 260)

Intensity Measure Type: PGA

Return Period: 475 (10% in 50)

Component: Total

Disaggregation Summary: Total

Disaggregation targets

Return period : 475 yrs

Exceedance rate : 2.105e-3 yr^{-1}

PGA ground motion : 1.764e-1 g

Recovered targets

Return period : 472.13895 yrs

Exceedance rate : 2.118e-3 yr^{-1}

Totals

Binned : 100 %

Residual : 0 %

Trace : 1.55 %

Mean (over all sources)

m : 8.1

r : 81.98 km

ε_0 : -0.12 σ

Mode (largest m-r bin)

m : 9.08

r : 112.41 km

ε_0 : -0.17 σ

Contribution : 10.19 %

Mode (largest m-r-ε_0 bin)

m : 9.06

r : 112.41 km

ε_0 : 0.07 σ

Contribution : 4.35 %

Discretization

r : min = 0.0, max = 1000.0, Δ = 20.0 km

m : min = 4.4, max = 9.4, Δ = 0.2

ε : min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0 : [-∞ .. -2.5)

ε1 : [-2.5 .. -2.0)

ε2 : [-2.0 .. -1.5)

ε3 : [-1.5 .. -1.0)

ε4 : [-1.0 .. -0.5)

ε5 : [-0.5 .. 0.0)

ε6 : [0.0 .. 0.5)

ε7 : [0.5 .. 1.0)

ε8 : [1.0 .. 1.5)

ε9 : [1.5 .. 2.0)

ε10 : [2.0 .. 2.5)

ε11 : [2.5 .. +∞]

Disaggregation Contributions: Total

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
Cascadia (full, bottom)	Interface							19.3
Cascadia (full, bottom)		64.83	9.11	-1.04	123.756°W	44.129°N	257.88	19.3
Cascadia (full, middle)	Interface							18.63
Cascadia (full, middle)		112.41	8.93	-0.08	124.383°W	44.572°N	289.41	18.63
WUS Branch Average (opt)	Grid							13.85
OR Intraslab	Slab							13.67
Cascadia (full, top)	Interface							5.79
Cascadia (full, top)		125.72	8.84	0.18	124.611°W	44.129°N	264.81	5.79
Cascadia (unsegmented, GEA12-B, bottom)	Interface							4.13
Cascadia (unsegmented, GEA12-B, bottom)		69.71	8.35	-0.50	123.756°W	44.129°N	257.88	4.13
Cascadia (unsegmented, GEA12-B, middle)	Interface							3.22
Cascadia (unsegmented, GEA12-B, middle)		116.36	8.38	0.36	124.383°W	44.572°N	289.41	3.22
WUS Branch Average	FaultSystem							2.23
Cascadia (unsegmented, GEA12-A, bottom)	Interface							1.47
Cascadia (unsegmented, GEA12-A, bottom)		74.97	8.38	-0.43	123.756°W	44.129°N	257.88	1.47
Cascadia (segmented, GEA12, C, bottom)	Interface							1.29
Cascadia (segmented, GEA12, C, bottom)		64.44	8.75	-0.84	123.756°W	44.129°N	257.88	1.29
Cascadia (unsegmented, GEA12-A, middle)	Interface							1.2
Cascadia (unsegmented, GEA12-A, middle)		120.43	8.41	0.39	124.383°W	44.572°N	289.41	1.2
Cascadia (segmented, GEA12, D, bottom)	Interface							1.03
Cascadia (segmented, GEA12, D, bottom)		88.89	8.61	-0.25	123.780°W	43.700°N	224.95	1.03
Cascadia (unsegmented, GEA12-B, top)	Interface							1.01
Cascadia (unsegmented, GEA12-B, top)		129.29	8.39	0.54	124.611°W	44.129°N	264.81	1.01
Cascadia (segmented, GEA12, C, middle)	Interface							1
Cascadia (segmented, GEA12, C, middle)		112.16	8.49	0.21	124.383°W	44.572°N	289.41	1

Application Metadata

Application: Disaggregation
URL: https://earthquake.usgs.gov/nshmp/hazard/disagg

Repository: nshmp-apps
Version: 21.5.4
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-apps

Repository : nshmp-haz
Version: 2.8.2
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-haz

Repository : nshmp-lib
Version: 1.7.15
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-lib

Repository : nshm-conus
Version: 6.1.3
URL: https://code.usgs.gov/ghsc/nshmp/nshms/nshm-conus.git

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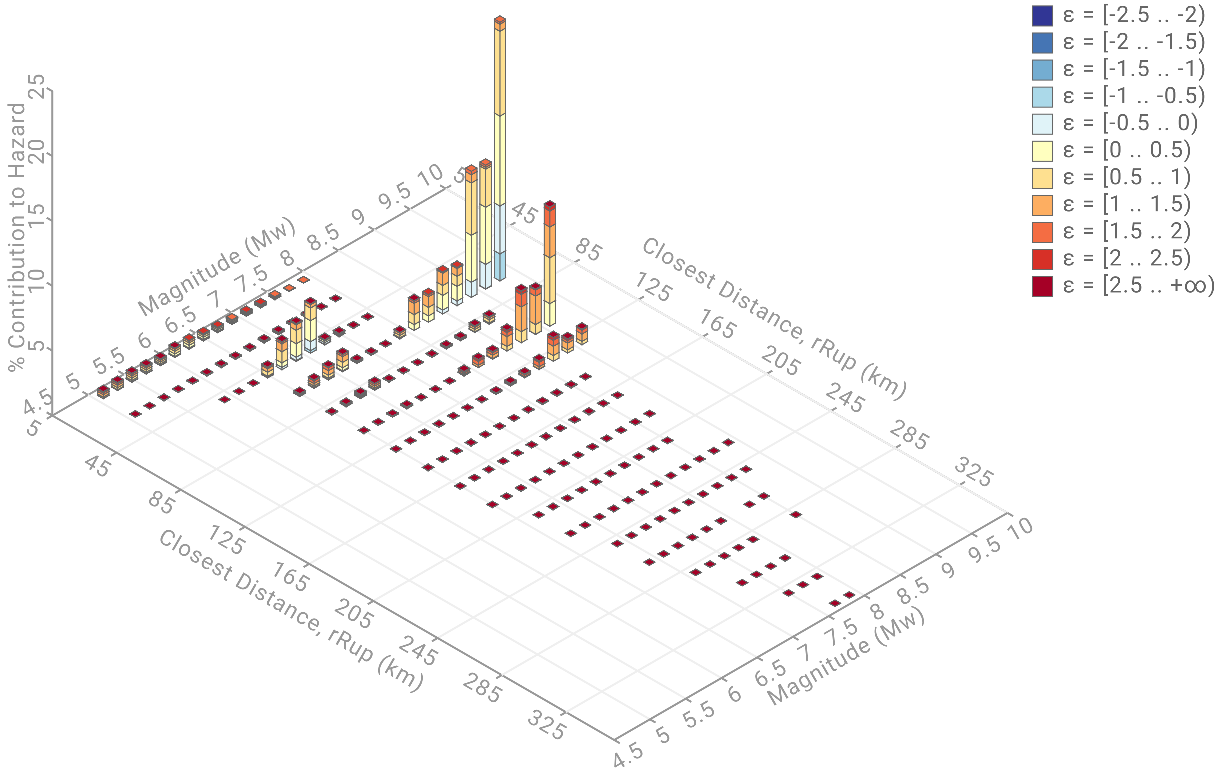
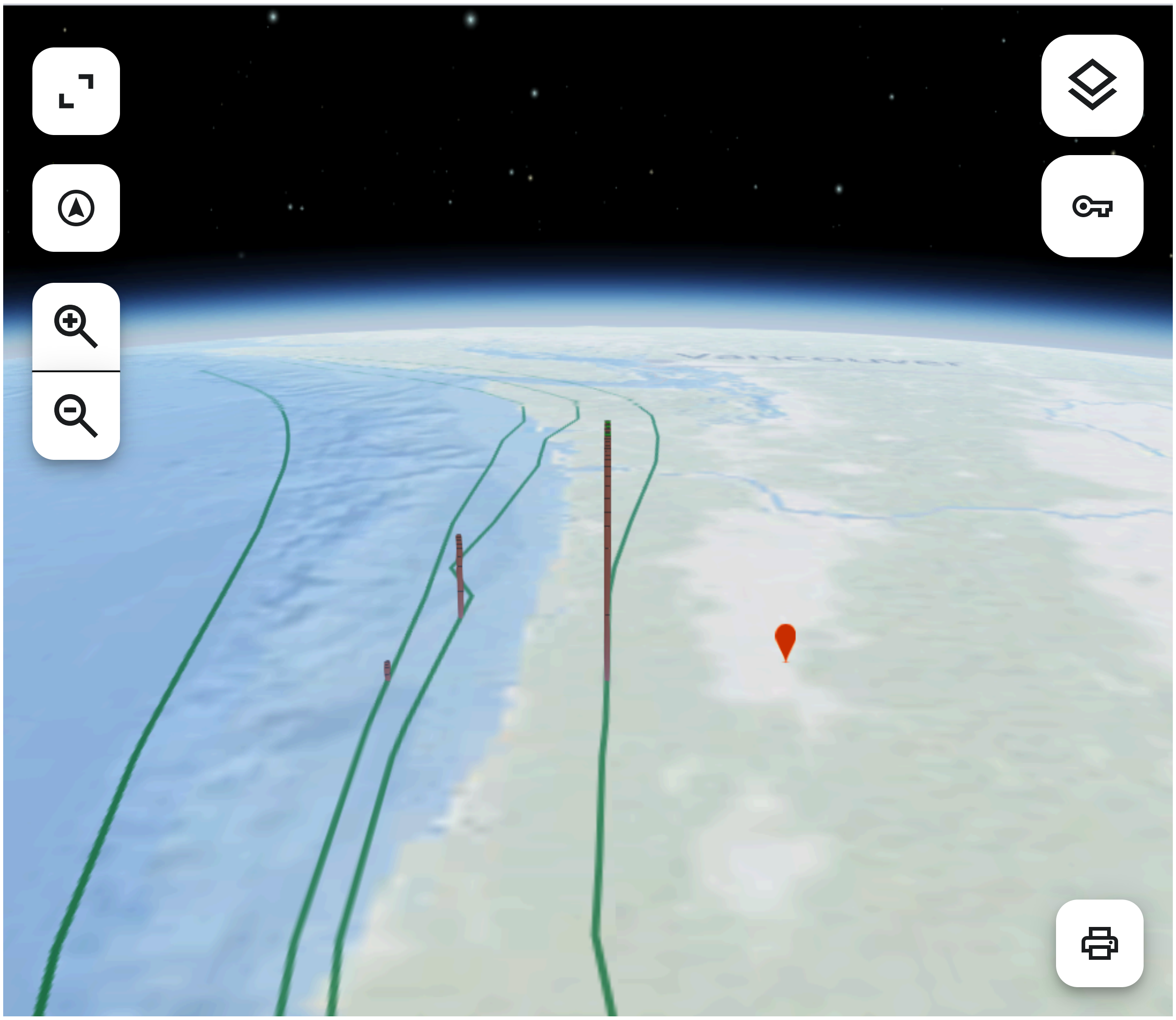
Attachment B-3. Probabilistic Seismic Hazard Deaggregation – 2,475-Year Return Time

Disaggregation Report

Disaggregation



Geographical Disaggregation



CHS, Esri, GEBCO, Garmin, NaturalVue | Oregon State Parks, State of Oregon GEO, Es... Powered by Esri

Parameter Summary

Model: NSHM Conterminous U.S. 2023

Latitude: 44.242 °

Longitude: -123.035 °

Site Class: C (Vs30 530)

Intensity Measure Type: PGA

Return Period: 2475 (2% in 50)

Component: Total

Disaggregation Summary: Total

Disaggregation targets

Return period : 2475 yrs

Exceedance rate : 4.040e-4 yr^{-1}

PGA ground motion : 4.121e-1 g

Recovered targets

Return period : 2444.1906 yrs

Exceedance rate : 4.091e-4 yr^{-1}

Totals

Binned : 100 %

Residual : 0 %

Trace : 0.91 %

Mean (over all sources)

m : 8.4

r : 73.23 km

ε_0 : 0.74 σ

Mode (largest m-r bin)

m : 9.28

r : 64.83 km

ε_0 : 0.27 σ

Contribution : 19.93 %

Mode (largest m-r-ε_0 bin)

m : 9.26

r : 64.83 km

ε_0 : 0.2 σ

Contribution : 6.93 %

Discretization

r : min = 0.0, max = 1000.0, Δ = 20.0 km

m : min = 4.4, max = 9.4, Δ = 0.2

ε : min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0 : [-∞ .. -2.5)

ε1 : [-2.5 .. -2.0)

ε2 : [-2.0 .. -1.5)

ε3 : [-1.5 .. -1.0)

ε4 : [-1.0 .. -0.5)

ε5 : [-0.5 .. 0.0)

ε6 : [0.0 .. 0.5)

ε7 : [0.5 .. 1.0)

ε8 : [1.0 .. 1.5)

ε9 : [1.5 .. 2.0)

ε10 : [2.0 .. 2.5)

ε11 : [2.5 .. +∞]

Disaggregation Contributions: Total

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
Cascadia (full, bottom)	Interface							35.81
Cascadia (full, bottom)		64.83	9.13	0.35	123.756°W	44.129°N	257.88	35.81
Cascadia (full, middle)	Interface							15.26
Cascadia (full, middle)		112.41	8.95	1.10	124.383°W	44.572°N	289.41	15.26
OR Intraslab	Slab							14.4
WUS Branch Average (opt)	Grid							7.41
Cascadia (unsegmented, GEA12-B, bottom)	Interface							4.8
Cascadia (unsegmented, GEA12-B, bottom)		66.52	8.40	0.79	123.756°W	44.129°N	257.88	4.8
Cascadia (full, top)	Interface							3.69
Cascadia (full, top)		125.72	8.86	1.32	124.611°W	44.129°N	264.81	3.69
Cascadia (segmented, GEA12, C, bottom)	Interface							2.01
Cascadia (segmented, GEA12, C, bottom)		64.44	8.76	0.54	123.756°W	44.129°N	257.88	2.01
Cascadia (unsegmented, GEA12-A, bottom)	Interface							1.63
Cascadia (unsegmented, GEA12-A, bottom)		68.68	8.43	0.81	123.756°W	44.129°N	257.88	1.63
Cascadia (unsegmented, GEA12-B, middle)	Interface							1.61
Cascadia (unsegmented, GEA12-B, middle)		113.94	8.44	1.49	124.383°W	44.572°N	289.41	1.61
Cascadia (segmented, GEA17, C, bottom)	Interface							1.59
Cascadia (segmented, GEA17, C, bottom)		64.41	8.85	0.49	123.756°W	44.129°N	257.88	1.59
Cascadia (cluster-8, bottom) : R1-526-yr	FaultCluster							1.1
Cascadia (cluster-8, bottom) : R1-526-yr		67.99	8.21	0.93	123.756°W	44.129°N	257.88	1.1
OR Intraslab	Slab							1.07
Cascadia (cluster-7a, bottom) : R1-526-yr	FaultCluster							1
Cascadia (cluster-7a, bottom) : R1-526-yr		72.03	8.22	1.00	123.756°W	44.129°N	257.88	1

Application Metadata

Application: Disaggregation
URL: https://earthquake.usgs.gov/nshmp/hazard/disagg

Repository: nshmp-apps
Version: 21.5.4
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-apps

Repository : nshmp-haz
Version: 2.8.2
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-haz

Repository : nshmp-lib
Version: 1.7.15
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-lib

Repository : nshm-conus
Version: 6.1.3
URL: https://code.usgs.gov/ghsc/nshmp/nshms/nshm-conus.git

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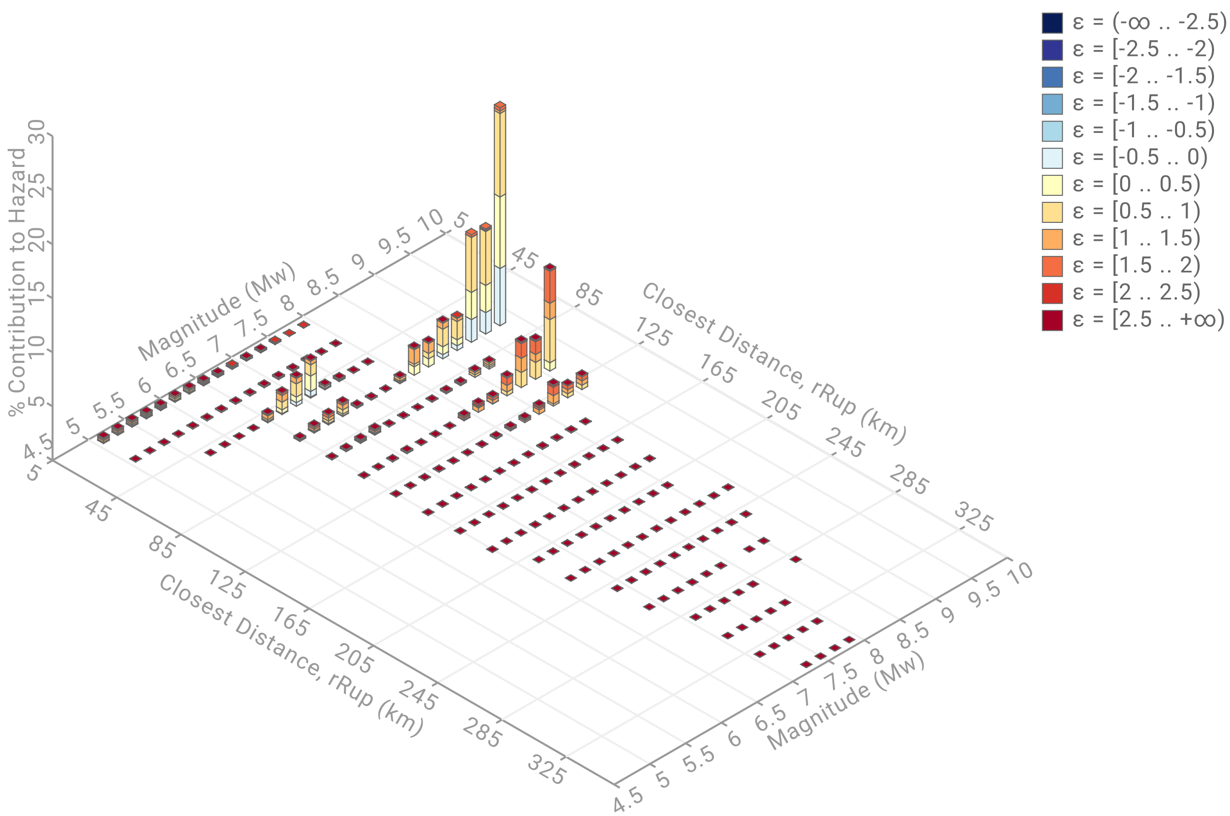
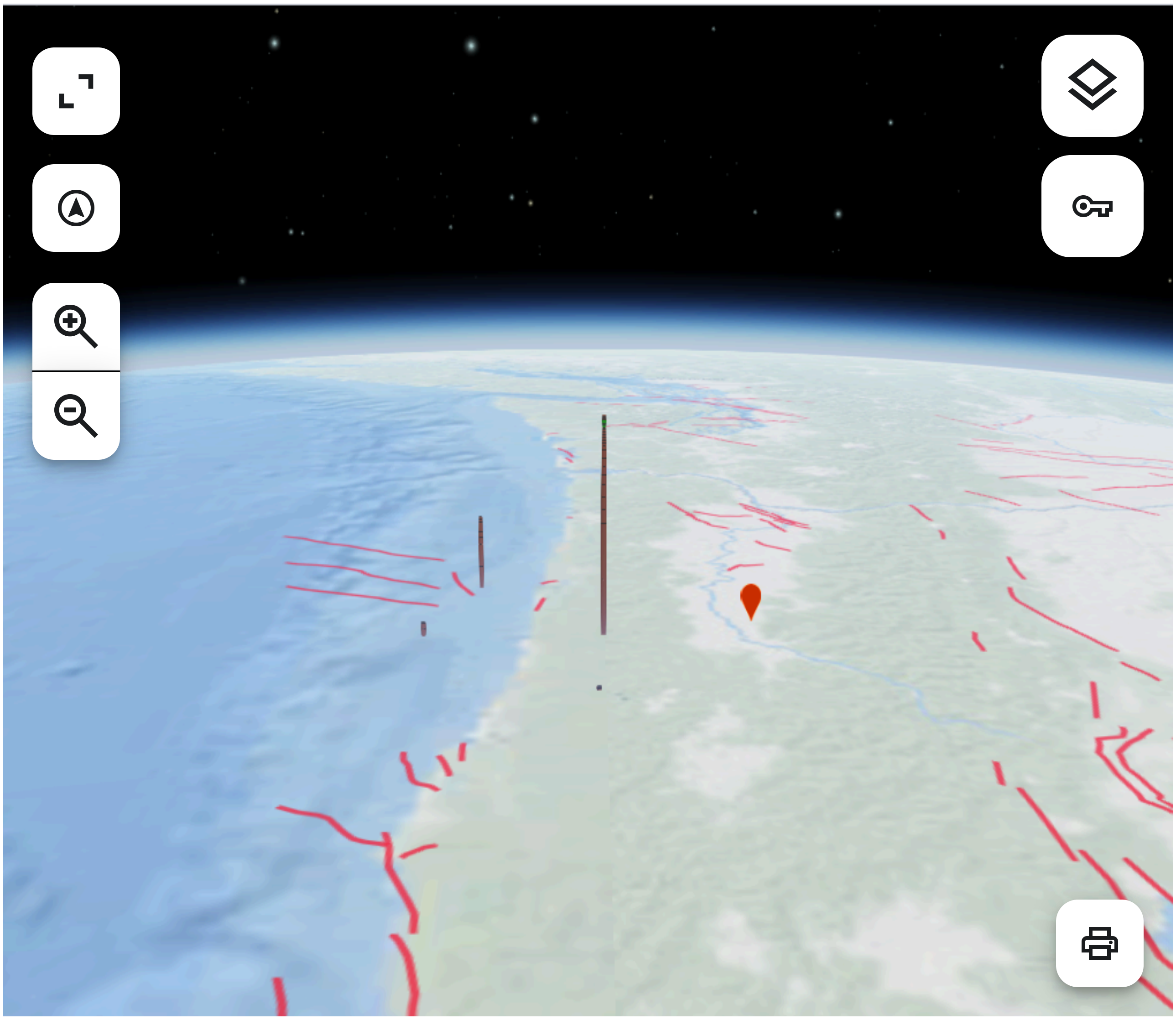
Disaggregation Report

Disaggregation



Geographical Disaggregation



CHS, Esri, GEBCO, Garmin, NaturalVue | Oregon State Parks, Esri, TomTom, Garmin, F... Powered by Esri

Parameter Summary

Model: NSHM Conterminous U.S. 2023

Latitude: 44.242 °

Longitude: -123.035 °

Site Class: D (Vs30 260)

Intensity Measure Type: PGA

Return Period: 2475 (2% in 50)

Component: Total

Disaggregation Summary: Total

Disaggregation targets

Return period : 2475 yrs

Exceedance rate : 4.040e-4 yr^{-1}

PGA ground motion : 4.853e-1 g

Recovered targets

Return period : 2443.31 yrs

Exceedance rate : 4.093e-4 yr^{-1}

Totals

Binned : 100 %

Residual : 0 %

Trace : 0.9 %

Mean (over all sources)

m : 8.45

r : 74.88 km

ε_0 : 0.78 σ

Mode (largest m-r bin)

m : 9.28

r : 64.83 km

ε_0 : 0.27 σ

Contribution : 20.16 %

Mode (largest m-r-ε_0 bin)

m : 9.28

r : 64.83 km

ε_0 : 0.63 σ

Contribution : 7.73 %

Discretization

r : min = 0.0, max = 1000.0, Δ = 20.0 km

m : min = 4.4, max = 9.4, Δ = 0.2

ε : min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0 : [-∞ .. -2.5)

ε1 : [-2.5 .. -2.0)

ε2 : [-2.0 .. -1.5)

ε3 : [-1.5 .. -1.0)

ε4 : [-1.0 .. -0.5)

ε5 : [-0.5 .. 0.0)

ε6 : [0.0 .. 0.5)

ε7 : [0.5 .. 1.0)

ε8 : [1.0 .. 1.5)

ε9 : [1.5 .. 2.0)

ε10 : [2.0 .. 2.5)

ε11 : [2.5 .. +∞]

Disaggregation Contributions: Total

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
Cascadia (full, bottom)	Interface							36.37
Cascadia (full, bottom)		64.83	9.12	0.35	123.756°W	44.129°N	257.88	36.37
Cascadia (full, middle)	Interface							15.67
Cascadia (full, middle)		112.41	8.95	1.16	124.383°W	44.572°N	289.41	15.67
OR Intraslab	Slab							13.3
WUS Branch Average (opt)	Grid							6.01
Cascadia (unsegmented, GEA12-B, bottom)	Interface							5.08
Cascadia (unsegmented, GEA12-B, bottom)		66.67	8.39	0.77	123.756°W	44.129°N	257.88	5.08
Cascadia (full, top)	Interface							3.82
Cascadia (full, top)		125.72	8.85	1.38	124.611°W	44.129°N	264.81	3.82
Cascadia (segmented, GEA12, C, bottom)	Interface							2.06
Cascadia (segmented, GEA12, C, bottom)		64.44	8.76	0.54	123.756°W	44.129°N	257.88	2.06
Cascadia (unsegmented, GEA12-B, middle)	Interface							1.79
Cascadia (unsegmented, GEA12-B, middle)		114.12	8.43	1.49	124.383°W	44.572°N	289.41	1.79
Cascadia (unsegmented, GEA12-A, bottom)	Interface							1.73
Cascadia (unsegmented, GEA12-A, bottom)		68.91	8.42	0.79	123.756°W	44.129°N	257.88	1.73
Cascadia (segmented, GEA17, C, bottom)	Interface							1.63
Cascadia (segmented, GEA17, C, bottom)		64.41	8.85	0.49	123.756°W	44.129°N	257.88	1.63
Cascadia (cluster-8, bottom) : R1-526-yr	FaultCluster							1.18
Cascadia (cluster-8, bottom) : R1-526-yr		68.40	8.21	0.89	123.756°W	44.129°N	257.88	1.18
Cascadia (cluster-7a, bottom) : R1-526-yr	FaultCluster							1.08
Cascadia (cluster-7a, bottom) : R1-526-yr		72.47	8.22	0.96	123.756°W	44.129°N	257.88	1.08
Cascadia (segmented, GEA12, D, bottom)	Interface							1.01
Cascadia (segmented, GEA12, D, bottom)		88.89	8.62	1.03	123.780°W	43.700°N	224.95	1.01
Cascadia (segmented, GEA12, B, bottom)	Interface							1
Cascadia (segmented, GEA12, B, bottom)		64.41	8.89	0.47	123.756°W	44.129°N	257.88	1

Application Metadata

Application: Disaggregation
URL: https://earthquake.usgs.gov/nshmp/hazard/disagg

Repository: nshmp-apps
Version: 21.5.4
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-apps

Repository : nshmp-haz
Version: 2.8.2
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-haz

Repository : nshmp-lib
Version: 1.7.15
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-lib

Repository : nshm-conus
Version: 6.1.3
URL: https://code.usgs.gov/ghsc/nshmp/nshms/nshm-conus.git

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Attachment B-4. Response Spectrum – Site Class D "Stiff Soil"

ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 41-23
Risk Category: NaN
Soil Class: D - Stiff Soil

Latitude: 44.241754
Longitude: -123.031222
Elevation: 342.380003984375 ft (NAVD 88)

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Stiff Soil

Hazard Level BSE-2N:

S_{XS} :	1.11	S_{X1} :	0.8

Hazard Level BSE-1N:

S_{XS} :	0.74	S_{X1} :	0.53

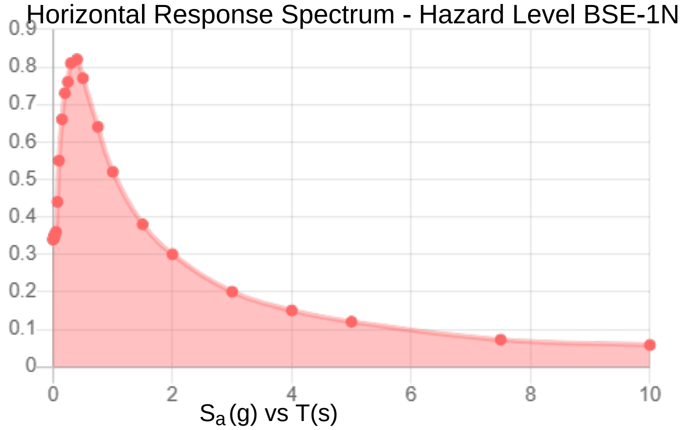
Hazard Level BSE-2E:

S_{XS} :	0.77	S_{X1} :	0.53

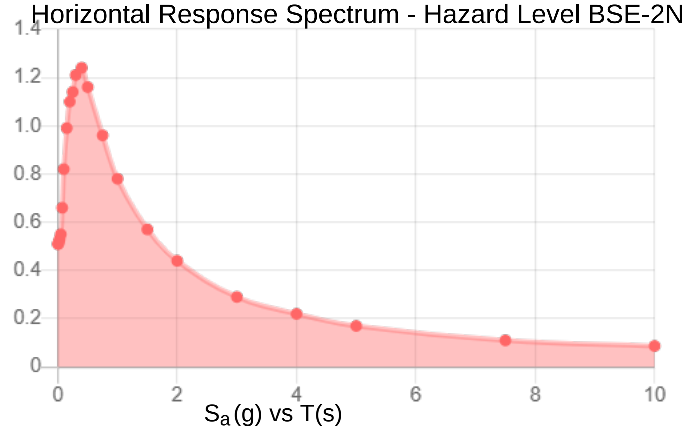
Hazard Level BSE-1E:

S_{XS} :	0.23	S_{X1} :	0.15

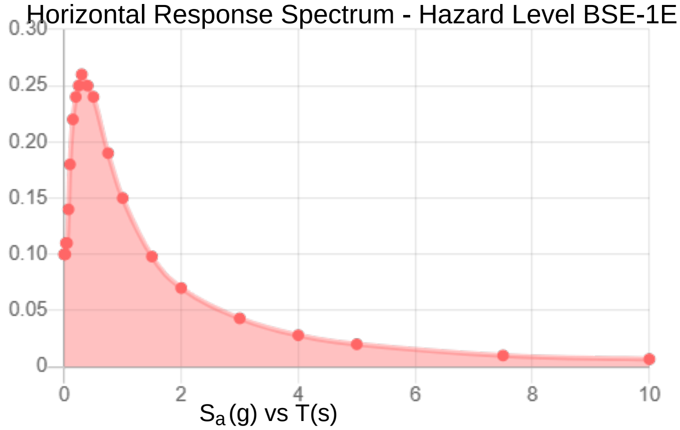
Horizontal Response Spectrum - Hazard Level BSE-1N



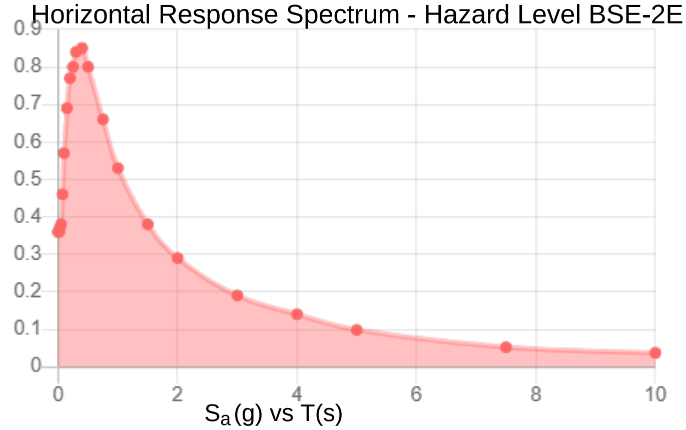
Horizontal Response Spectrum - Hazard Level BSE-2N



Horizontal Response Spectrum - Hazard Level BSE-1E



Horizontal Response Spectrum - Hazard Level BSE-2E



Data Accessed: **Fri Mar 20 2026**

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