Exhibit H

Geologic and Soil Stability

Yellow Rosebush Energy Center
August 2024

Prepared for
Yellow Rosebush Energy Center, LLC

Prepared by

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Acronyms and Abbreviations

Applicant	Yellow Rosebush Energy Center, LLC
BMP	best management practice
BPA	Bonneville Power Administration
DOGAMI	Oregon Department of Geology and Mineral Industries
ESCP	Erosion and Sediment Control Plan
Facility	Yellow Rosebush Energy Center
FEMA	Federal Emergency Management Agency
GIS	geographic information system
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
km^3	cubic kilometer
kV	kilovolt
MMI	Modified Mercalli Intensity
MW	megawatt
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
O&M	operations and maintenance
OAR	Oregon Administrative Rules
ODOE	Oregon Department of Energy
OSSC	Oregon Structural Specialty Code
PGA	peak ground acceleration
POI	point of interconnect
PV	photovoltaic
SLIDO	Statewide Landslide Information Database for Oregon
USGS	U.S. Geological Survey

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1.0 Introduction

Yellow Rosebush Energy Center, LLC (Applicant) seeks to develop the Yellow Rosebush Energy Center (Facility), a solar energy generation facility, battery energy storage system, and related or supporting facilities in Wasco and Sherman counties, Oregon. This Exhibit H was prepared to meet the submittal requirements in Oregon Administrative Rules (OAR) 345-021-0010(1)(h).

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 hazards including potentially active faults included a 50-mile buffer around the proposed site boundary. The site boundary is defined in detail in Exhibits B and C and is shown on Figure H-1.

3.0 Geologic Report – OAR 345-021-0010(1)(h)(A)

> *OAR 345-021-0010(1)(h) Information from reasonably available sources regarding the geological and soil stability within the analysis area, providing evidence to support findings by the Council as required by OAR 345-022-0020, including:*
>
> > *OAR 345-021-0010(1)(h)(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;*

OAR 345-021-0010(1)(h)(A) requires submission of a geological report meeting the Oregon State Board of Geologist Examiners geologic report guidelines. Current guidelines will 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. The Applicant's geologist completed a limited geological site reconnaissance of the area to observe the existing features at the site and look for evidence of past or potential geologic hazards. The site reconnaissance conducted on July 8, 2023, included visual evaluation of existing exposures of soil and rock, and observation of typical slopes in the proposed solar and transmission line areas where visible from roads. No specific concerns were noted during the site reconnaissance, although steep slopes were observed along drainages.

3.1 Topographic Setting

The site boundary is in Wasco County, approximately 9 miles east of Maupin, Oregon. The site boundary is generally bounded by Bakeoven Road to the south and west and U.S. Route 97 (US-97) to the east. The site boundary slopes range from 0 to 95 percent, with an average of 7.6 percent. The steepest slopes are located along the drainages on the northern and eastern boundaries along Buck Hollow Creek and the tributary drainage. Elevations within the site boundary range from approximately 1,395 feet to 2,757 feet above mean sea level.

3.2 Geologic Setting

The geologic setting of the proposed Facility is located in the Columbia Plateau province (NPS 2023). The Columbia Plateau province was formed by a series of layered basalt flows extruded from vents (located mainly in southeastern Washington and northeastern Oregon) during the Miocene epoch (between 7 and 16 million years before present) (Swanson et al. 1979). Collectively, these basalt flows are known as the Columbia River Basalt Group. These flood basalts cover an area of over 200,000 cubic kilometers (km^3) in Washington, Oregon, and western Idaho with a total estimated volume of over 224,000 km^3 (Hooper et al. 2002; Camp et al. 2003).

The bedrock lithology throughout the site boundary is primarily mapped as the Columbia River Basalt Group unconformably overlying volcanogenic rocks of the ancestral Cascade Volcanic Arc. As shown in Figure H-1, the majority of the site boundary is mapped as the Wanapum Basalt, and a small amount of Grande Ronde basalt is mapped in the northeastern corner and eastern border along the Buck Hollow Creek valley and a tributary drainage (DOGAMI 2023a and USGS 2023a). The Wanapum Basalt and Grande Ronde basalt consists of basalt and basaltic andesite lava flows.

Exhibit I describes properties of the site soils based on Natural Resources Conservation Service (NRCS) data within the Facility site boundary, as well as the approximate thickness, formation setting, permeability, runoff potential, and potential hazard for erosion. Information presented in Exhibit I indicates that approximately 52 percent of the site boundary includes silt loam soils with a depth to bedrock of 2.5 feet, approximately 34 percent of the site boundary soils have a depth to bedrock of 0.6 foot, and approximately 10 percent of the site boundary has a depth to bedrock of 1 foot. These soils have a formation setting described as loess over basalt and loess over residuum weathered from basalt, with lesser amounts of shallow, stony colluvium that is a mixture of loess, basalt fragments, and residuum weathered from basalt.

4.0 Consultation with DOGAMI – OAR 345-021-0010(1)(h)(B)

> *OAR 345-021-0010(1)(h)(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 January 11, 2024. The meeting included a PowerPoint presentation that provided preliminary data sources and findings. The meeting memorandum is included in Attachment H-1. Meeting attendees included representatives of DOGAMI, Savion, and Tetra Tech. DOGAMI staff generally noted that the existing analysis used the correct data and interpreted the data correctly. DOGAMI provided another publication reference for evaluation of seismic hazards that is included in Section 7.2.2.

5.0 Site-Specific Geotechnical Investigation – OAR 345-021-0010(1)(h)(C)

> *OAR 345-021-0010(1)(h)(C) A description and schedule of site-specific geotechnical work that will be performed before construction for inclusion in the site certificate as conditions;*

At an appropriate stage in the development, additional subsurface explorations will be completed prior to construction 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 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 the Oregon Department of Energy (ODOE) following the 2014 Oregon State Board of Engineering Geology Reports guidelines. 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; and
- 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 345-021-0010(1)(h)(D)

OAR 345-021-0010(1)(h)(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 primary and alternative point of interconnect (POI). The primary POI under consideration is using a proposed Bonneville Power Administration (BPA)-owned switchyard, located along the western edge of the Facility site boundary, which is adjacent to the BPA's John Day to Grizzly 500-kilovolt (kV) transmission line (See Figure C-2 in Exhibit C). The alternate POI under consideration is located in Sherman County to the north of the Facility at BPA's existing Buckley Substation (See Figure C-2 in Exhibit C).

The Applicant will perform site-specific geotechnical work along the alternate generation-tie (gen-tie) line where potential geologic hazards have been identified to inform the final design of the proposed Facility.

The alternate gen-tie will be constructed on approximately 160 to 180-foot steel monopoles that will be spaced approximately 1,000 feet apart. Each monopole will require a concrete caisson foundation that will be approximately 8 feet in diameter (larger for dead-end structures) with a foundation depth of between 40 and 60 feet. Custom structures may be required to accommodate larger spans to avoid sensitive resources or steep terrain.

The proposed Facility does not include pipelines carrying hazardous substances as described in OAR 345-021-0010(1)(h)(E).

7.0 Seismic Hazard Assessment – OAR 345-021-0010(1)(h)(E)

OAR 345-021-0010(1)(h)(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 this Application for Site Certificate (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 U.S. Geological Survey (USGS), and the NRCS.

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, 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

Overall, the DOGAMI HazView mapping tool (DOGAMI 2023b) indicates that the Cascadia earthquake hazard is moderate and the expected earthquake shaking is moderate. The USGS Unified Hazard Tool (USGS 2023c) 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 2021) supplemented by the Oregon Structural Specialty Code (OSSC; State of Oregon 2022). 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 (PGA) of 0.2178 acceleration from gravity for the site boundary. The values of PGA on rock are an average representation of the acceleration most likely to occur at the site for all seismic events (crustal, intraplate, or subduction).

Seismic design parameters were developed following IBC 2021. Using current information, the Facility would be designed for Site Class C, according to IBC requirements (Table H-1). Most areas within the site boundary are mapped as shallow basalt bedrock and generally have characteristics that meet Site Class B. However, Site Class C characteristics are present as soils mapped as loess over shallow bedrock and therefore Site Class C is the most conservative site class for Facility design.

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

Location	Site Class	Earthquake Magnitude	Peak Horizontal Ground Acceleration on Bedrock	Return Period
Facility Site Boundary	C	6.65	0.2178g	2,475 years
Facility Site Boundary	B	6.76	0.1607g	2,475 years
Facility Site Boundary	C	6.77	0.09206g	475 years
Facility Site Boundary	B	6.86	0.0671g	475 years
Source: USGS 2023a.				

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 are 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.

No potentially active faults are mapped within the site boundary (USGS 2023b, Figure H-2). A number of middle- and late-Quaternary-age faults are mapped within 50 miles of the site boundary, as shown in Figure H-2. The DOGAMI Oregon HazVu: Statewide Geohazards Viewer earthquake hazard layer (DOGAMI 2023b) and the USGS Geologic Hazards Science Center (USGS 2023d; Figure H-2) show active faults near the Facility site boundary. These faults depicted on Figure H-2 present the largest potential for seismic contribution to the Facility. The nearest potentially active fault is a Class B fault located approximately 7 miles northwest of the site boundary. A Class B fault indicates geologic evidence demonstrating the existence of a fault or suggesting Quaternary deformation; however, the fault might not extend deeply enough to be a potential source of significant earthquakes. As shown in Figure H-1, there are numerous historic faults located in along the eastern site boundary and in the southeastern portion of the site boundary. Although these faults are not indicated to be active during Quaternary time, the geotechnical investigation will provide additional field and desktop review for any potential concerns (DOGAMI 2023a).

The geotechnical investigation that will be conducted prior to construction 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 "very light" shaking category. This means that a magnitude 9.0 Cascadia scenario earthquake would produce a very light shaking event that would be felt outdoors, wake sleepers, disturb or spill liquids, upset small unstable objects, and potentially swing doors or move pictures (OSSPAC 2013).

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

7.2.2 Recorded Earthquakes

Figure H-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. There are numerous earthquakes within the site boundary ranging from magnitude 2.5 to 2.9. One 4.0 magnitude earthquake occurred within the site boundary in 1976. Twenty-three earthquakes from magnitude 3.0 to 4.6 occurred within 4 miles of the site boundary from 1976 to 2007. Eleven earthquakes from 3.5 to 4.5 magnitude occurred within 50 miles of the site boundary from 1976 to 2021. A more recent earthquake with magnitude 4.5-5.0 is mapped to the northwest near the Mt. Hood National Forest (DOGAMI 2023b).

An active earthquake swarm was recorded by the Pacific Northwest Seismic Network from December 2006 to November 2011 in the vicinity of Maupin west/northwest of the site boundary (Braunmiller et al. 2014). The swarm includes 20 events of magnitude 3.0 and greater. Earthquake depths were approximately 10 to 11 miles. A seasonal factor was found for the earthquake activity, indicating the highest activity during the spring.

Table H-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 and can generally be associated with Modified Mercalli Intensity III as characterized by shaking that is “noticeable indoors but may not be recognized as an earthquake” (USGS 2023c).

Table H-2. Significant Historical Earthquakes within 50 Miles of the Facility by Magnitude

Year	Month	Day	Latitude	Longitude	Moment Magnitude	Miles from Site Boundary
2010	5	14	45.3595	-121.75217	3	42.46
2009	3	20	45.13517	-120.959	3	3.40
2007	1	20	45.12817	-120.94867	3	3.32
2007	1	4	45.11883	-120.93233	3	3.38
1999	1	14	45.32417	-121.66383	3	37.78
1999	1	11	45.32317	-121.65433	3	37.31
1996	4	7	45.35883	-121.71533	3	40.69
1993	12	16	45.19583	-120.08983	3	34.91
1976	3	29	45.12217	-120.89033	3	1.70
2023	6	6	45.367	-121.70383	3.03	40.27
2008	4	28	45.12583	-120.95383	3.1	3.61
2008	3	20	45.1295	-120.94283	3.1	3.05
1997	3	23	45.24633	-120.04933	3.1	37.42
1997	3	23	45.19517	-120.05083	3.1	36.80
1987	9	8	45.19117	-120.072	3.1	35.74
2008	6	20	45.12933	-120.93867	3.2	2.93
2007	4	8	45.12717	-120.95567	3.2	3.61
2002	6	29	45.3275	-121.6815	3.2	38.67
2000	8	17	45.312	-120.0415	3.2	38.73
1999	1	14	45.33033	-121.66983	3.2	38.14
1999	1	11	45.3195	-121.6545	3.2	37.28
1997	4	17	45.1885	-120.082	3.2	35.24
1980	7	7	45.2	-121.73433	3.2	40.68
2008	2	4	45.12883	-120.94233	3.3	3.07
2007	11	21	45.12983	-120.94133	3.3	2.99

Year	Month	Day	Latitude	Longitude	Moment Magnitude	Miles from Site Boundary
2007	5	2	45.12717	-120.942	3.3	3.15
2003	7	7	45.32733	-121.68567	3.3	38.86
2008	11	16	45.13067	-120.9535	3.4	3.37
2008	6	1	45.132	-120.9535	3.4	3.31
2000	1	30	45.18317	-120.10283	3.4	34.19
1982	8	18	45.37167	-121.69667	3.4	40.01
2021	2	9	45.51583	-121.58833	3.47	38.84
1999	8	31	45.18633	-120.09083	3.5	34.79
1990	10	19	45.341	-121.68583	3.5	39.04
1989	9	15	45.37267	-121.70683	3.5	40.51
2010	12	30	45.1315	-120.932	3.6	2.62
2010	1	2	45.137	-120.9555	3.6	3.19
2009	4	20	45.1335	-120.955	3.6	3.31
2008	12	27	45.131	-120.95133	3.6	3.28
2008	4	5	45.13	-120.9425	3.6	3.02
2007	3	1	45.12383	-120.93417	3.6	3.12
2000	2	1	45.19	-120.11267	3.6	33.76
1976	10	10	45.27033	-120.4995	3.6	16.64
1975	7	1	45.60533	-120.01617	3.6	48.93
2007	6	14	45.12567	-120.944	3.8	3.29
2002	6	29	45.34233	-121.67983	3.8	38.77
1997	3	22	45.19733	-120.06717	3.9	36.02
2021	6	6	45.34233	-121.6935	3.94	39.42
1976	4	17	45.1585	-120.84733	4	0.00
2000	1	30	45.19717	-120.12483	4.1	33.23
1974	12	13	45.265	-121.599	4.1	34.17
2008	7	14	45.12867	-120.95	4.2	3.34
2002	6	29	45.33483	-121.68633	4.5	38.99
1976	4	13	45.07567	-120.85883	4.6	2.15
Source: DOGAMI 2023b						

The Ground Response Spectra Assessment (Attachments H-4 and H-5) assessed the design response spectrum given in the 2010/2016/2022 IBC using the ASCE 7 Hazard Tool (ASCE 2023).

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 C are provided. Due to the shallow bedrock and loess in the site boundary, the Facility should be designed for Site Class C.

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 low, as discussed below. Since the Facility is far from the Oregon coast, and not in a DOGAMI-defined tsunami evacuation zone (DOGAMI 2023c), 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 2021 code for structural design. Specifically, this is Section 1613 (Earthquake Loads) of the 2022 OSSC, which is in Chapter 16. 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 most conservatively Site Class C. As described in Section 7.2, Site Class C (very dense soil and soft rock) 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. There are several Class B faults at approximately 7 and 20 miles away (northwest and northeast respectively). The closest potentially active faults (Middle and Late Quaternary faults) are approximately 30 miles southwest (Figure H-2). In addition, as shown in Figure H-1, there are numerous historic faults mapped along the eastern boundary and southeastern portions of the site boundary. These faults are not indicated to have been active in more recent Quaternary time. Faults and seismic activity will be further evaluated during pre-construction geotechnical investigation.

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 not saturated and are generally clastic (loess) in nature. In addition, basalt bedrock is indicated to be shallow with average depths from 0.5 to 2.5 feet below ground surface. Based on well logs in the vicinity of the site boundary (OWRD 2023), static groundwater levels range from 171 to 460 feet below ground surface and depths to bedrock range from 2 to 5 feet below ground surface. Along with the relatively low seismic event potential, this indicates that the liquefaction of soils within the site boundary is considered unlikely. In addition, the site boundary and surrounding area is mapped as no susceptibility to liquefaction (DOGAMI 2023b).

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 2023d). Landslide risk increases to high along drainages with steep sides such as Karlen Draw or Hauser Canyon. Figure H-3 shows the steep drainages across the northern and eastern site boundary. Facility construction and permanent infrastructure will avoid these steep drainages and steep slopes. The site-specific geotechnical investigation will review evidence of active faults and landslides, which will inform the final Facility design and layout.

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 highly unlikely. In most areas, the bedrock is relatively shallow (5 feet or less), and the overlying soils are not saturated.

7.2.9 Seismic Hazard Mitigation

The State of Oregon uses the 2021 IBC, with current amendments by the OSSC (State of Oregon 2022). Pertinent design codes relating to geology, seismicity, and near-surface soil are found in IBC Chapter 16, Section 1613, with slight modifications for current State amendments. 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 (IEEE) 693. Although the region has only a moderate seismicity potential, the Facility 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 345-021-0010(1)(h)(F)

OAR 345-021-0010(1)(h)(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:

(i) 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

(ii) 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.

8.1 Landslides

In 2021, DOGAMI released an update to the Statewide Landslide Information Database for Oregon (SLIDO-4.4; DOGAMI 2023d). 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 H-3. The closest mapped landslides on the SLIDO database are located nearest the town of Maupin, Oregon. No existing landslides were observed during the site reconnaissance. In addition, a review of HazView mapping (DOGAMI 2023b) indicates that most of the site boundary is located in a low landslide susceptibility area, while moderate and high landslide susceptibility hazard areas are indicated only along the steep drainages along the northern and eastern site boundary. Facility construction and permanent infrastructure will avoid these areas to the extent possible. However, the Facility transmission line will cross an area of moderate to high landslide susceptibility at the Buck Hollow

Creek valley crossing. The Applicant anticipates spanning this area and will complete a geotechnical investigation prior to construction and final design to determine structure placement and specific geotechnical requirements and specifications.

Available DOGAMI LiDAR mapping was also reviewed for signs of potential landslides or debris flows (DOGAMI 2023e). There was no available LiDAR data for the site boundary.

Slopes within the vicinity of the site boundary range from approximately zero to 95 percent, with an average slope of 7.6 percent. If slope stability issues are identified in the final design geotechnical investigations, the structures will either be relocated 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 volcano to the site boundary is Mount Hood, located approximately 40 miles away to the northwest. 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 volcano, 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 this close volcano. It is unlikely that there would be any adverse effects from volcanic activity on the construction or operation of the Facility.

8.3 Erosion

Soil impacts during construction, operation, and decommissioning are discussed in Exhibit I. Potential soil erosion impacts during construction are associated with clearing, grading and excavation, and construction of access roads. Best management practices (BMPs) will be implemented to control dust. An Erosion and Sediment Control Plan (ESCP) satisfactory to the Oregon Department of Environmental Quality and as required under the National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge General Permit #1200-C (see Attachment I-1 for the draft/example ESCP) will be applied for by the Applicant. The ESCP will include any procedures necessary to meet local erosion and sediment control requirements or stormwater management requirements. Erosion-sensitive soils and steep terrain, as described in Exhibit I, will be avoided to the extent possible during design and construction.

8.4 Flooding

Federal Emergency Management Agency (FEMA) National Flood Hazard data (DLCD 2023) are shown on Figure H-3. Areas of 100-year floodplains are mapped along Buck Hollow Creek and within the tributary located in the eastern portion of the site boundary. The transmission line corridor crosses Buck Hollow Creek. Other portions of the Facility would avoid 100-year floodplains. The mapped floodplains were compared to the temporary and permanent disturbance areas in the site boundary to evaluate flood hazards. No temporary or permanent disturbance areas associated with the Facility are located in areas of mapped floodplains.

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.

8.5 Shrinking and Swelling Soils

Clayey soils are the most susceptible to shrinking and swelling. These soils were not found in the Facility soil data (see Exhibit I). 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 will be evaluated by laboratory testing and analysis. 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.

9.0 Disaster Resilience

The State of Oregon uses IBC 2021, with current amendments by the OSSC and local agencies. Pertinent design codes related to geology, seismicity, and near-surface soils are contained in IBC Chapter 16, Section 1613, with slight modifications by the current amendments of the State of Oregon and local agencies. The Facility will be designed to meet or exceed the minimum standards required by these design codes. The Applicant acknowledges that DOGAMI encourages, but does not require, applicants to 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 Applicant 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 IEEE. 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 Applicant 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 for the Facility (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.

10.0 Climate Change

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 hydropower'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.

11.0 Conclusion

The risk of seismic hazards to human safety at the Facility is low. The Applicant reviewed regional geologic information and performed a site-specific desktop analysis of potential seismic, geologic, and soils hazards. In addition, a 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. 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. 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 arrays, transformers, generators, site access roads, transmission line structures, a battery energy storage system, a collector substation, and an operations and maintenance (O&M) building. The O&M building will be staffed; however, the probability of a large seismic event occurring while the O&M building is occupied is much lower than for a typical building or facility. This very low probability results in minimal risk to human safety. During preconstruction geotechnical investigations, any potentially active faults in the vicinity will be surveyed.
- 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.

12.0 Submittal Requirements and Approval Standards

12.1 Submittal Requirements

Table H-3. Submittal Requirements Matrix

Requirement	Location
OAR 345-021-0010(1)(h) Information from reasonably available sources regarding the geological and soil stability within the analysis area, providing evidence to support findings by the Council as required by OAR 345-022-0020, including:	Section 3.0

Requirement	Location
(A) A geologic 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, 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 shall 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.	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
(i) 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.	Section 9.0
(ii) 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 10.0

12.2 Approval Standards

Table H-4. Approval Standard

Requirement	Location
OAR 345-022-0020 Structural Standard	
(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; and	Section 7.0
(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);	Sections 7.0 and 8.0
(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	Section 8.0
(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).	Sections 8.0 through 10.0
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.	N/A
(3) The Council may not impose the Structural Standard in section (1) to deny an application for a special criteria facility under OAR 345-015-0310. 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.	N/A

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Figures

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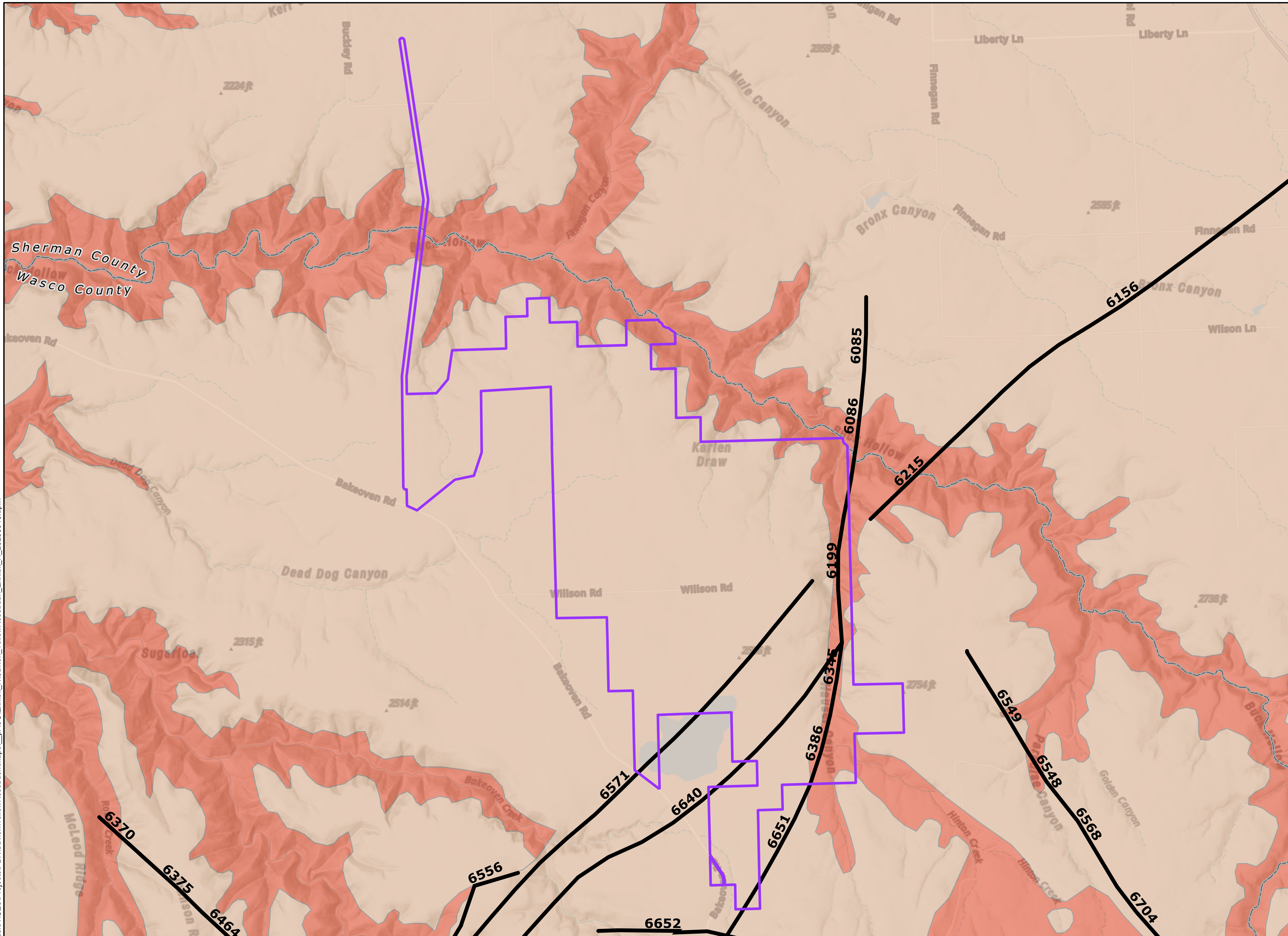


Yellow Rosebush Energy Center

Figure H-1 Geologic Map

SHERMAN AND WASCO COUNTIES, OR

- Facility Site Boundary
- County Boundary
- Fault Line (USGS SGMC)

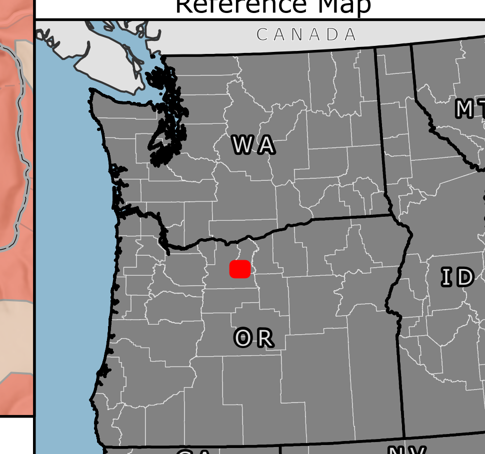
DOGAMI Surface Geology

- Tf - Wanapum Basalt, Frenchman Springs Member (Miocene)
- Tgn2 - Grande Ronde Basalt, upper flow of normal magnetic polarity (Miocene)

TETRA TECH

SAVION A RENEWABLE ENERGY COMPANY

Reference Map



1:60,000 WGS 1984 UTM Zone 10N

0 0.5 1 2 3 4 Miles

NOT FOR CONSTRUCTION

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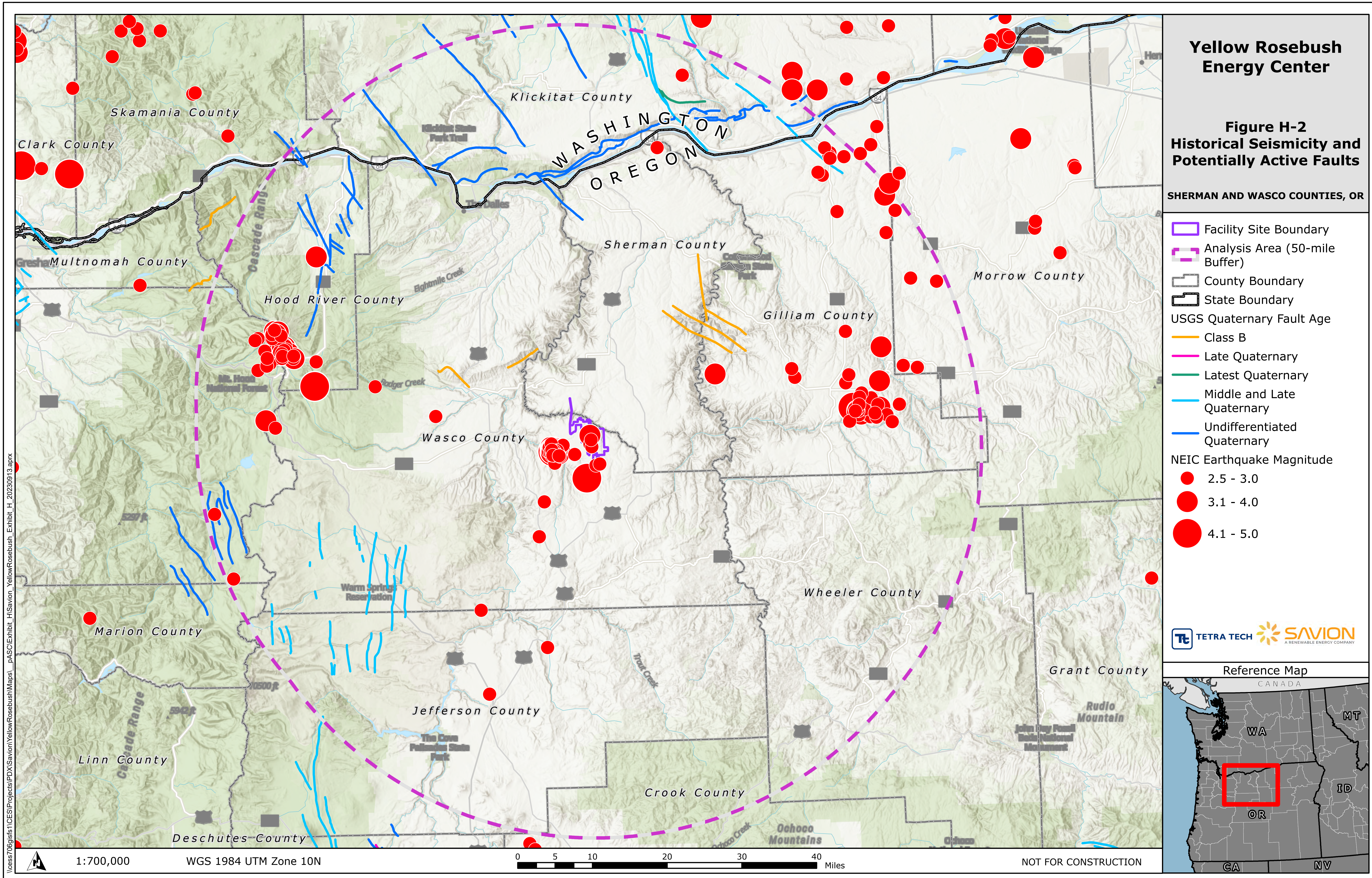
Yellow Rosebush Energy Center
Figure H-2
Historical Seismicity and Potentially Active Faults
SHERMAN AND WASCO COUNTIES, OR
Facility Site Boundary
Analysis Area (50-mile Buffer)
County Boundary
State Boundary
USGS Quaternary Fault Age
Class B
Late Quaternary
Latest Quaternary
Middle and Late Quaternary
Undifferentiated Quaternary
NEIC Earthquake Magnitude
2.5 - 3.0
3.1 - 4.0
4.1 - 5.0
TETRA TECH
SAVION
A RENEWABLE ENERGY COMPANY
Reference Map
CANADA
WA
MT
ID
OR
CA
NV
WASHINGTON
OREGON
Klickitat County
Skamania County
Clark County
Multnomah County
Hood River County
Sherman County
Gilliam County
Morrow County
Wasco County
Wheeler County
Marion County
Jefferson County
Grant County
Linn County
Crook County
Deschutes County
The Dalles
Cascade Range
Mt. Hood National Forest
Warm Springs Reservation
Ochoco Mountains
1:700,000
WGS 1984 UTM Zone 10N
0 5 10 20 30 40 Miles
NOT FOR CONSTRUCTION
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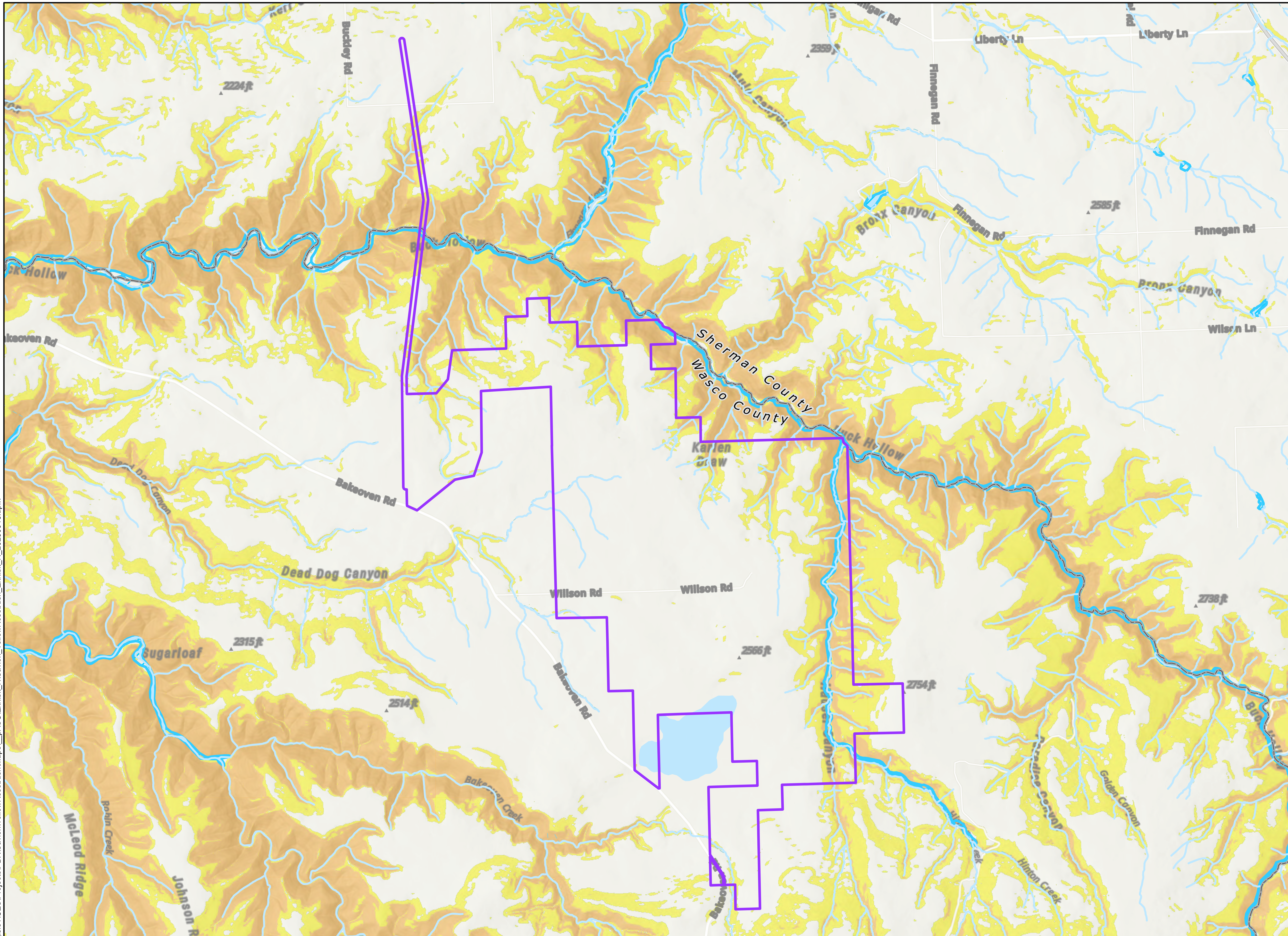
Yellow Rosebush Energy Center

Figure H-3
Landslide Susceptibility & Special Flood Hazards

SHERMAN AND WASCO COUNTIES, OR



- Facility Site Boundary
- County Boundary
- Stream/River (NHD)

Non-Effective FEMA Flood Hazard Areas*

- Zone A (100-Year Floodplain)

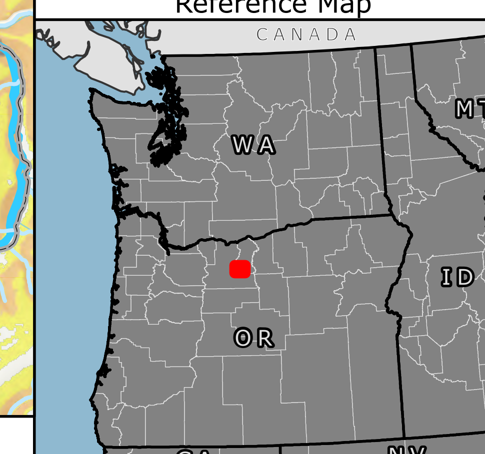
DOGAMI Landslide Susceptibility

- Low
- Moderate
- High

Effective FEMA Special Flood Hazard Areas digital data not available for this area; data presented for guidance only

TETRA TECH | SAVION A RENEWABLE ENERGY COMPANY

Reference Map



1:60,000 | WGS 1984 UTM Zone 10N | 0 0.5 1 2 3 4 Miles | NOT FOR CONSTRUCTION

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Attachment H-1.
Record of Correspondence with DOGAMI

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TETRA TECH

MEMO

Date:	January 11, 2024
Subject:	DOGAMI Consultation for the Oregon Energy Facility Siting Council process (Exhibit H)
Project:	Application for Site Certificate for the Yellow Rosebush Energy Center

Conference Call Meeting with Oregon Department of Geology and Mineral Industries (DOGAMI), January 11, 2024, at 3:30 pm PST

A conference call meeting was held with DOGAMI on January 11, 2024, 3:30 pm PST with the following attendees present: Jason McClaughry (DOGAMI), Anneka Solsby (Savion), Jeff Watson (Savion), 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 Yellow Rosebush Energy Center:

- Jeff Watson 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 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 DOGAMI:

- Jason McClaughry provided another publication resource to include in the evaluation that describes active earthquake swarms in the vicinity of Maupin. He provided the reference during the meeting: BraunmillerJochenCEOASSeasonallyModulatedEarthquake.pdf. The earthquakes generally occurred during 2006/2011. Rachel stated that the information would be reviewed and discussion added to Exhibit H.
- Jason also indicated that the geologic map presented during the meeting is the best available.
- Jason asked about the source of the bedrock depth information. Rachel responded that it was from soils data and that no geotechnical borings have been done as yet for the site. Jason indicated that the soil depths were probably fairly accurate for this area.
- Jason asked if the steep areas along the canyons/creeks would be avoided by the Project infrastructure. Jeff stated that these areas would be avoided and that most of the site does

not have steep areas and offers sufficient area for the Project.

- Jeff and Anneka generally discussed that there are plans for pre-construction geotechnical work that will be included in Exhibit H.
- Jason did not have additional comments at the time of the meeting.

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

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U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (update) (4.2.0)

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

45.163117

Time Horizon

Return period in years

475

Longitude

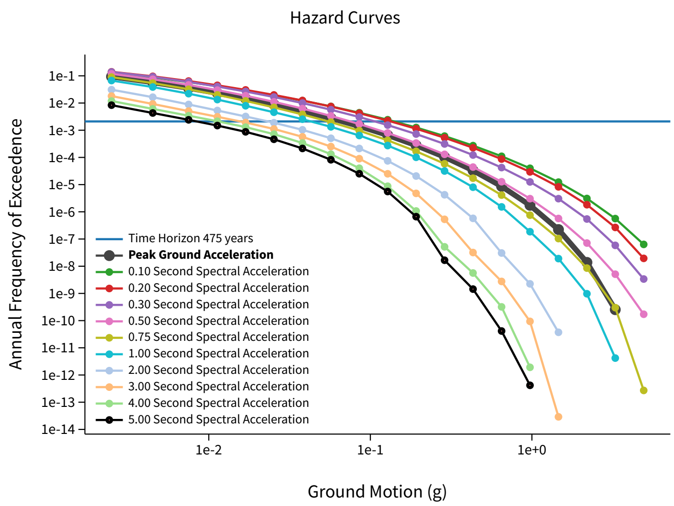
Decimal degrees, negative values for western longitudes

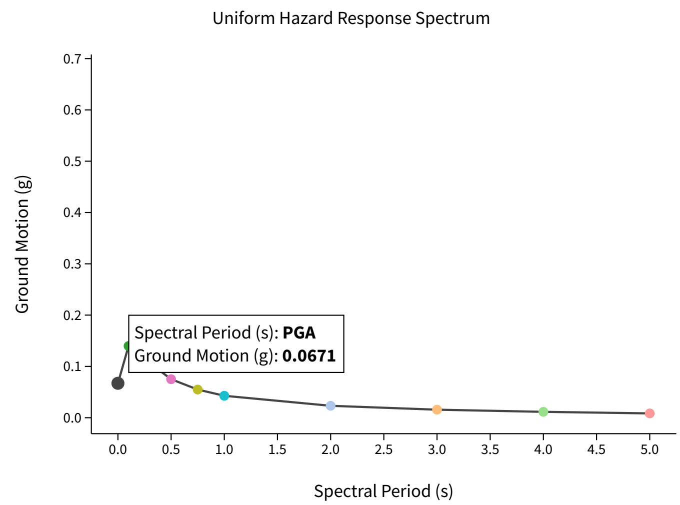
-120.851631

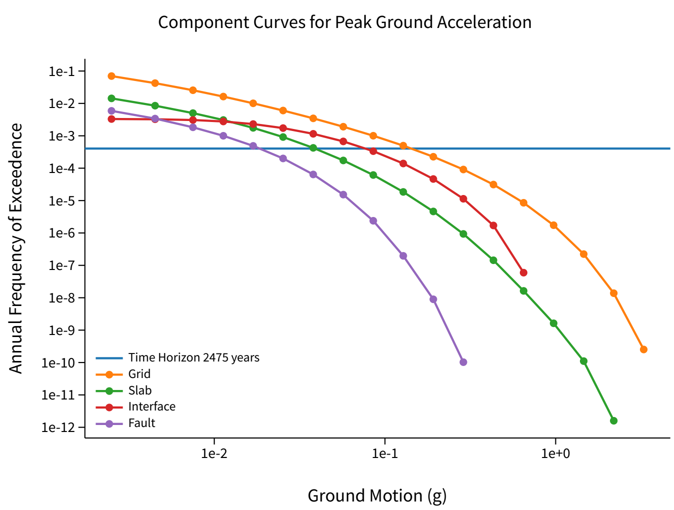
Site Class

1150 m/s (Site class B)

Hazard Curve





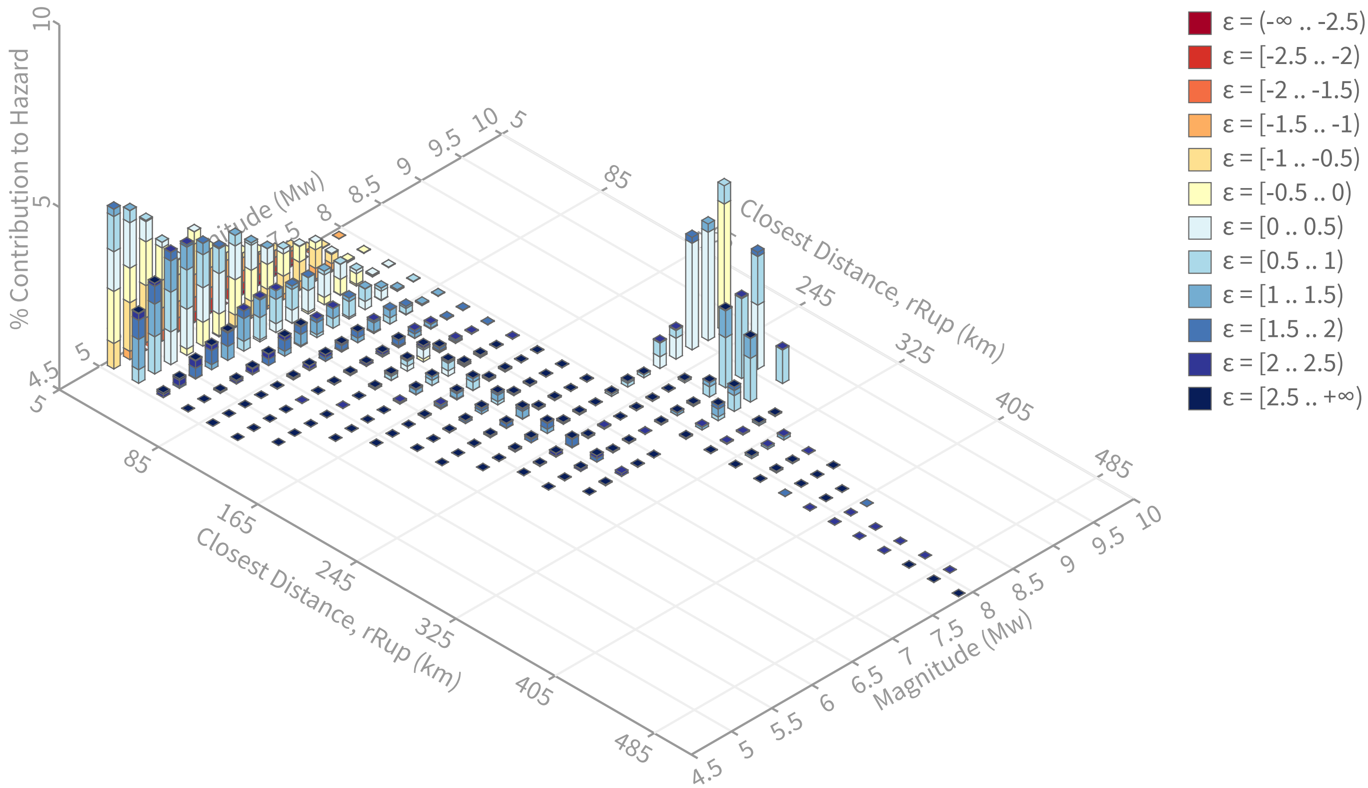


View Raw Data

Deaggregation

Component

Total


% Contribution to Hazard
Closest Distance, rRup (km)
Magnitude (Mw)
ε = (-∞ .. -2.5)
ε = [-2.5 .. -2)
ε = [-2 .. -1.5)
ε = [-1.5 .. -1)
ε = [-1 .. -0.5)
ε = [-0.5 .. 0)
ε = [0 .. 0.5)
ε = [0.5 .. 1)
ε = [1 .. 1.5)
ε = [1.5 .. 2)
ε = [2 .. 2.5)
ε = [2.5 .. +∞)

Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr^{-1}
PGA ground motion: 0.067104926 g

Recovered targets

Return period: 478.24399 yrs
Exceedance rate: 0.0020909829 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.96 %

Mean (over all sources)

m: 6.86
r: 94.76 km
ε_0: 0.26 σ

Mode (largest m-r bin)

m: 5.1
r: 11.57 km
ε_0: 0.08 σ
Contribution: 4.38 %

Mode (largest m-r-ε_0 bin)

m: 9.34
r: 221.43 km
ε_0: -0.19 σ
Contribution: 3.49 %

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 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
sub0_ch_bot.in	Interface							9.61
Cascadia Megathrust - whole CSZ Characteristic		221.43	9.10	0.12	123.599°W	45.501°N	280.91	9.61
WUSmap_2014_fixSm.ch.in (opt)	Grid							9.32
noPuget_2014_fixSm.ch.in (opt)	Grid							9.31
WUSmap_2014_fixSm.gr.in (opt)	Grid							9.31
noPuget_2014_fixSm.gr.in (opt)	Grid							9.31
sub0_ch_mid.in	Interface							7.29
Cascadia Megathrust - whole CSZ Characteristic		275.21	8.92	0.70	124.330°W	45.489°N	278.83	7.29
noPuget_2014_adSm.ch.in (opt)	Grid							6.07
noPuget_2014_adSm.gr.in (opt)	Grid							6.06
WUSmap_2014_adSm.ch.in (opt)	Grid							6.06
WUSmap_2014_adSm.gr.in (opt)	Grid							6.06
WUSmap_2014_fixSm_M8.in (opt)	Grid							2.28
noPuget_2014_fixSm_M8.in (opt)	Grid							2.28
sub0_ch_top.in	Interface							2.10
Cascadia Megathrust - whole CSZ Characteristic		290.98	8.82	0.89	124.549°W	45.485°N	278.36	2.10
coastalOR_deep.in	Slab							1.88
noPuget_2014_adSm_M8.in (opt)	Grid							1.49
WUSmap_2014_adSm_M8.in (opt)	Grid							1.49

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (update) (4.2.0)

Latitude

Decimal degrees

45.163117

Longitude

Decimal degrees, negative values for western longitudes

-120.851631

Site Class

537 m/s (Site class C)

Spectral Period

Peak Ground Acceleration

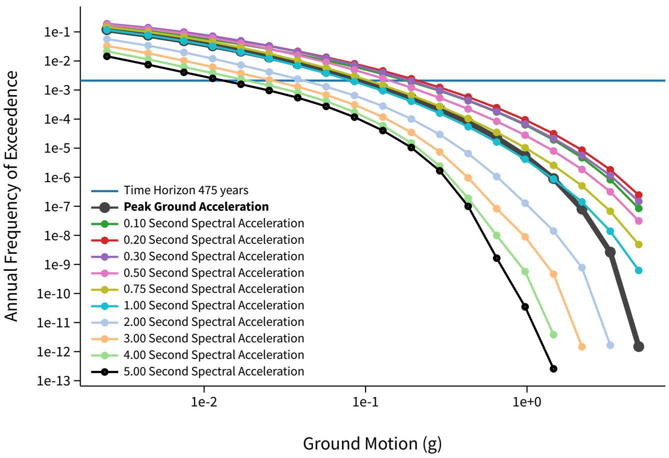
Time Horizon

Return period in years

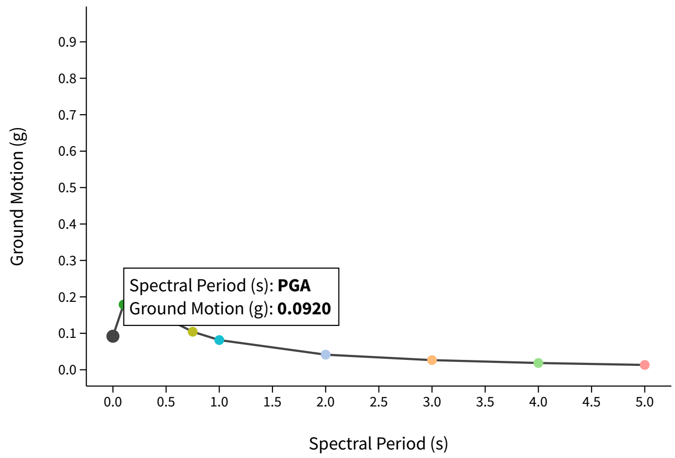
475

Hazard Curve

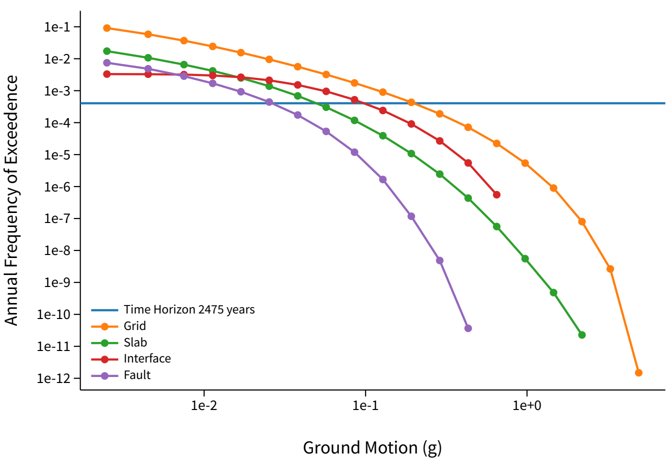
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

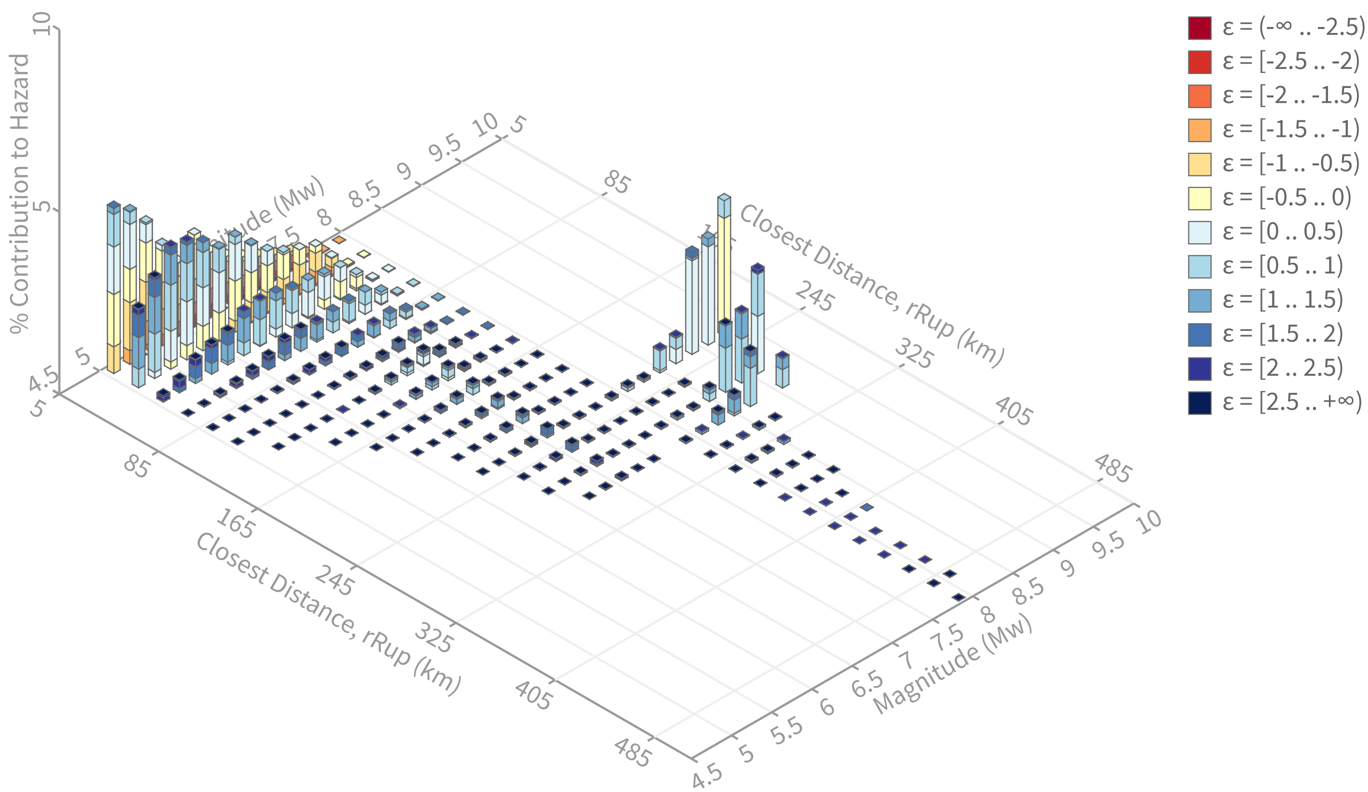


[View Raw Data](#)

^ Deaggregation

Component

Total


% Contribution to Hazard
Closest Distance, rRup (km)
Magnitude (Mw)
ε = (-∞ .. -2.5)
ε = [-2.5 .. -2)
ε = [-2 .. -1.5)
ε = [-1.5 .. -1)
ε = [-1 .. -0.5)
ε = [-0.5 .. 0)
ε = [0 .. 0.5)
ε = [0.5 .. 1)
ε = [1 .. 1.5)
ε = [1.5 .. 2)
ε = [2 .. 2.5)
ε = [2.5 .. +∞)

Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr^{-1}
PGA ground motion: 0.091967857 g

Recovered targets

Return period: 480.36772 yrs
Exceedance rate: 0.0020817386 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.96 %

Mean (over all sources)

m: 6.77
r: 87.47 km
ε_0: 0.27 σ

Mode (largest m-r bin)

m: 5.1
r: 11.64 km
ε_0: 0.05 σ
Contribution: 4.53 %

Mode (largest m-r-ε_0 bin)

m: 9.34
r: 221.43 km
ε_0: -0.08 σ
Contribution: 3.22 %

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 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
WUSmap_2014_fixSm.ch.in (opt)	Grid							9.80
noPuget_2014_fixSm.ch.in (opt)	Grid							9.80
WUSmap_2014_fixSm.gr.in (opt)	Grid							9.79
noPuget_2014_fixSm.gr.in (opt)	Grid							9.79
sub0_ch_bot.in	Interface							8.81
Cascadia Megathrust - whole CSZ Characteristic		221.43	9.11	0.23	123.599°W	45.501°N	280.91	8.81
noPuget_2014_adSm.ch.in (opt)	Grid							6.39
WUSmap_2014_adSm.ch.in (opt)	Grid							6.38
noPuget_2014_adSm.gr.in (opt)	Grid							6.38
WUSmap_2014_adSm.gr.in (opt)	Grid							6.38
sub0_ch_mid.in	Interface							6.38
Cascadia Megathrust - whole CSZ Characteristic		275.21	8.92	0.80	124.330°W	45.489°N	278.83	6.38
WUSmap_2014_fixSm_M8.in (opt)	Grid							2.40
noPuget_2014_fixSm_M8.in (opt)	Grid							2.40
sub0_ch_top.in	Interface							1.81
Cascadia Megathrust - whole CSZ Characteristic		290.98	8.82	0.98	124.549°W	45.485°N	278.36	1.81
coastalOR_deep.in	Slab							1.59
noPuget_2014_adSm_M8.in (opt)	Grid							1.57
WUSmap_2014_adSm_M8.in (opt)	Grid							1.56

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

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U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (update) (4.2.0)

Latitude

Decimal degrees

45.163117

Longitude

Decimal degrees, negative values for western longitudes

-120.851631

Site Class

1150 m/s (Site class B)

Spectral Period

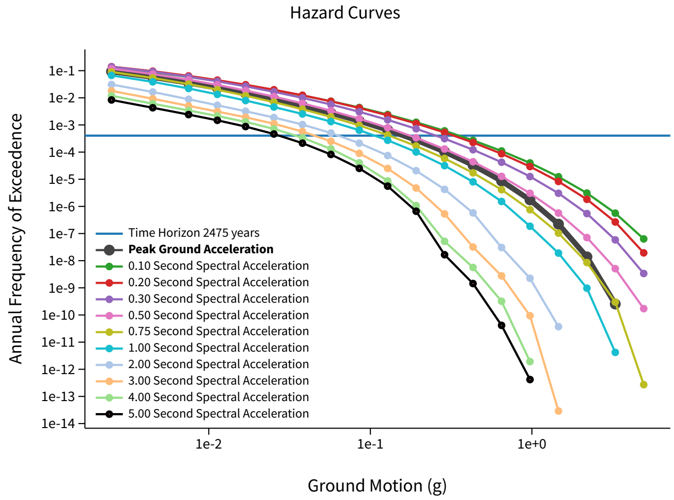
Peak Ground Acceleration

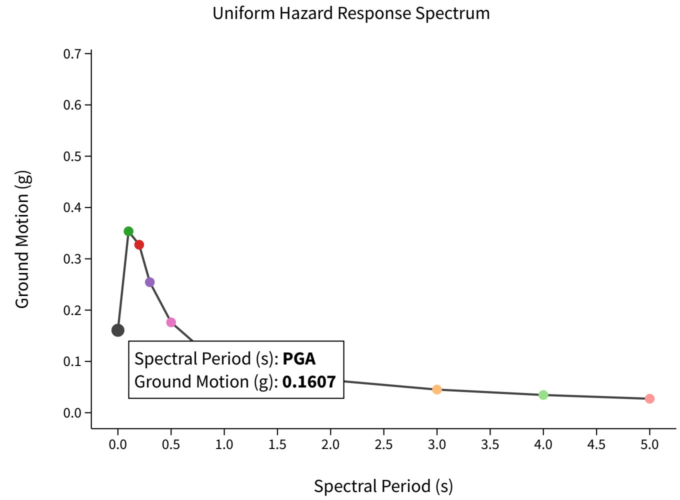
Time Horizon

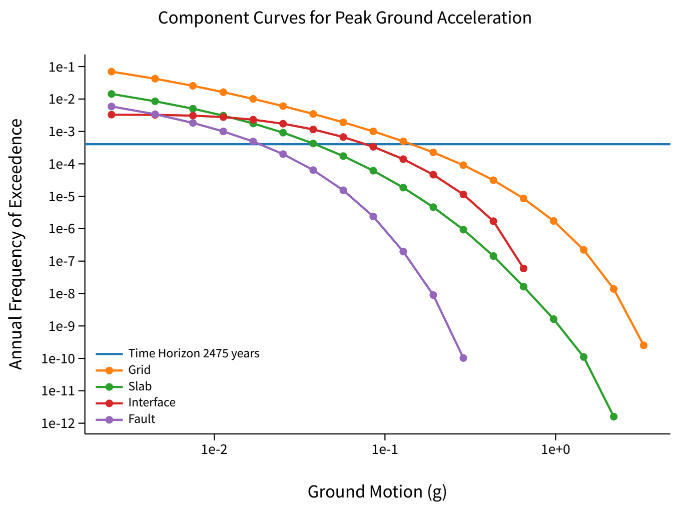
Return period in years

2475

Hazard Curve





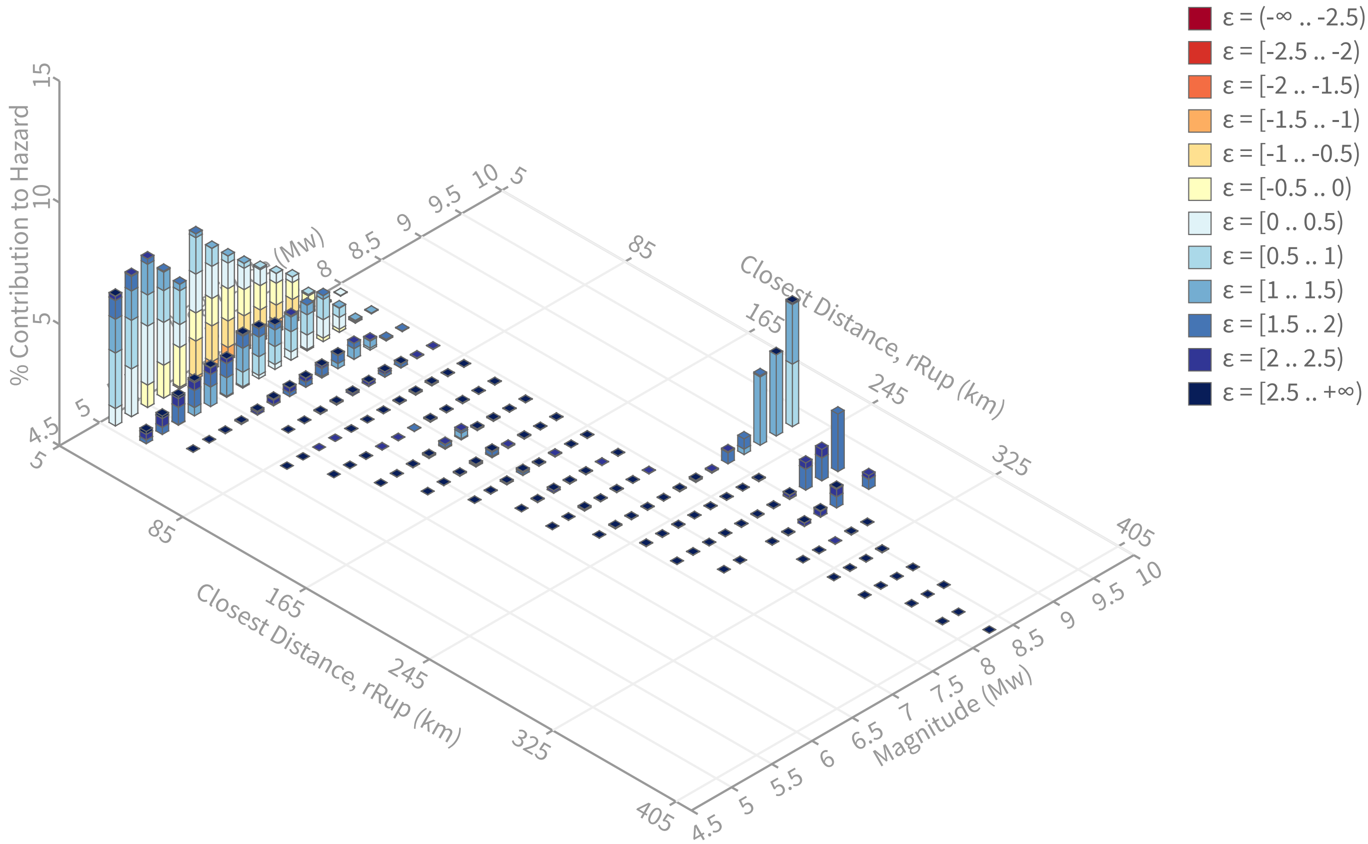


View Raw Data

Deaggregation

Component

Total


ε = (-∞ .. -2.5)
ε = [-2.5 .. -2)
ε = [-2 .. -1.5)
ε = [-1.5 .. -1)
ε = [-1 .. -0.5)
ε = [-0.5 .. 0)
ε = [0 .. 0.5)
ε = [0.5 .. 1)
ε = [1 .. 1.5)
ε = [1.5 .. 2)
ε = [2 .. 2.5)
ε = [2.5 .. +∞)
% Contribution to Hazard
Closest Distance, rRup (km)
Magnitude (Mw)

Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.16067072 g

Recovered targets

Return period: 2516.7415 yrs
Exceedance rate: 0.00039733917 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.62 %

Mean (over all sources)

m: 6.76
r: 64.74 km
ε_0: 0.73 σ

Mode (largest m-r bin)

m: 5.5
r: 10.95 km
ε_0: 0.54 σ
Contribution: 6.1 %

Mode (largest m-r-ε_0 bin)

m: 9.01
r: 221.39 km
ε_0: 1.28 σ
Contribution: 3.34 %

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 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
sub0_ch_bot.in	Interface							10.66
Cascadia Megathrust - whole CSZ Characteristic		221.43	9.13	1.19	123.599°W	45.501°N	280.91	10.66
WUSmap_2014_fixSm.ch.in (opt)	Grid							10.61
PointSourceFinite: -120.852, 45.213		7.47	5.74	-0.13	120.852°W	45.213°N	0.00	2.03
noPuget_2014_fixSm.ch.in (opt)	Grid							10.61
PointSourceFinite: -120.852, 45.213		7.47	5.74	-0.13	120.852°W	45.213°N	0.00	2.03
WUSmap_2014_fixSm.gr.in (opt)	Grid							10.61
PointSourceFinite: -120.852, 45.213		7.47	5.74	-0.13	120.852°W	45.213°N	0.00	2.03
noPuget_2014_fixSm.gr.in (opt)	Grid							10.61
PointSourceFinite: -120.852, 45.213		7.47	5.74	-0.13	120.852°W	45.213°N	0.00	2.03
noPuget_2014_adSm.ch.in (opt)	Grid							6.75
PointSourceFinite: -120.852, 45.213		7.47	5.74	-0.13	120.852°W	45.213°N	0.00	1.26
noPuget_2014_adSm.gr.in (opt)	Grid							6.75
PointSourceFinite: -120.852, 45.213		7.47	5.74	-0.13	120.852°W	45.213°N	0.00	1.26
WUSmap_2014_adSm.ch.in (opt)	Grid							6.75
PointSourceFinite: -120.852, 45.213		7.47	5.74	-0.13	120.852°W	45.213°N	0.00	1.25
WUSmap_2014_adSm.gr.in (opt)	Grid							6.75
PointSourceFinite: -120.852, 45.213		7.47	5.74	-0.13	120.852°W	45.213°N	0.00	1.25
sub0_ch_mid.in	Interface							4.63
Cascadia Megathrust - whole CSZ Characteristic		275.21	8.95	1.80	124.330°W	45.489°N	278.83	4.63
WUSmap_2014_fixSm_M8.in (opt)	Grid							2.61
noPuget_2014_fixSm_M8.in (opt)	Grid							2.61
noPuget_2014_adSm_M8.in (opt)	Grid							1.67
WUSmap_2014_adSm_M8.in (opt)	Grid							1.67
sub0_ch_top.in	Interface							1.08
Cascadia Megathrust - whole CSZ Characteristic		290.98	8.85	1.98	124.549°W	45.485°N	278.36	1.08

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (update) (4.2.0)

Latitude

Decimal degrees

45.163117

Longitude

Decimal degrees, negative values for western longitudes

-120.851631

Site Class

537 m/s (Site class C)

Spectral Period

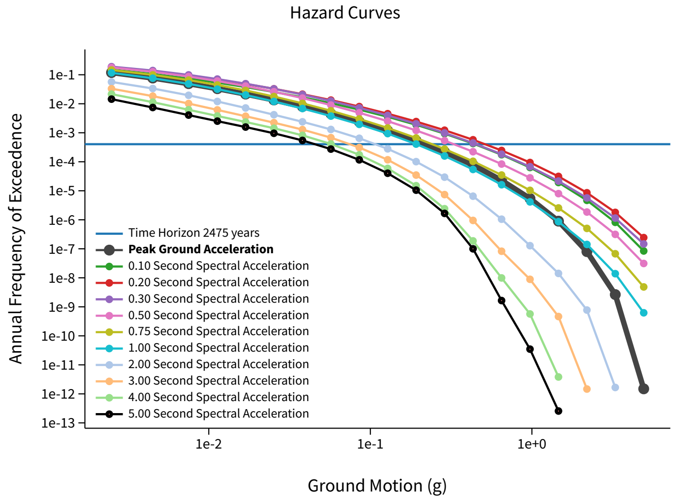
Peak Ground Acceleration

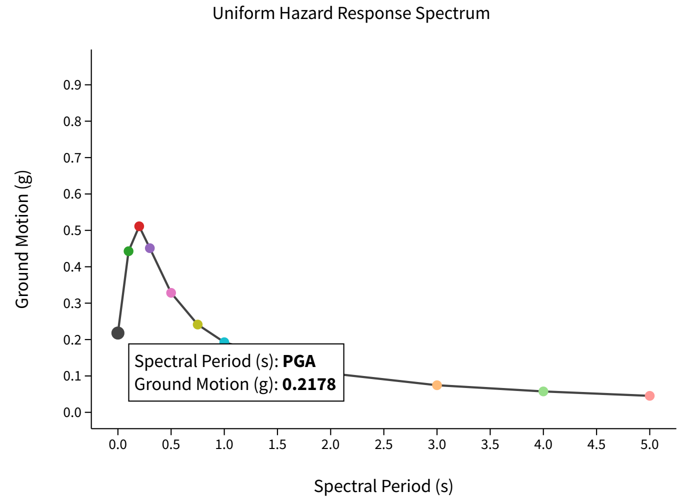
Time Horizon

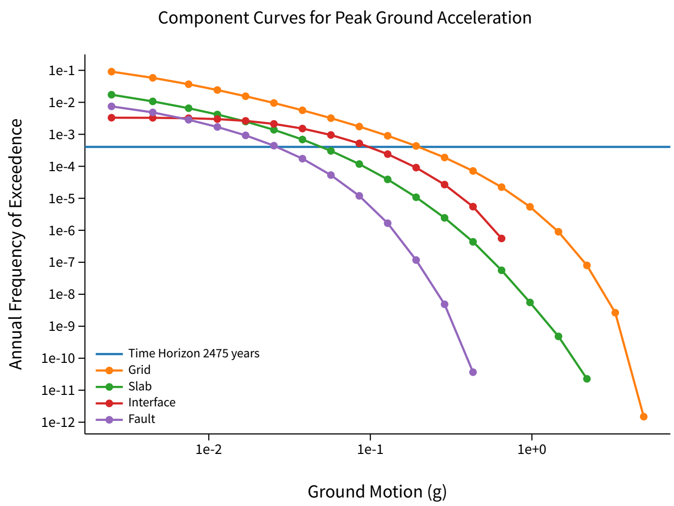
Return period in years

2475

Hazard Curve





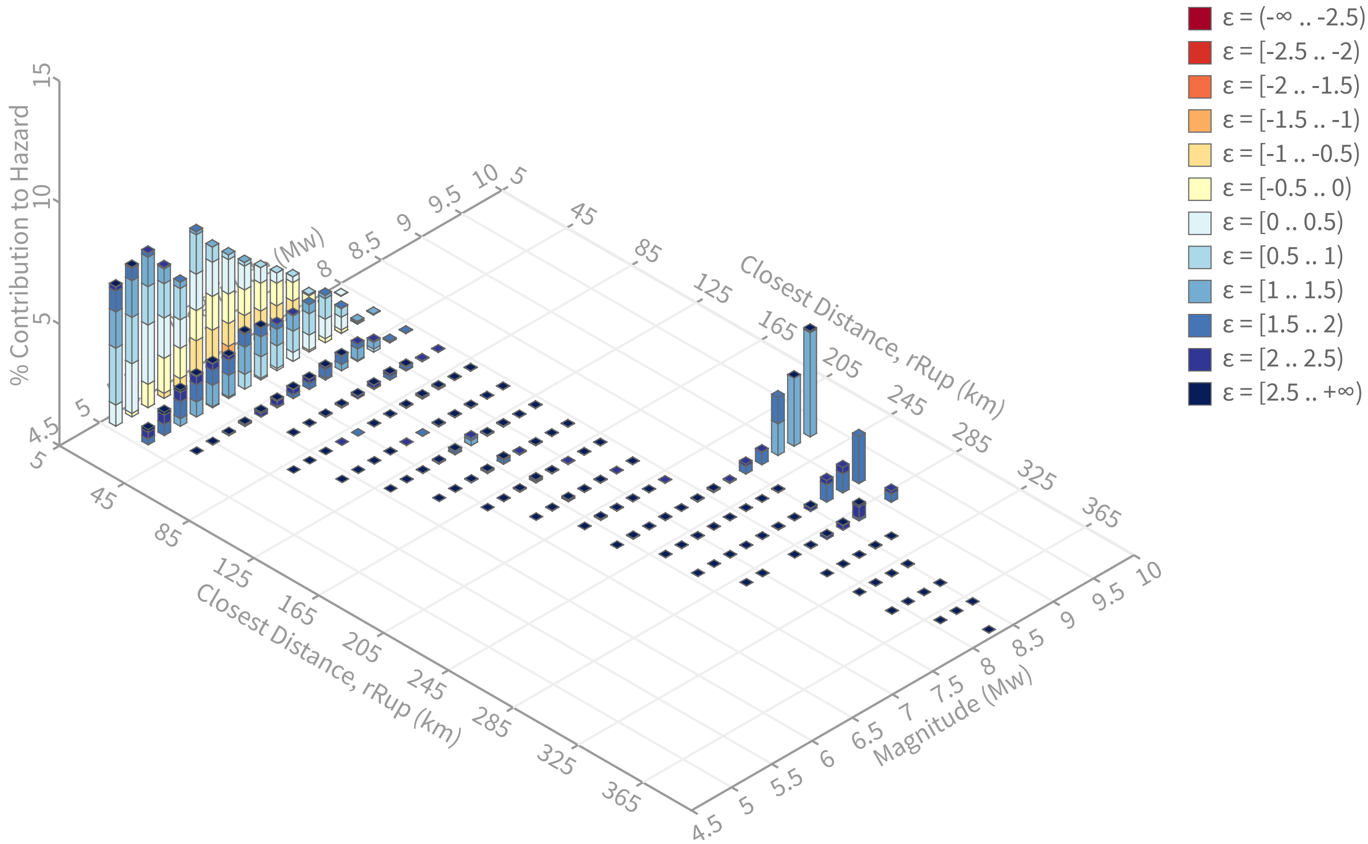


View Raw Data

Deaggregation

Component

Total


% Contribution to Hazard
Closest Distance, rRup (km)
Magnitude (Mw)
ε = (-∞ .. -2.5)
ε = [-2.5 .. -2)
ε = [-2 .. -1.5)
ε = [-1.5 .. -1)
ε = [-1 .. -0.5)
ε = [-0.5 .. 0)
ε = [0 .. 0.5)
ε = [0.5 .. 1)
ε = [1 .. 1.5)
ε = [1.5 .. 2)
ε = [2 .. 2.5)
ε = [2.5 .. +∞)

Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.21784845 g

Recovered targets

Return period: 2524.7986 yrs
Exceedance rate: 0.0003960712 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.59 %

Mean (over all sources)

m: 6.65
r: 56.69 km
ε_0: 0.72 σ

Mode (largest m-r bin)

m: 5.5
r: 11.07 km
ε_0: 0.5 σ
Contribution: 6.35 %

Mode (largest m-r-ε_0 bin)

m: 9.34
r: 221.43 km
ε_0: 1.1 σ
Contribution: 4.29 %

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 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
WUSmap_2014_fixSm.ch.in (opt)	Grid							11.13
PointSourceFinite: -120.852, 45.213		7.47	5.73	-0.15	120.852°W	45.213°N	0.00	2.07
noPuget_2014_fixSm.ch.in (opt)	Grid							11.13
PointSourceFinite: -120.852, 45.213		7.47	5.73	-0.15	120.852°W	45.213°N	0.00	2.07
WUSmap_2014_fixSm.gr.in (opt)	Grid							11.13
PointSourceFinite: -120.852, 45.213		7.47	5.73	-0.15	120.852°W	45.213°N	0.00	2.07
noPuget_2014_fixSm.gr.in (opt)	Grid							11.13
PointSourceFinite: -120.852, 45.213		7.47	5.73	-0.15	120.852°W	45.213°N	0.00	2.07
sub0_ch_bot.in	Interface							9.01
Cascadia Megathrust - whole CSZ Characteristic		221.43	9.13	1.28	123.599°W	45.501°N	280.91	9.01
noPuget_2014_adSm.ch.in (opt)	Grid							7.09
PointSourceFinite: -120.852, 45.213		7.47	5.73	-0.15	120.852°W	45.213°N	0.00	1.28
noPuget_2014_adSm.gr.in (opt)	Grid							7.09
PointSourceFinite: -120.852, 45.213		7.47	5.73	-0.15	120.852°W	45.213°N	0.00	1.28
WUSmap_2014_adSm.ch.in (opt)	Grid							7.08
PointSourceFinite: -120.852, 45.213		7.47	5.73	-0.15	120.852°W	45.213°N	0.00	1.28
WUSmap_2014_adSm.gr.in (opt)	Grid							7.08
PointSourceFinite: -120.852, 45.213		7.47	5.73	-0.15	120.852°W	45.213°N	0.00	1.28
sub0_ch_mid.in	Interface							3.75
Cascadia Megathrust - whole CSZ Characteristic		275.21	8.95	1.88	124.330°W	45.489°N	278.83	3.75
WUSmap_2014_fixSm_M8.in (opt)	Grid							2.74
noPuget_2014_fixSm_M8.in (opt)	Grid							2.74
noPuget_2014_adSm_M8.in (opt)	Grid							1.75
WUSmap_2014_adSm_M8.in (opt)	Grid							1.75

Attachment H-4.
Response Spectrum – Site Class B

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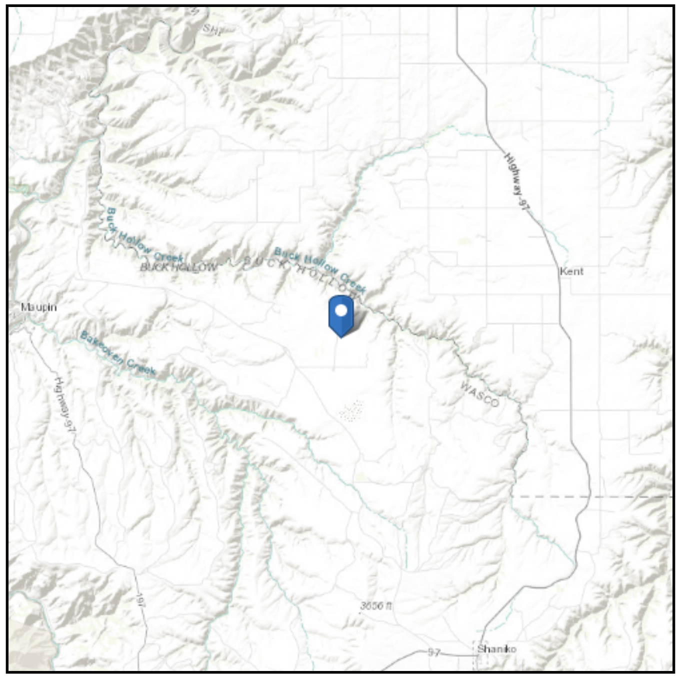
ASCE 7 Hazards Report

Address:
Maupin, Oregon
97037

Standard:	ASCE/SEI 7-22	**Latitude:**	45.163117
Risk Category:	I	**Longitude:**	-120.851631
Soil Class:	B - Rock	**Elevation:**	2359.7962341125585 ft (NAVD 88)



ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

B - Rock

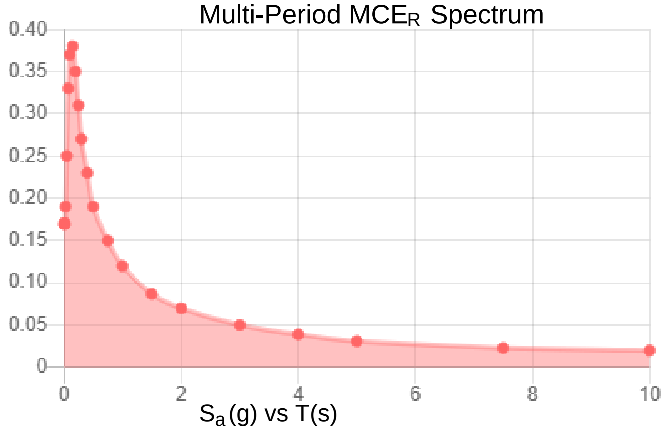
Site Soil Class:

Results:

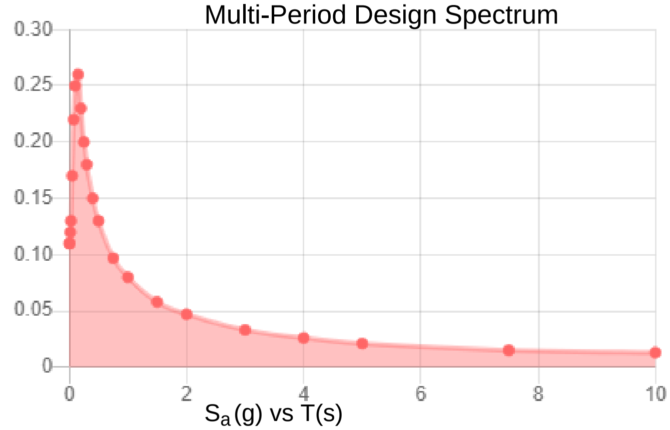
PGA_M :	0.16	T_L :	16
S_{MS} :	0.31	S_S :	0.43
S_{M1} :	0.13	S_1 :	0.15
S_{DS} :	0.21	V_{S30} :	1080
S_{D1} :	0.084		

Seismic Design Category: B

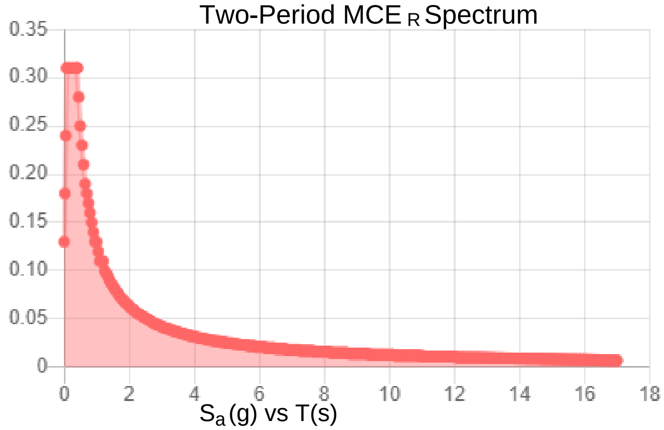
Multi-Period MCE_R Spectrum



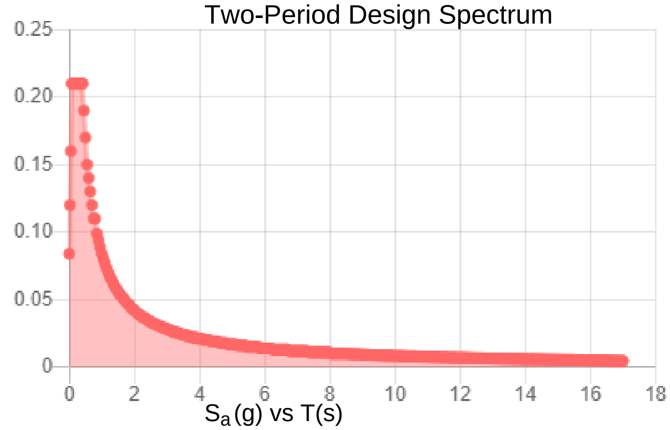
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Fri Sep 15 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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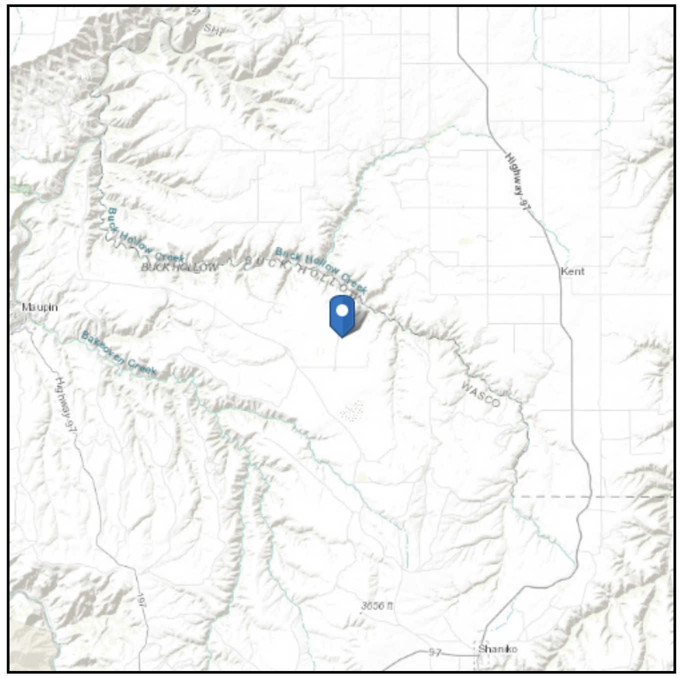
ASCE 7 Hazards Report

Address:
Maupin, Oregon
97037

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: B - Rock

Latitude: 45.163117
Longitude: -120.851631
Elevation: 2359.7962341125585 ft (NAVD 88)



Seismic

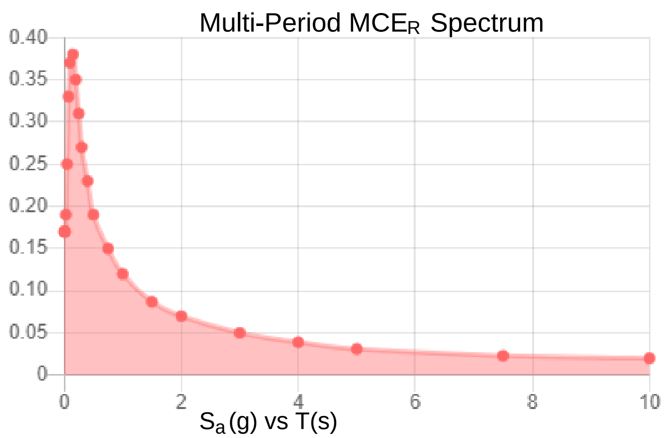
B - Rock

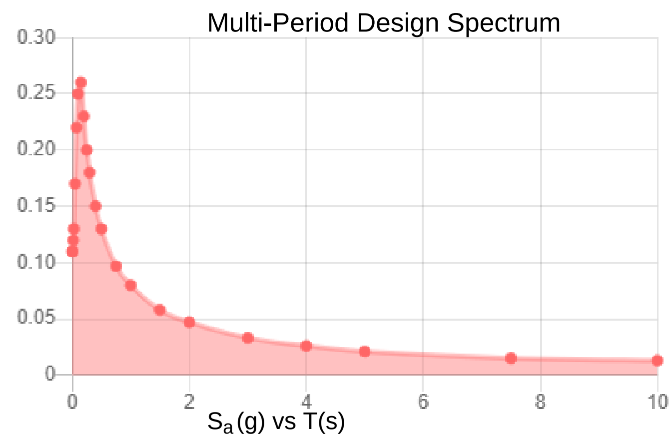
Site Soil Class:

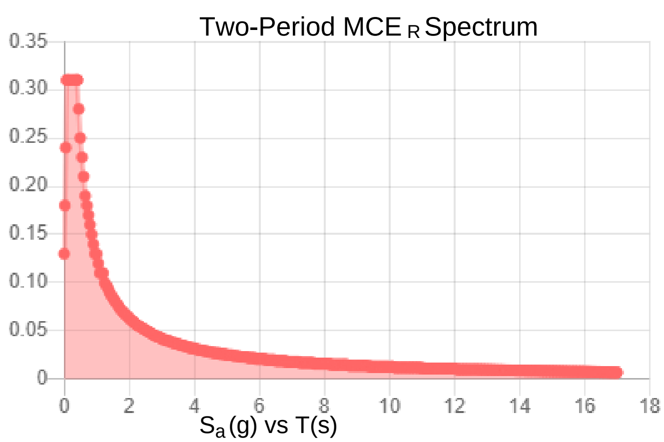
Results:

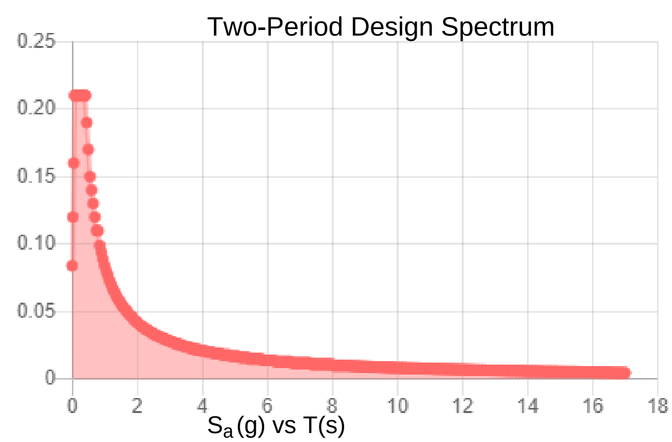
PGA_M :	0.16	T_L :	16
S_{MS} :	0.31	S_S :	0.43
S_{M1} :	0.13	S_1 :	0.15
S_{DS} :	0.21	V_{S30} :	1080
S_{D1} :	0.084		

Seismic Design Category: B









MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Fri Sep 15 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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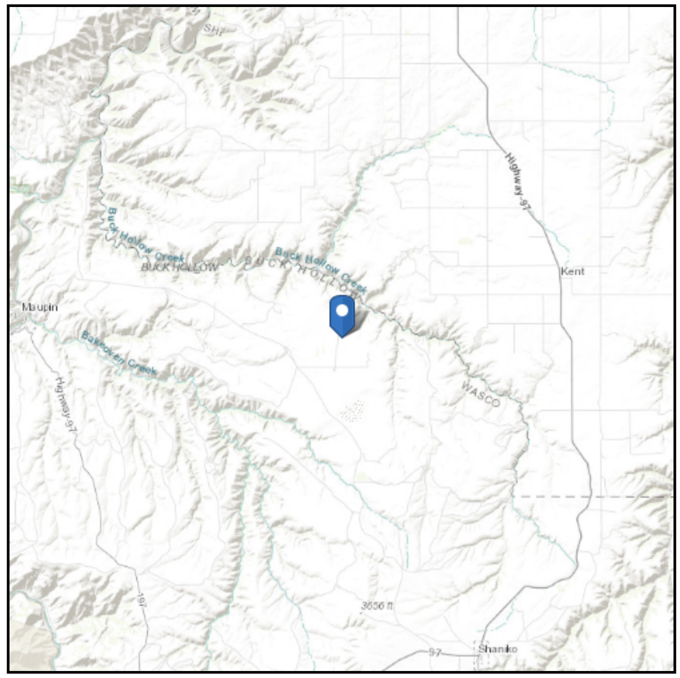
ASCE 7 Hazards Report

Address:
Maupin, Oregon
97037

Standard: ASCE/SEI 7-22
Risk Category: III
Soil Class: B - Rock

Latitude: 45.163117
Longitude: -120.851631
Elevation: 2359.7962341125585 ft (NAVD 88)



ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

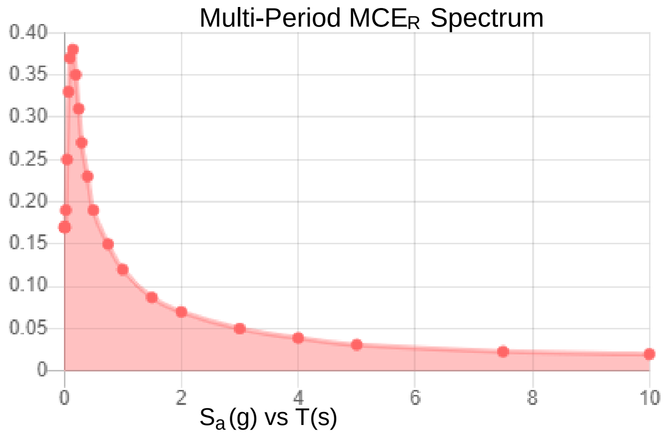
B - Rock

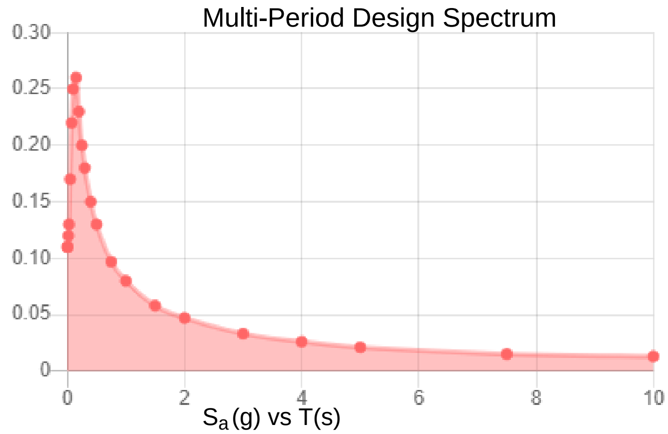
Site Soil Class:

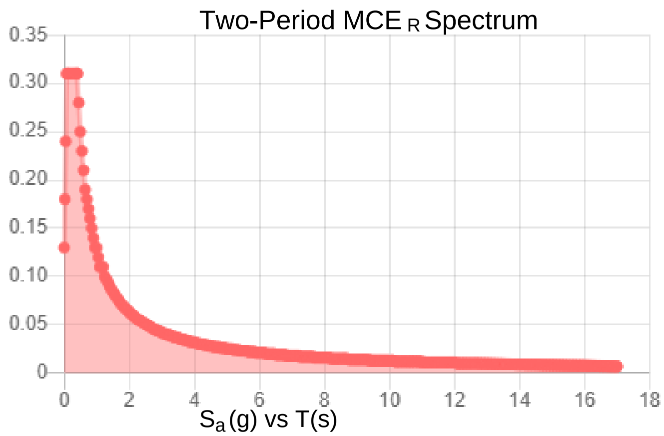
Results:

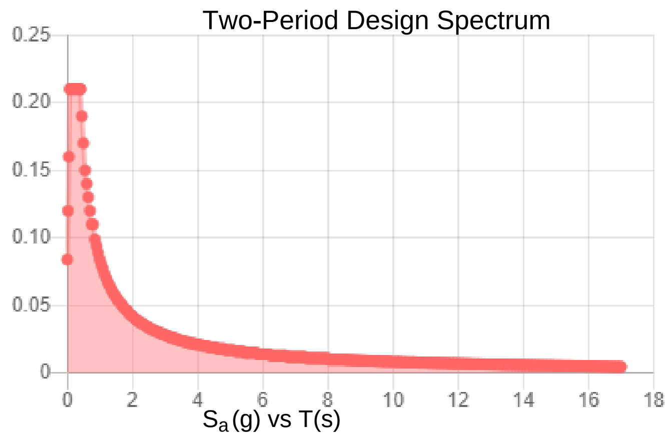
PGA_M :	0.16	T_L :	16
S_{MS} :	0.31	S_S :	0.43
S_{M1} :	0.13	S_1 :	0.15
S_{DS} :	0.21	V_{S30} :	1080
S_{D1} :	0.084		

Seismic Design Category: B









MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Fri Sep 15 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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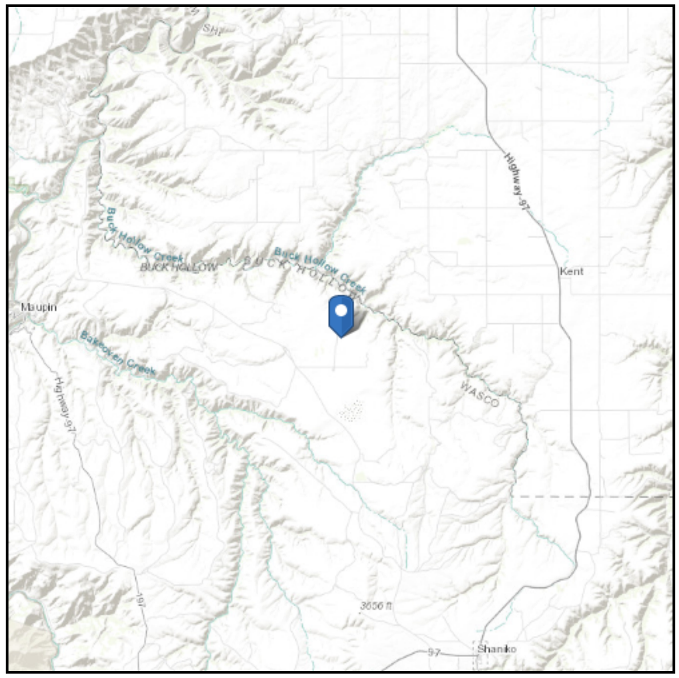
ASCE 7 Hazards Report

Address:
Maupin, Oregon
97037

Standard: ASCE/SEI 7-22
Risk Category: IV
Soil Class: B - Rock

Latitude: 45.163117
Longitude: -120.851631
Elevation: 2359.7962341125585 ft (NAVD 88)



ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

B - Rock

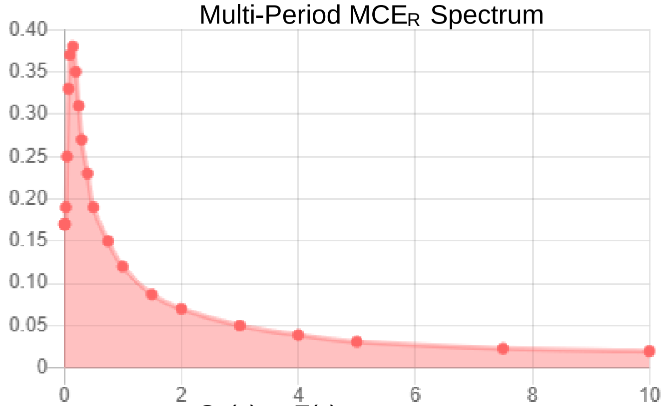
Site Soil Class:

Results:

PGA_M :	0.16	T_L :	16
S_{MS} :	0.31	S_S :	0.43
S_{M1} :	0.13	S_1 :	0.15
S_{DS} :	0.21	V_{S30} :	1080
S_{D1} :	0.084		

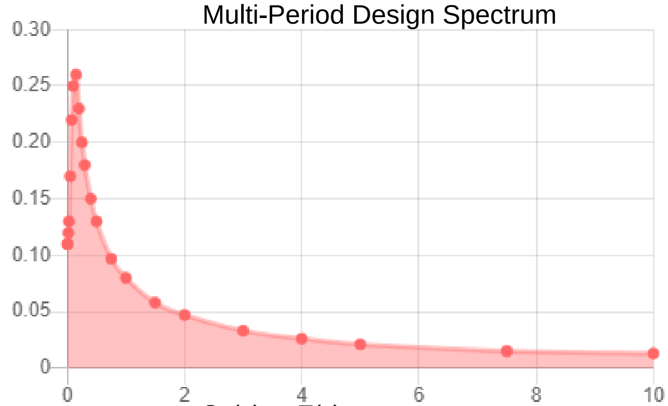
Seismic Design Category: C

Multi-Period MCE_R Spectrum



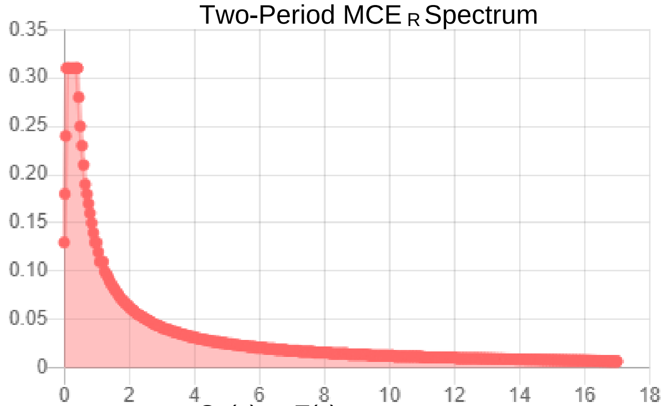
S_a(g) vs T(s)

Multi-Period Design Spectrum



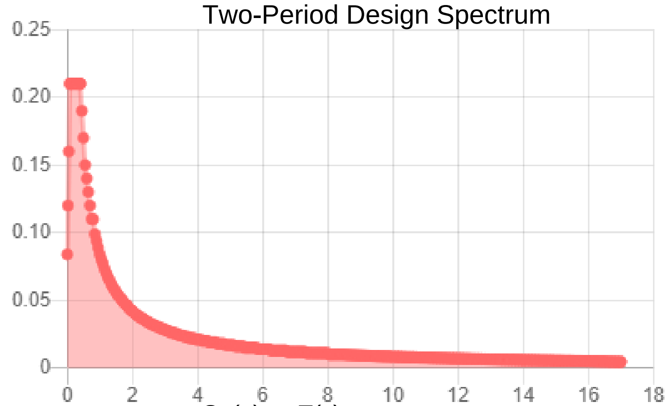
S_a(g) vs T(s)

Two-Period MCE_R Spectrum



S_a(g) vs T(s)

Two-Period Design Spectrum



S_a(g) vs T(s)

MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Fri Sep 15 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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Attachment H-5.
Response Spectrum – Site Class C

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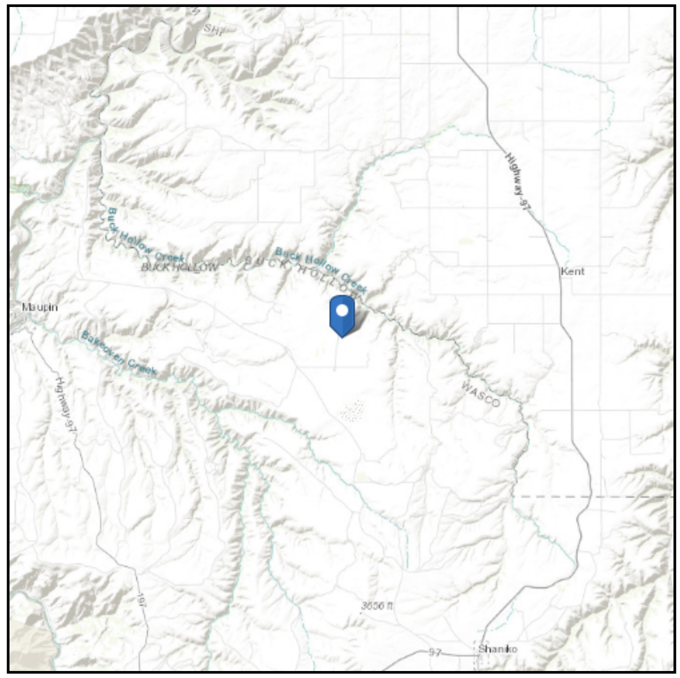
ASCE 7 Hazards Report

Address:
Maupin, Oregon
97037

Standard: ASCE/SEI 7-22
Risk Category: I
Soil Class: C - Very Dense Soil and Soft Rock
Latitude: 45.163117
Longitude: -120.851631
Elevation: 2359.7962341125585 ft (NAVD 88)



Seismic C - Very Dense Soil and Soft Rock

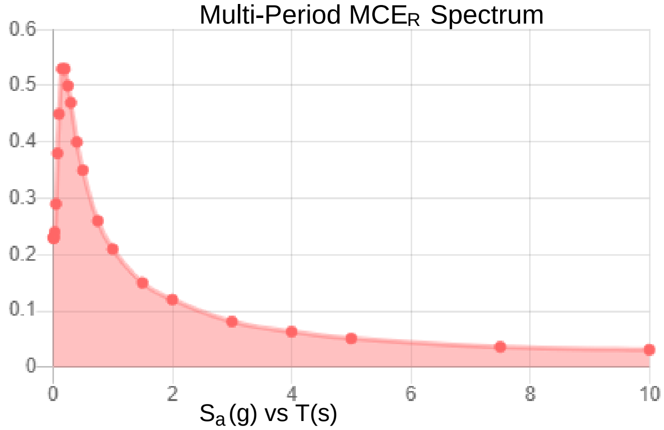
Site Soil Class:

Results:

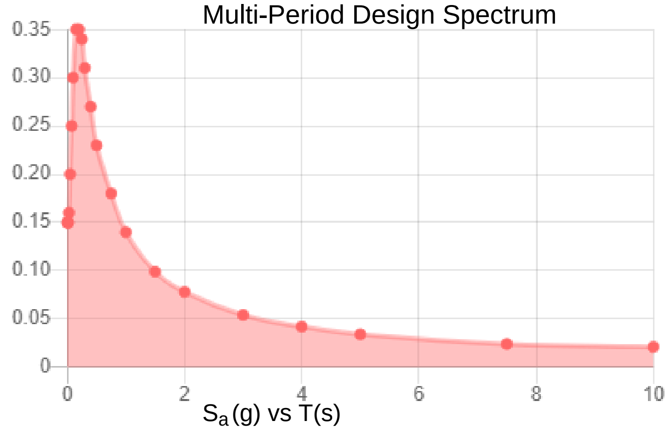
PGA_M :	0.21	T_L :	16
S_{MS} :	0.48	S_S :	0.43
S_{M1} :	0.21	S_1 :	0.15
S_{DS} :	0.32	V_{S30} :	530
S_{D1} :	0.14		

Seismic Design Category: C

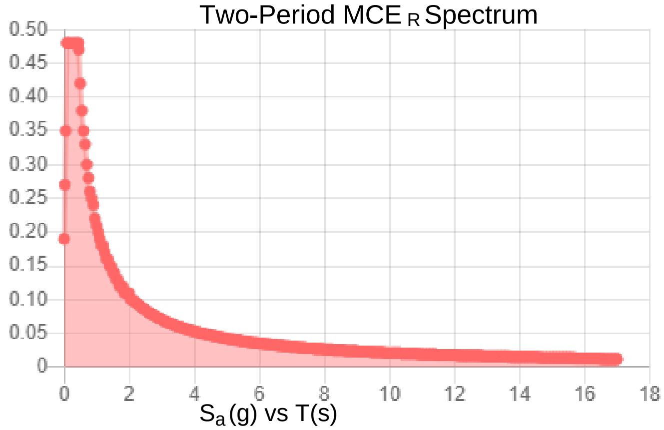
Multi-Period MCE_R Spectrum



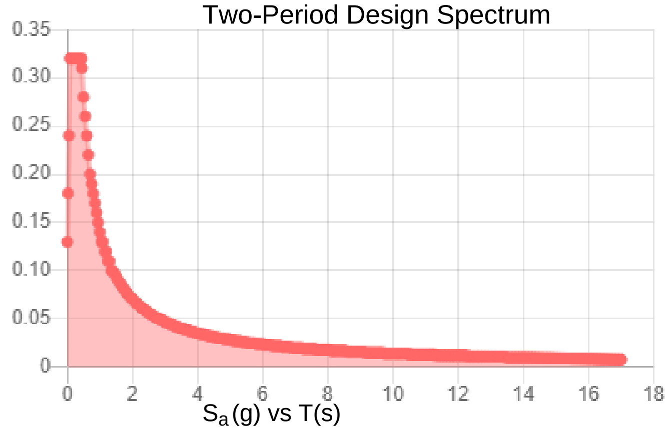
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Fri Sep 15 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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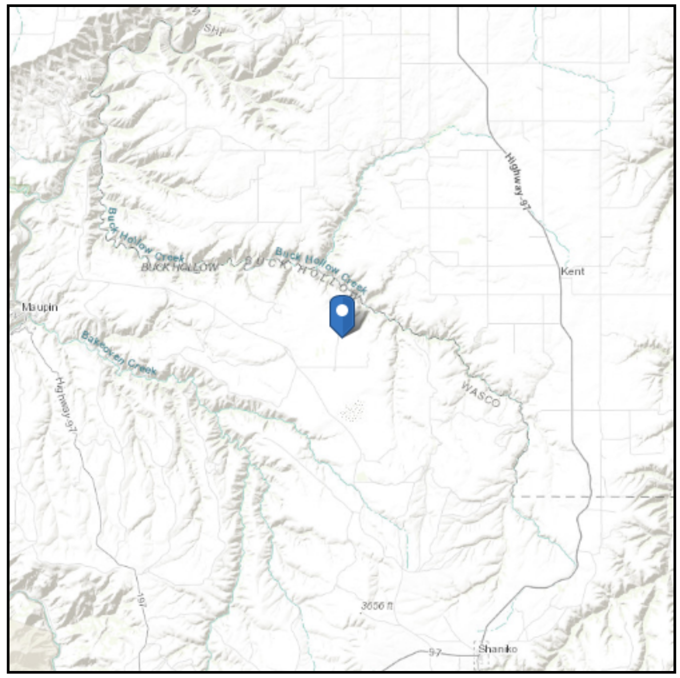
ASCE 7 Hazards Report

Address:
Maupin, Oregon
97037

Standard:	ASCE/SEI 7-22	**Latitude:**	45.163117
Risk Category:	II	**Longitude:**	-120.851631
Soil Class:	C - Very Dense Soil and Soft Rock	**Elevation:**	2359.7962341125585 ft (NAVD 88)



Seismic

C - Very Dense Soil and Soft Rock

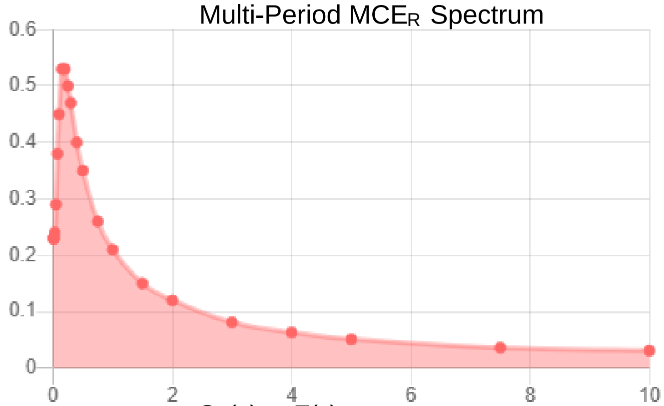
Site Soil Class:

Results:

PGA_M :	0.21	T_L :	16
S_{MS} :	0.48	S_S :	0.43
S_{M1} :	0.21	S_1 :	0.15
S_{DS} :	0.32	V_{S30} :	530
S_{D1} :	0.14		

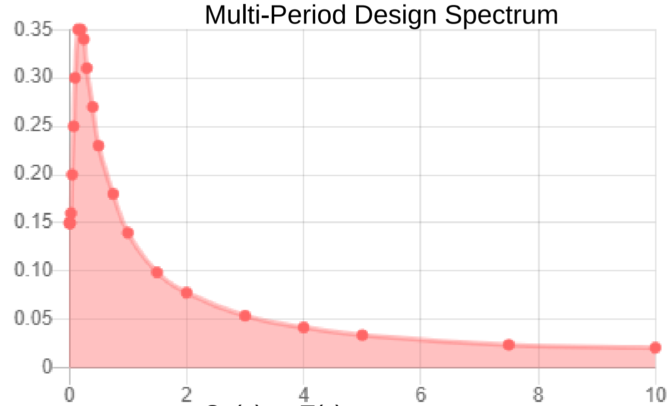
Seismic Design Category: C

Multi-Period MCE_R Spectrum



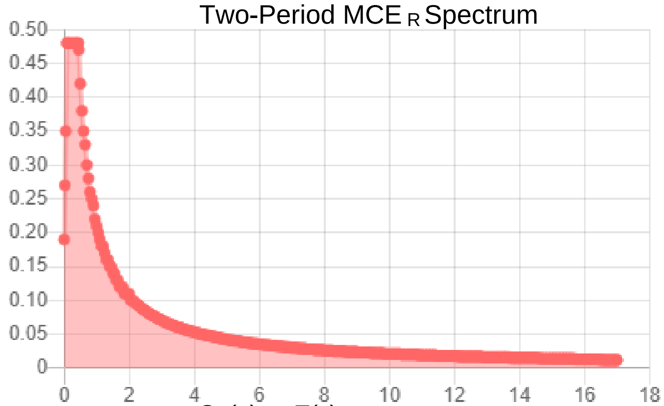
S_a(g) vs T(s)

Multi-Period Design Spectrum



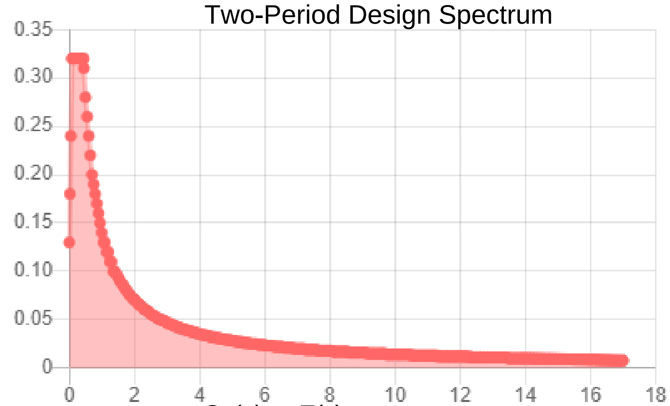
S_a(g) vs T(s)

Two-Period MCE_R Spectrum



S_a(g) vs T(s)

Two-Period Design Spectrum



S_a(g) vs T(s)

MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Fri Sep 15 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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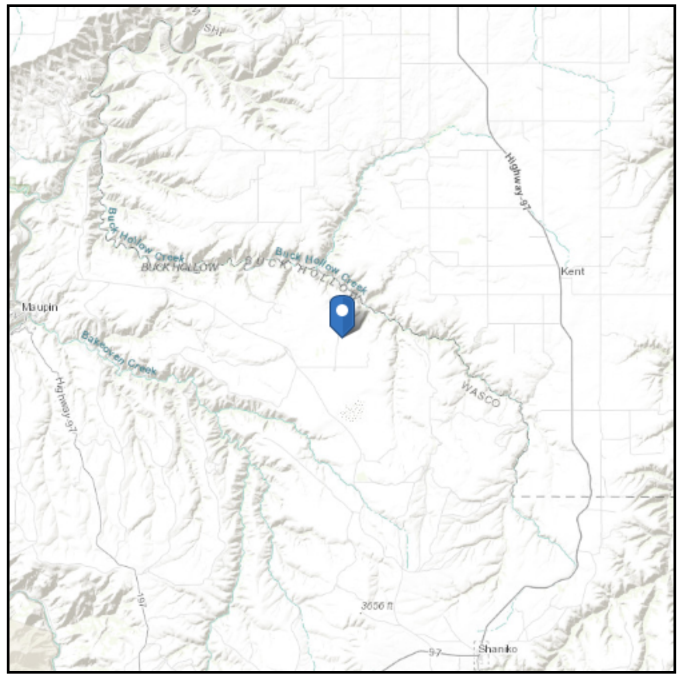
ASCE 7 Hazards Report

Address:
Maupin, Oregon
97037

Standard:	ASCE/SEI 7-22	**Latitude:**	45.163117
Risk Category:	III	**Longitude:**	-120.851631
Soil Class:	C - Very Dense Soil and Soft Rock	**Elevation:**	2359.7962341125585 ft (NAVD 88)



Seismic

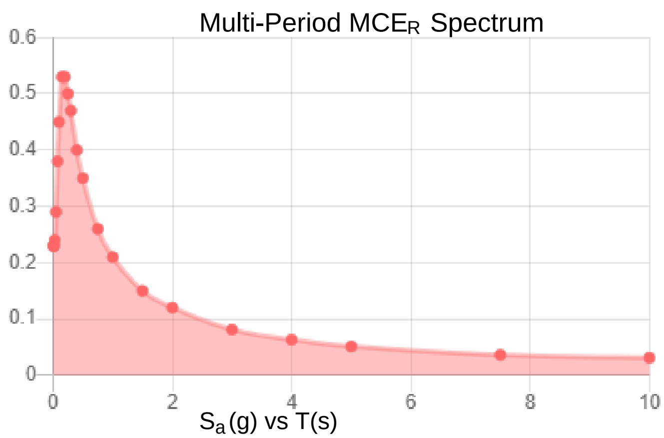
C - Very Dense Soil and Soft Rock

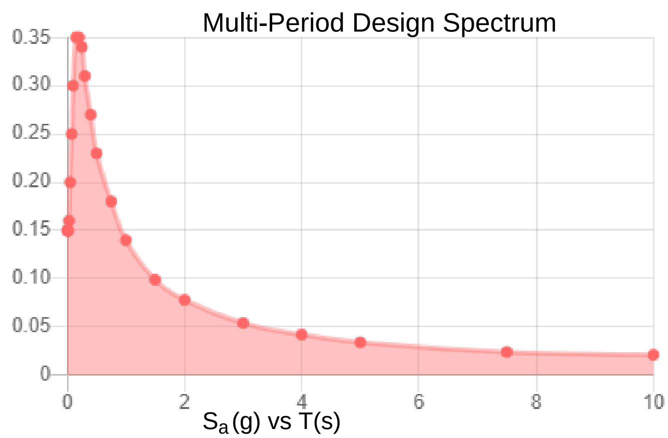
Site Soil Class:

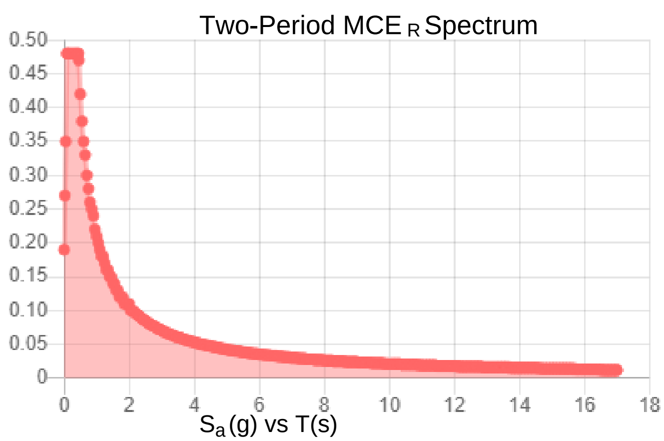
Results:

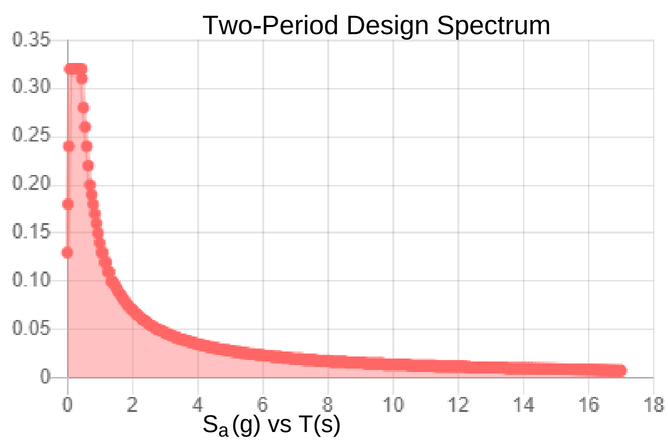
PGA_M :	0.21	T_L :	16
S_{MS} :	0.48	S_S :	0.43
S_{M1} :	0.21	S_1 :	0.15
S_{DS} :	0.32	V_{S30} :	530
S_{D1} :	0.14		

Seismic Design Category: C









MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed: **Fri Sep 15 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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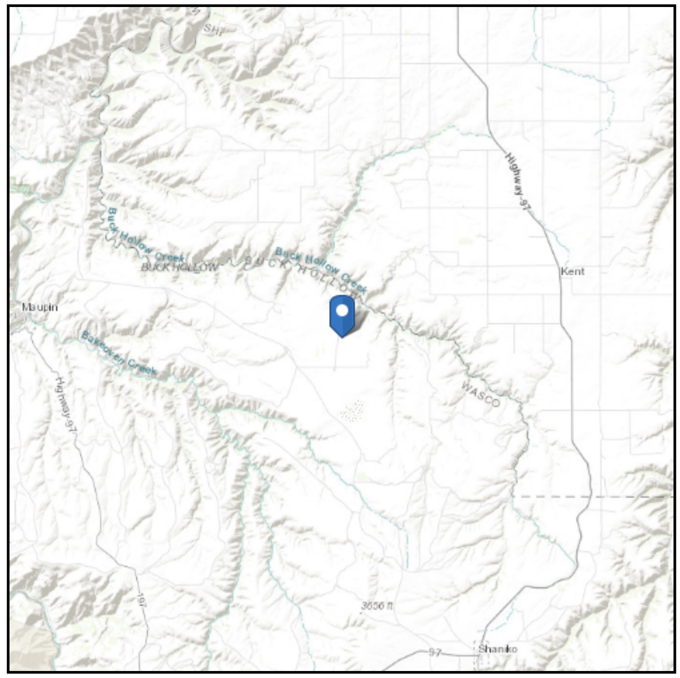
ASCE 7 Hazards Report

Address:
Maupin, Oregon
97037

Standard:	ASCE/SEI 7-22	**Latitude:**	45.163117
Risk Category:	IV	**Longitude:**	-120.851631
Soil Class:	C - Very Dense Soil and Soft Rock	**Elevation:**	2359.7962341125585 ft (NAVD 88)



Seismic

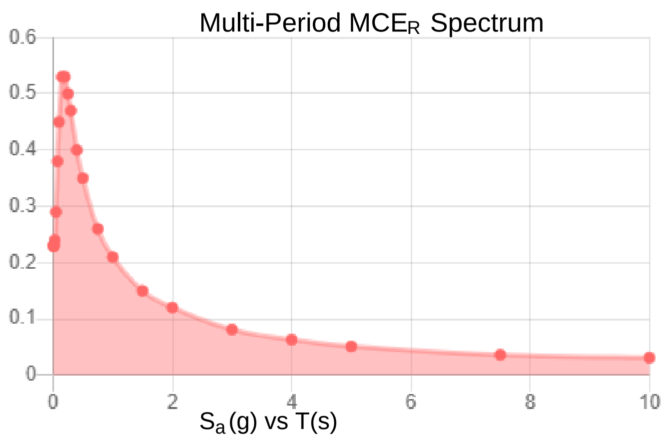
C - Very Dense Soil and Soft Rock

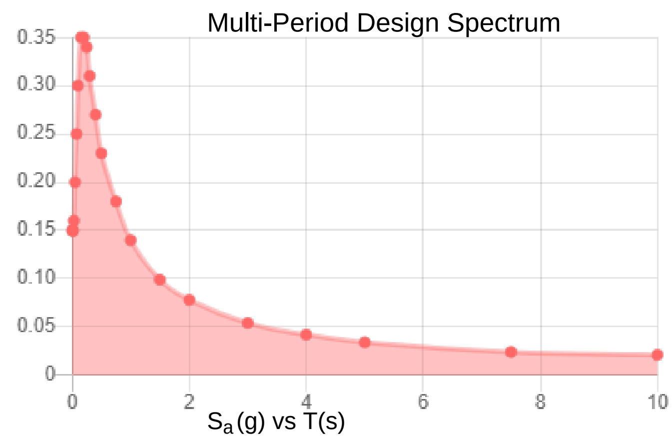
Site Soil Class:

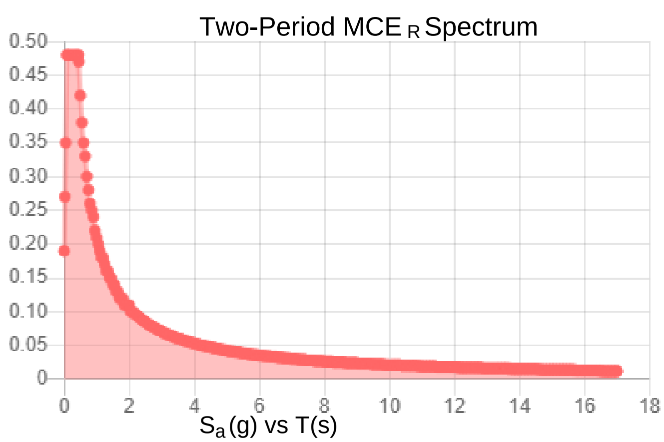
Results:

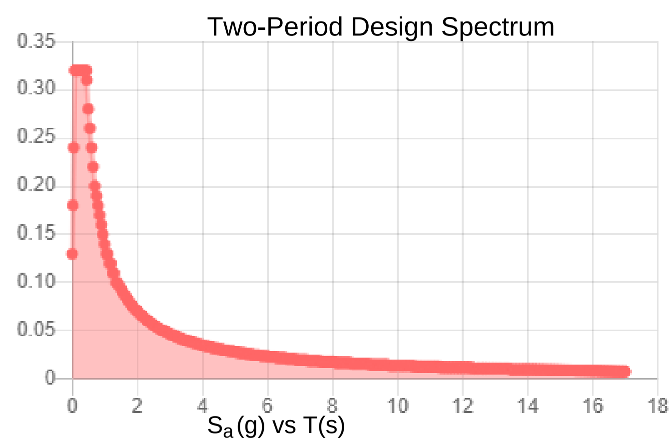
PGA_M :	0.21	T_L :	16
S_{MS} :	0.48	S_S :	0.43
S_{M1} :	0.21	S_1 :	0.15
S_{DS} :	0.32	V_{S30} :	530
S_{D1} :	0.14		

Seismic Design Category: D









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