OREGON ENVIROTHON 2024 TEAM #_____

SOILS Test Total: _____/ 50 points

SOIL FORMATION

1) Name the missing soil formation factors known by their acronym **CIORPT**. *(2 points)*
   Climate
   Organisms
   Relief
   Parent material
   Time

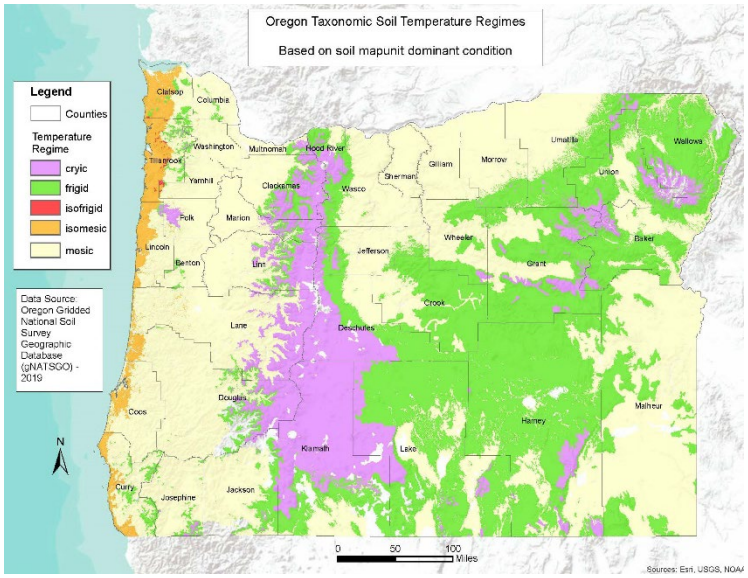
2) Soil mineral oxidation (like metals weathering to rust) is an example of a/an: (*1 point*)
   a) addition
   b) loss
   c) translocation
   d) transformation

3) Soil macrofauna consists of… (*1 point*)
   a) humus
   b) microscopic organisms
   c) visible insects and animals
   d) a tiny species of deer

4) How do macrofauna affect the soil? (*1 point*)
   a) They photosynthesize and release carbon into the soil
   b) They churn the soil and create large channels for water and air movement
   c) They act as a living mulch and prevent erosion
   d) They release glomalin to hold soil structure together

5) Which parent material type is formed in place from bedrock? (*1 point*)
   a) Ash
   b) Residuum
   c) Organic material
   d) Loess

6) Using the map below, which soil temperature regime dominates the Oregon coast? (*1 point*)
   a) Mesic
   b) Cryic
   c) Frigid
   d) Isomesic



____/ 7 points

SOIL CHARACTERISTICS

7) What is a seasonal high water table? (*1 point*)
   a) a place for tall people to look at hydrology maps
   b) how much water a soil holds
   c) groundwater
   d) the highest level that water reaches in a soil profile during the year

8) Which soil layer (horizon) is also known as the substratum and is relatively undeveloped? (*1 point*)
   a) O
   b) A
   c) B
   d) C

9) Which soil texture group drains water fastest? (*1 point*)
   a) sandy
   b) loamy and silty
   c) clayey
   d) gravelly

10) Using Munsell color notation, match the correct part to its definition (*3 points, one point each*)

A	hue	B	how dark or light the soil is
B	value	C	how bright or dull a soil is
C	chroma	A	the colors present in the soil

11) Circle the color chip to the right that corresponds to 7.5YR 4/6. (*1 point*) →

12) Examine the rock samples. What do you think the white coating on the outside of the sample rocks is called? (*1 point*)
   a) calcium carbonate
   b) ash
   c) organic material
   d) fluff

13) Determine the texture and color of the soil sample from the Umpqua National Forest. Use **Soil Texture By Feel Flow Chart** and **Munsell Color Book** provided**.** (*6 points*)

Texture	Munsell Color Notation (moist)
3 points:	*3 points*:

____/ 14 points

SOIL CLASSIFICIATION AND LAND USE

14) Soils are used as a medium for plant growth, for water storage and infiltration, as a habitat for organisms, for cycling nutrients, and for which other main function? (*1 point)*

a) an engineering foundation
b) a place for wildlife to nap
c) an ingredient in mud pies
d) a place to store nuclear waste

15) Which slope class is the most limited for use by people? (*1 point*)

A - ≤ 3% slope
B - 4 to 8% slope
C - 9 to 15% slope
D - 16 to 35% slope
E - 36 to 60% slope
F - 61 to 80% slope

16) Do upland rangeland soils typically have a thick O horizon (layer)? (*1 point*)

a) yes
b) no

17) In which setting would you find the thickest O horizon? *(1 point)*

a) O horizons are too rare to reliably find
b) rangeland
c) wetland
d) agricultural field

18) What is the name of the soil tool provided? (*1 point*)

a) spade
b) bucket auger
c) bulk density tester
d) soil sieve

19) Match the soil classification to the soil characteristics? (*5 points, 1 point each*)

A	Prime farmland	E	Often contains fill like construction debris or dredged materials
B	Hydric	B	Wetland soils which may be grey in color or *gleyed*
C	Rangeland	A	Plowed A horizon and not too wet or too rocky
D	Subaqueous	C	Surface layers may have a higher pH and may be covered by biological crusts
E	Urban	D	Most likely to have anaerobic conditions and support submerged aquatic vegetation

____/ 10 points

SOIL SURVEY

Use the **Soil Map** for a portion of Southern Boardman to answer the following questions:

20) At what scale was this soil survey **mapped**? (*1 point*)
1:24,000

21) What is the **scale of the printed map**? (*1 point*)
1:38,400

22) What is the Map Unit Name of map symbol **54B**? (*1 point*)
Sagehill fine sandy loam, 2 to 5 percent slopes (slope optional)

23) Two map units do not have a soil series name. One is displayed using soil taxonomy and one is a "miscellaneous area" without any soil data associated with it. Which is which? (*2 points, one point each*)

Soil taxonomy	78 - Xeric Torriorthents, nearly level (just 78 or Xeric Torriorthents okay)
Miscellaneous area	9 - Dune land (either 9 or Dune land okay)

24) Which map unit is rated as "**not rated**" for **soil-anchored solar arrays**? *(1 point)*
9 - Dune land (either 9 or Dune land okay)

25) Name two of the five **limitations** (rating reasons) to installing soil-anchored solar arrays in this area. (*2 points, one point each*)
- Depth to thin cemented pan
- Frost action
- Steel corrosion
- Slope direction and gradient
- Slope

26) Choose one of the above limitations and explain why this limitation would prevent solar array installation. (4 *points*) Answer must include at least one of the following:
- **Depth to thin cemented pan**- cemented pan limits excavation/ solar array anchor installation
- **Frost action**- the frost action of the soil could damage the solar array anchors.
- **Steel corrosion**- the solar array anchors would corrode quickly in the soil
- **Slope direction and gradient**- the area is too steep to support soil array anchors and they area would not maximize solar production (as in north facing-slopes)
- **Slope**- the area is too steep to support soil array anchors

Two points for using a limitation from the list and two points for valid reasoning.

____/ 12 points

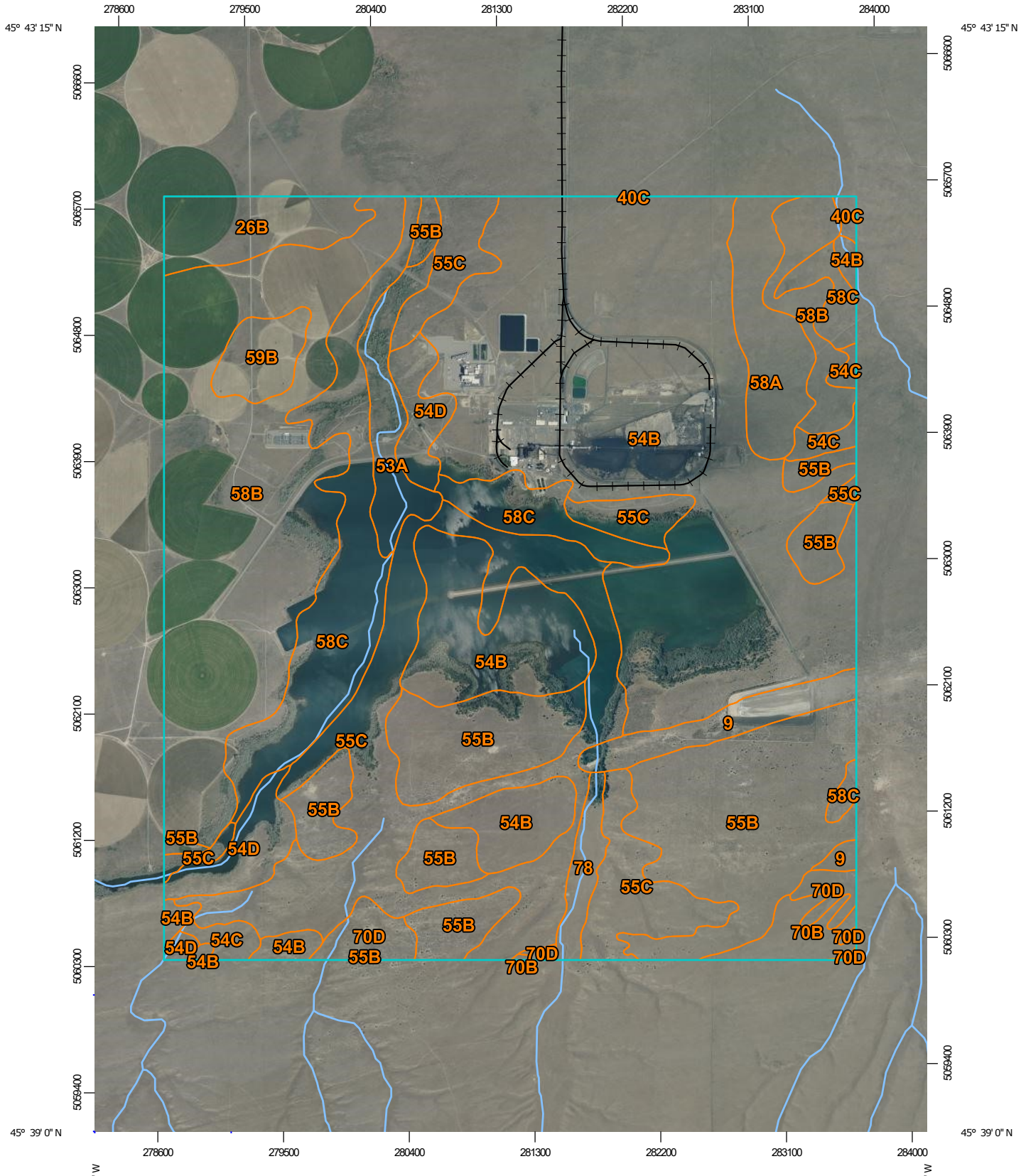
27) Which three map units are not **prime or other important farmland**? (See pages 10-12. (*3 points*)
- 9 - Dune land (either 9 or Dune land okay)
- 26B - Koehler loamy fine sand, 2 to 5 percent slopes (either 26B or Koehler okay)
- 40C - Quincy loamy fine sand, 2 to 12 percent slopes (either 40C or Quincy okay)

28) Knowing that the rest of the map units (95.9% of the map area of interest or AOI) are some kind of farmland soil, and that Boardman is a very sunny place, would you build a soil-anchored solar array here? Why or why not? (*4 points*)
IF SAY NO: Answer must include soil-anchored solar array limitations and/or the competition for use with prime and other important farmland. The reasons may be monetary, environmental, or social.
Two points for using a limitation from the list and two points for valid reasoning.

IF SAY YES: Answer must say why the soil-anchored solar array benefits outweigh the map unit limitations and competition for use with prime and other important farmland. The reasons may be monetary, environmental, or social.
Two points for discussing prime and other important farmland soils and two points for valid reasoning.

___/ 7 points

Soil Map—Morrow County Area, Oregon
(Boardman)



Map Scale: 1:38,400 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 1500 3000 6000 9000

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

Soil Survey Area: Morrow County Area, Oregon
Survey Area Data: Version 11, Sep 8, 2023

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

Date(s) aerial images were photographed: Jun 3, 2020—Jun 26, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
9	Dune land	115.3	1.7%
26B	Koehler loamy fine sand, 2 to 5 percent slopes	147.1	2.2%
40C	Quincy loamy fine sand, 2 to 12 percent slopes	10.1	0.2%
53A	Royal silt loam, 0 to 3 percent slopes	121.9	1.8%
54B	Sagehill fine sandy loam, 2 to 5 percent slopes	2,047.8	30.6%
54C	Sagehill fine sandy loam, 5 to 12 percent slopes	56.4	0.8%
54D	Sagehill fine sandy loam, 12 to 20 percent slopes	172.3	2.6%
55B	Sagehill fine sandy loam, hummocky, 2 to 5 percent slopes	939.3	14.0%
55C	Sagehill fine sandy loam, hummocky, 5 to 12 percent slopes	972.9	14.5%
58A	Taunton fine sandy loam, 0 to 2 percent slopes	173.5	2.6%
58B	Taunton fine sandy loam, 2 to 5 percent slopes	1,107.7	16.6%
58C	Taunton fine sandy loam, 5 to 12 percent slopes	532.8	8.0%
59B	Taunton fine sandy loam, hummocky, 0 to 5 percent slopes	78.8	1.2%
70B	Warden very fine sandy loam, 2 to 5 percent slopes	66.0	1.0%
70D	Warden very fine sandy loam, 12 to 20 percent slopes	89.3	1.3%
78	Xeric Torriorthents, nearly level	57.7	0.9%
Totals for Area of Interest		**6,689.3**	**100.0%**

Solar Arrays, Soil-based Anchor Systems—Morrow County Area, Oregon
(Boardman)

Solar Arrays, Soil-based Anchor Systems

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
9	Dune land	Not rated	Dune land (85%)		115.3	1.7%
26B	Koehler loamy fine sand, 2 to 5 percent slopes	Somewhat limited	Koehler (75%)	Depth to thin cemented pan (0.65)	147.1	2.2%
				Frost action (0.50)		
				Steel corrosion (0.25)		
40C	Quincy loamy fine sand, 2 to 12 percent slopes	Somewhat limited	Quincy (85%)	Steel corrosion (0.25)	10.1	0.2%
				Slope direction and gradient (0.16)		
53A	Royal silt loam, 0 to 3 percent slopes	Very limited	Royal (85%)	Frost action (1.00)	121.9	1.8%
				Steel corrosion (0.75)		
54B	Sagehill fine sandy loam, 2 to 5 percent slopes	Very limited	Sagehill (85%)	Frost action (1.00)	2,047.8	30.6%
				Steel corrosion (0.75)		
54C	Sagehill fine sandy loam, 5 to 12 percent slopes	Very limited	Sagehill (85%)	Frost action (1.00)	56.4	0.8%
				Steel corrosion (0.75)		
				Slope direction and gradient (0.57)		
				Slope (0.04)		
54D	Sagehill fine sandy loam, 12 to 20 percent slopes	Very limited	Sagehill (85%)	Frost action (1.00)	172.3	2.6%
				Slope (1.00)		
				Steel corrosion (0.75)		
				Slope direction and gradient (0.04)		
55B	Sagehill fine sandy loam, hummocky, 2 to 5 percent slopes	Very limited	Sagehill, hummocky (85%)	Frost action (1.00)	939.3	14.0%
				Steel corrosion (0.75)		

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
55C	Sagehill fine sandy loam, hummocky, 5 to 12 percent slopes	Very limited	Sagehill, hummocky (90%)	Frost action (1.00)	972.9	14.5%
				Steel corrosion (0.75)		
				Slope direction and gradient (0.57)		
				Slope (0.04)		
58A	Taunton fine sandy loam, 0 to 2 percent slopes	Somewhat limited	Taunton (85%)	Frost action (0.50)	173.5	2.6%
				Steel corrosion (0.25)		
				Depth to thin cemented pan (0.20)		
58B	Taunton fine sandy loam, 2 to 5 percent slopes	Somewhat limited	Taunton (85%)	Frost action (0.50)	1,107.7	16.6%
				Steel corrosion (0.25)		
				Depth to thin cemented pan (0.20)		
58C	Taunton fine sandy loam, 5 to 12 percent slopes	Somewhat limited	Taunton (85%)	Slope direction and gradient (0.57)	532.8	8.0%
				Frost action (0.50)		
				Steel corrosion (0.25)		
				Depth to thin cemented pan (0.20)		
				Slope (0.04)		
59B	Taunton fine sandy loam, hummocky, 0 to 5 percent slopes	Somewhat limited	Taunton, hummocky (85%)	Frost action (0.50)	78.8	1.2%
				Steel corrosion (0.25)		
				Depth to thin cemented pan (0.20)		
70B	Warden very fine sandy loam, 2 to 5 percent slopes	Very limited	Warden (85%)	Frost action (1.00)	66.0	1.0%
				Steel corrosion (0.75)		
70D	Warden very fine sandy loam, 12 to 20 percent slopes	Very limited	Warden (85%)	Frost action (1.00)	89.3	1.3%

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Slope direction and gradient (1.00)		
				Slope (1.00)		
				Steel corrosion (0.75)		
78	Xeric Torriorthents, nearly level	Not limited	Xeric Torriorthents (85%)		57.7	0.9%
Totals for Area of Interest					**6,689.3**	**100.0%**

Rating	Acres in AOI	Percent of AOI
Very limited	4,465.9	66.8%
Somewhat limited	2,050.0	30.6%
Not limited	57.7	0.9%
Null or Not Rated	115.3	1.7%
Totals for Area of Interest	**6,689.3**	**100.0%**

Description

ENG - Engineering

Ground-based Solar Arrays, Soil-penetrating Anchor Systems

Ground-based solar arrays are sets of photovoltaic panels that are not situated on a building or pole. These installations consist of a racking system that holds the panel in the desired orientation and the foundation structures that hold the racking system to the ground. Two basic methods are used to hold the systems to the ground, based on site conditions and cost. One method employs driven piles, screw augers, or concrete piers that penetrate into the soil to provide a stable foundation. The ease of installation and general site suitability of soil-penetrating anchoring systems depends on soil characteristics such as rock fragment content, soil depth, soil strength, soil corrosivity, shrink-swell tendencies, and drainage. The other basic anchoring system utilizes precast ballasted footings or ballasted trays on the soil surface to make the arrays too heavy to move. The site considerations that impact both basic systems are slope, slope aspect, wind speed, land surface shape, flooding, and ponding. Other factors that will contribute to the function of a solar power array include daily hours of sunlight and shading from hills, trees or buildings.

Soil-penetrating anchoring systems can be used where the soil conditions are not limited. Installation of these systems requires some power equipment for hauling components and either driving piles, turning helices, or boring holes to install the anchoring apparatus.

Soils can be a non-member, partial member or complete members of the set of soils that are limited for "Ground-based Solar Panel Arrays". If a soil's property within 150 cm (60 inches) of the soil surface has a membership indices greater than zero, then that soil property is limiting and the soil restrictive feature is identified. The overall interpretive rating assigned is the maximum membership indices of each soil interpretive property that comprise the "Ground-based Solar Panel Array" interpretive rule. Minor restrictive soil features are identified but not considered as part of the overall rating process. These restrictive features could be important factors where the major restrictive features are overcome through design application.

Soils are placed into interpretive rating classes per their rating indices. These are not limited (rating index = 0), somewhat limited (rating index greater than 0 and less than 1.0), or very limited (rating index = 1.0).

Numerical ratings indicate the degree of limitation. The ratings are shown in decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil has the least similarity to a good site (1.00) and the point at which the soil feature is very much like known good sites (0).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated

rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

References:

Canada, S. 2012. Corrosion impacts on steel piles. Solarpro. Solarprofessional.com.

Romanoff, Melvin. 1962. Corrosion of Steel Pilings in Soils. Journal of Research of the National Bureau of Standards. (Volume 66C, No. 3). July/September, 1962.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Prime and other Important Farmlands

This table lists the map units in the survey area that are considered important farmlands. Important farmlands consist of prime farmland, unique farmland, and farmland of statewide or local importance. This list does not constitute a recommendation for a particular land use.

In an effort to identify the extent and location of important farmlands, the Natural Resources Conservation Service, in cooperation with other interested Federal, State, and local government organizations, has inventoried land that can be used for the production of the Nation's food supply.

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. The water supply is dependable and of adequate quality. Prime farmland is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

For some of the soils identified in the table as prime farmland, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures.

A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. It has the special combination of soil quality, growing season, moisture supply, temperature, humidity, air drainage, elevation, and aspect needed for the soil to economically produce sustainable high yields of these crops when properly managed. The water supply is dependable and of adequate quality. Nearness to markets is an additional consideration. Unique farmland is not based on national criteria. It commonly is in areas where there is a special microclimate, such as the wine country in California.

In some areas, land that does not meet the criteria for prime or unique farmland is considered to be *farmland of statewide importance* for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate State agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by State law.

In some areas that are not identified as having national or statewide importance, land is considered to be *farmland of local importance* for the production of food, feed, fiber, forage, and oilseed crops. This farmland is identified by the appropriate local agencies. Farmland of local importance may include tracts of land that have been designated for agriculture by local ordinance.

Report—Prime and other Important Farmlands

Prime and other Important Farmlands–Morrow County Area, Oregon		
Map Symbol	**Map Unit Name**	**Farmland Classification**
9	Dune land	Not prime farmland
26B	Koehler loamy fine sand, 2 to 5 percent slopes	Not prime farmland
40C	Quincy loamy fine sand, 2 to 12 percent slopes	Not prime farmland
53A	Royal silt loam, 0 to 3 percent slopes	Prime farmland if irrigated
54B	Sagehill fine sandy loam, 2 to 5 percent slopes	Prime farmland if irrigated
54C	Sagehill fine sandy loam, 5 to 12 percent slopes	Farmland of statewide importance
54D	Sagehill fine sandy loam, 12 to 20 percent slopes	Farmland of statewide importance
55B	Sagehill fine sandy loam, hummocky, 2 to 5 percent slopes	Prime farmland if irrigated
55C	Sagehill fine sandy loam, hummocky, 5 to 12 percent slopes	Farmland of statewide importance
58A	Taunton fine sandy loam, 0 to 2 percent slopes	Prime farmland if irrigated
58B	Taunton fine sandy loam, 2 to 5 percent slopes	Prime farmland if irrigated
58C	Taunton fine sandy loam, 5 to 12 percent slopes	Farmland of statewide importance
59B	Taunton fine sandy loam, hummocky, 0 to 5 percent slopes	Farmland of statewide importance
70B	Warden very fine sandy loam, 2 to 5 percent slopes	Prime farmland if irrigated

Prime and other Important Farmlands–Morrow County Area, Oregon		
Map Symbol	**Map Unit Name**	**Farmland Classification**
70D	Warden very fine sandy loam, 12 to 20 percent slopes	Farmland of statewide importance
78	Xeric Torriorthents, nearly level	Farmland of statewide importance

Data Source Information

Soil Survey Area: Morrow County Area, Oregon
Survey Area Data: Version 11, Sep 8, 2023