EXHIBIT I
SOILS
OAR 345-021-0010(1)(i)

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OAR 345-021-0010(1)(i) *Information from reasonably available sources regarding soil conditions and uses in the analysis area, providing evidence to support findings by the Council as required by OAR 345-022-0022, including:*

Response: The evidence provided in this Exhibit demonstrates that the requirements specified in OAR 345-022-0022 have been met, because the Madras Solar Energy Facility (Facility) is not expected to result in significant adverse impacts to soils. The potential impacts from erosion are anticipated to be minimal and will occur primarily during construction. The impacts are addressed through erosion-control measures required by the 1200-C Construction Stormwater National Pollution Discharge Elimination System (NPDES) Permit. A 1200-C permit application is included as Attachment I-1 to this Exhibit. The application has been independently submitted to the Oregon Department of Environmental Quality (DEQ) under separate cover. Madras PV1, LLC (Applicant) anticipates a permit decision from DEQ before the start of Facility construction. Attachment I-2 in Exhibit I contains a response from DEQ deeming the application complete. DEQ states in the attached response letter that a permit will be issued within 30 days of receiving the site certificate from ODOE following review of the final ESCP.

I.1 IDENTIFICATION AND DESCRIPTION OF SOIL TYPES

OAR 345-021-0010(1)(i)(A) *Identification and description of the major soil types in the analysis area.*

I.1.1 Overview

Response: The near-surface soils at the Facility site and vicinity were identified according to the Natural Resources Conservation Service (NRCS) web-based soil survey (NRCS, 2019) and Myhrum and Ferry (2002). The NRCS database includes the physical and chemical properties of the soils in the vicinity and also the soil map unit distribution. In addition, Cascade Earth Sciences (CES) prepared a site-specific soil survey for the area within the Facility site boundary with the goal of refining and revising the NRCS soil classifications at the site (CES, 2018). The CES report is included as Attachment I-3 to this Exhibit.

The soil-related criteria for siting a solar facility are contained in OAR 660-033. The policy favors siting solar facilities on “nonarable” land, which OAR 660-033-0020 defines to predominantly comprise nonarable soils. Nonarable soils are defined in the OAR as all soils in land capability classes V through VIII, with no history of irrigation. Therefore, the CES (2018) report focused on the Land Capability Classification, and whether the site soils are predominantly arable versus nonarable.

The Facility components such as roads, substation, and arrays of photovoltaic cells will be constructed on the flat, upland portion of the site. No structures or Facility components will be situated on the steep slopes that surround the site. Thus, the soils that underlie the flat upland areas are more likely to be impacted.

The following section contains detailed descriptions of the major soil units that underlie the proposed Facility features and are most likely to be impacted. Figure I-1 contains a soils map adapted from Figure 4 of the CES report to show the Facility site boundary and the major soil units within and outside of the site boundary.

I.1.2 Jefferson County Soil Survey Area

According to the NRCS, the predominant soils on the flat portion of the site within the Facility site boundary are mapped as described below.

Map Units 87A and 87B: Madras loam, 0 to 3 percent slopes (Unit 87A) and 3 to 8 percent slopes (Unit 87B). Madras soils typically are moderately deep, well-drained, and formed in loess over volcaniclastic sediment of the Deschutes Formation on lava plains and hills.

A typical profile for the Madras series consists of:

- 0 to 10 inches: loam
- 10 to 16 inches: loam
- 16 to 23 inches: clay loam
- 23 to 27 inches: weathered bedrock
- 27 to 37 inches: unweathered bedrock

Map Units 30A and 30B: According to the Soil Survey of the Upper Deschutes (NRCS, 2019), the Cullius loam soils are included within the Madras loam. Cullius soils consist of shallow (10 to 20 inches to bedrock), well-drained, slow permeability soils that formed in loess overlying colluvium on lava plains. Slopes range from 0 to 15 percent.

A typical profile for the Cullius series consists of:

- 0 to 6 inches—grayish brown loam
- 6 to 9 inches—grayish brown clay loam
- 9 to 17 inches—grayish brown clay
- 17 to 18 inches—weathered, fractured tuff
- 18 inches—welded tuff of the Deschutes Formation

The Cullius series soils are included in the Madras soils mapped unit. The Cullius soils are similar to the Madras soils, where they both occur on lava plains, have similar texture, and support the same vegetation. The primary differentiator between the two is that Cullius soils are Class VI (nonarable) soils that are *less than* 20 inches deep, whereas the Madras soils are Class IV soils that are *more than* 20 inches deep. According to mapping revisions by CES (2018), the predominant soils on site (approximately 55 percent) are considered the Cullius series, because of a depth of less than 20 inches to bedrock. Approximately 45 percent of the site is underlain by Madras soils.

The side slopes that surround the site are underlain by Map Unit 119D, Simas-Ruckles complex, 15 to 40 percent slopes, and Map unit 120F and 121F, Simas-Ruckles complex, 40 to 80 percent slopes. These map units consist of shallow to very deep, well-drained soils formed in colluvium on toe-slopes and mid-slopes. These soils will not be disturbed by construction or operation of the Facility, and therefore are not discussed in further detail.

Table I-1 summarizes the physical properties and some of the potential limitations of the predominant onsite soils. An assessment of Facility impacts on soils during construction is included in Section I.3.

Table I-1. Physical Properties of Predominant Onsite Soils within the Facility Site Boundary

Soil Series/ Map Unit	USDA Soil Texture/ Description	Percentage of SIte	Slopes (percent)	Depth (inches)	Soil Erodibility Factor (K)	Wind Erodibility Group	Shrink-Swell Potential
Madras	Loam to Clay Loam	45	0 - 8	>20	0.37	6	0.32 (Low)
Cullius	Loam to Clay Loam	55	0 - 8	<20	0.37	6	0.32 (Low)

I.2 IDENTIFICATION AND DESCRIPTION OF LAND USES

OAR 345-021-0010(1)(i)(B) *Identification and description of current land uses in the analysis area, such as growing crops, that require or depend on productive soils.*

Response: The entirety of the Facility site boundary is on land zoned as Exclusive Farm Use (A-1) within Jefferson County, Oregon. Based on the CES (2018) report, the landowner indicated that the land within the Facility site boundary was at one time cultivated for dryland crops. The last attempt at cultivation was more than 30 years ago (about 1987), according to the landowner. The Facility site does not have any water rights and there is no realistic potential for water rights in the future. The site, therefore, has no history of irrigation.

I.3 IDENTIFICATION AND ASSESSMENT OF IMPACTS ON SOILS

OAR 345-021-0010(1)(i)(C) *Identification and assessment of significant potential adverse impact to soils from construction, operation and retirement of the facility, including, but not limited to, erosion and chemical factors such as salt deposition from cooling towers, land application of liquid effluent, and chemical spills.*

Response: As listed in Table C-1 of Exhibit C, construction of the Facility will result in a total disturbance of approximately 2 acres. The Facility will permanently disturb approximately

270 acres and unavoidable impacts to soils will result during operations from the footprint of structures and components. Temporarily disturbed acres will be restored following construction, and the permanently disturbed acres will be restored following retirement.

The following section discuss potential water and wind erosion impacts to site soil, and the limitations posed by the soils related to Facility construction, operation, and retirement activities, hazardous materials, and other soil limitations such as frost action and shrink-swell.

I.3.1 Water Erosion Impacts

The rate and magnitude of soil erosion by water are controlled by rainfall intensity and runoff, soil erodibility, and vegetation cover. The erosion factor (K) indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Revised Universal Soil Loss Equation to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter, soil structure, and saturated hydraulic conductivity. Overall, values of K range from 0.02 to 0.69, with the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Data from the NRCS (NRCS, 2019) indicate that the predominant soils within the Facility site boundary, the Madras and Cullius loam, have an erodibility rating of 0.37, which indicates moderate water erosion potential.

I.3.2 Wind Erosion Impacts

Wind can be a serious environmental and economic concern. It can cause soil erosion and crop damage. The soils within the Facility site boundary could be subject to wind erosion, particularly when the vegetation is removed. Wind Erodibility Groups (WEGs) consist of soils that have similar properties (primarily textural classes) that affect their resistance to soil blowing if cultivated or disturbed. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. WEGs range from 1 to 8, where 1 is the most susceptible and 8 is the least susceptible to wind erosion. The Madras and Cullius loam soils are assigned to a WEG of 6, which means these soils are expected to have moderate to high wind erosion potential.

The wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. The Madras loam is rated as potential to lose 47 tons per acre.

Soil data indicate that the potential for water and wind erosion potential within the Facility site boundary is generally moderate to high. Because of steady, relatively high wind speeds, and brief but intense rainfall events, areas of vegetation removal could potentially expose soils to accelerated water and wind erosion during construction until they are stabilized. Excavations for foundations, roads, and trenches could also temporarily expose the excavated spoils to wind and water erosion during construction. Mitigation measures to account for the high wind erosion potential (Fugitive Dust Abatement) are described in Section I.4.

I.3.3 Construction Impacts

Facility construction will require aggregate and construction of new or improved access roads and surfacing. If a temporary concrete batch plant is needed for construction, it will be located within the Facility site boundary. The batch plant may be used for aggregate storage and concrete preparation for foundations. Any rock for construction purposes will be obtained from existing permitted quarries. Associated rock-crushing activities may occur at the quarry as needed, before transporting material to the temporary batch plant. Operation of the batch plant will meet applicable local and state ordinances and codes.

Vegetation will be removed and soils will be disturbed during clearing for roads, foundations, substation, and buried cables. Because the construction of roads, foundations, and other Facility components will be engineered, these components are subject to the requirements of a NPDES stormwater construction permit and other pertinent construction and operation permits and pollution controls. In accordance with these regulations, the Applicant will implement an erosion and sediment control plan and erosion-control best management practices (BMPs) during Facility construction and operation. Attachment I-1 contains the NPDES permit application.

Construction will require the use of heavy equipment and haul trucks to deliver aggregates, concrete, water, and similar construction supplies. The repeated traffic of heavy machinery could cause localized soil compaction, which could result in temporary loss of agricultural productivity where the trucks are forced to leave existing access roads. However, because the soils on the site are considered "nonarable" and opportunity for agricultural productivity is minimal, the loss of this land for agricultural purposes is considered negligible.

I.3.4 Operations Impacts

Facility operations will not have the potential to increase soil erosion. General Facility operations will be constrained to the access and service roads. Therefore, no ground disturbance is anticipated to occur during Facility operations. Depending on the effects of solar module dust and dirt on energy production (referred to as soiling), the solar modules will be washed. For the purpose of this analysis, it is conservatively assumed that they will be washed twice a year and require 1,650,000 million gallons per year. Washwater will be discharged by evaporation and seepage into the ground using BMPs and will be covered under an Oregon General Water Pollution Control Facilities Permit, WPCF-1700-B, Washwater Discharge from Equipment Cleaning.

I.3.5 Retirement Impacts

During retirement, potential erosion hazards will be similar to those occurring during construction. Soil will be exposed to accelerated soil erosion because of the lack of vegetation during the removal of solar arrays, underground cables, and roadways. Mitigation measures employed will be similar to those during construction.

I.3.6 Hazardous Material Impacts

No significant impacts are expected to occur from chemical factors during construction, operation, or retirement. Only minimal amounts of chemicals, such as lubricating oils and cleaners for various mechanical and electrical equipment as well as pesticides for weed control, will be used at the Facility site. Chemicals will be stored according to applicable requirements and regulations to limit the risk of adverse effects related to chemical factors. The risk of a chemical spill is negligible and the impacts of any such spill would be limited, because of the small amounts of chemicals that will be transported to the Facility site. Exhibit G provides a discussion of precautions to be taken in handling hazardous materials, such as lubricating oils, and the measures to be taken in the event of a spill.

I.3.7 Other Soil Limitations

Frost Action: Frost action refers to freezing and thawing of soil moisture. Frost action can damage roads, buildings, and other structures. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. The Madras series soils are rated "moderate" for frost action potential. Therefore, to avoid damage from frost action these soils could potentially require mitigation measures (discussed below).

Shrink-Swell: Changes in soil moisture cause certain clay minerals in soils to either expand or contract. The amount and type of clay minerals in the soil influence the change in volume. Structures or roads built on shrinking or swelling soils could be damaged by the change in volume of the soil. Linear extensibility (shrink-swell potential) refers to the change in length of an unconfined clod as its moisture content is decreased from a moist state to a dry state. The volume change is reported as percent change for the soil. The Madras and Cullius series soils on the site have a low shrink-swell potential. Therefore, shrinking and swelling of these soils are not expected to impact the Facility.

Shallow Rock: The site-specific soils survey conducted (CES, 2018) indicated that the Cullius and Madras soils that underlie the Facility range in thickness between 8 and 40 inches. The Cullius are distinguished by being less than 20 inches thick, and the Madras soils are between 20 and 40 inches thick. Therefore, shallow basalt rock is expected to be present throughout the Facility.

Each tracker table will be bolted to steel posts driven into the ground to serve as the foundation. The post depths will vary depending on soil conditions, which will be confirmed via a detailed geotechnical investigation, but are typically driven to a depth of at least 8 feet below the surface.

A ballasted design may be used in portions of the site featuring shallow rock. This design involves mounting the tracker tables on foundations embedded in concrete blocks (ballasts) that would rest on the surface of the ground rather than on posts driven into the ground.

At the Facility substation, the voltage will again be stepped up to 230 kilovolts for delivery via direct buried cables. Other electrical cables within arrays will be buried to a depth of approximately 3 feet. The collector lines will be directly buried at a depth of approximately 3 feet; however, some portion of the conductors may also be above ground.

Exact collector line routing within the Facility site boundary is still being decided. Detailed subsurface information obtained using the existing soil pits or conducting Geoprobe borings will help facilitate final layout of the cables, along with an evaluation of locations of shallow rock where rock excavation may be required. Where the cables will be buried in basalt rock, rock excavation will be required. This could include constructing the trenches via ripping, excavating with a hydraulic hammer, rock saw mounting on a D-8, or blasting.

Corrosion: Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. Steel that intersects multiple soil boundaries or soil layers is more susceptible to corrosion than the steel entirely within one kind of soil or within one soil layer. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. The Madras and Cullius soils are both rated as “low” for corrosion potential of both steel and concrete. Therefore, the proposed steel post foundations and also concrete ballast block are not considered as risk of corrosion.

I.4 DESCRIPTION OF PROPOSED MITIGATION MEASURES

OAR 345-021-0010(1)(i)(D) *A description of any measures the applicant proposes to avoid or mitigate adverse impact to soils.*

Response: Direct permanent impacts to soils will occur as a result of Facility construction. Although permanent impacts are unavoidable, they will be minimized whenever possible. Reclamation measures will be implemented to restore the temporarily disturbed near-surface soils at the Facility. Construction of access roads, foundations, and other facilities will be regulated by an erosion and sediment control plan and a 1200-C Construction Stormwater NPDES Permit (see Attachment I-1) that will require BMPs to minimize possible impacts from erosion or other impacts to soils.

A summary of the BMPs provided in Attachment I-1 along with additional proposed mitigation measures is provided below. The mitigation measures will be implemented to minimize or avoid adverse impacts to soils during construction of the Facility and access roads. The measures may be upgraded or modified as needed to comply with applicable local, state, and federal erosion and sediment control regulations; as well as local site conditions. The mitigation measures are as follows:

- **Clearing and Grading:** To the maximum extent practicable, clearing and grading will be phased to prevent exposed inactive areas from becoming a source of erosion. As grading progresses, temporary or permanent soil stabilization measures will be applied immediately on disturbed areas and for all roadways, including gravel roadways. Construction activities will avoid or minimize excavation and creation of bare ground during wet weather.
- **Existing Vegetation:** To the extent practicable, existing vegetation will be preserved and open areas will be revegetated or placed with stable ground cover. When practicable, open areas will be revegetated or stabilized before and after grading or construction. Erosion and sediment control and perimeter sediment control measures will be in place before vegetation is disturbed and will remain in place and be maintained, repaired, and promptly implemented for the duration of construction.
- **Soil Stockpiles:** At the end of each workday, soil stockpiles will be stabilized or covered, or other BMPs will be implemented to prevent discharges to surface waters or conveyance systems leading to surface waters.

- **Silt Fencing:** Silt fencing will be installed at various locations throughout the Facility and will be used as perimeter control. The fencing will be installed around the perimeter of material stockpiles and the perimeter of construction laydown areas. The silt fencing and other erosion-control measures will remain in place until the disturbed areas are permanently stabilized and the risk of erosion has been eliminated. Additional details regarding silt fencing construction and placement are provided in the 1200-C Construction Stormwater NPDES Permit (see Attachment I-1).
- **Fiber Rolls:** Fiber rolls may be installed to decrease the velocity of stormwater sheet flow. The rolls will be used along the downgradient edge of access roads adjacent to slopes or sensitive areas. Additional details regarding fiber roll construction and placement are provided in the 1200-C Construction Stormwater NPDES Permit (see Attachment I-1).
- **Temporary Stabilization (Mulching, Matting, Soil Binders, and Tackifiers):** These measures may be used for stabilization and during reseeding and revegetation of disturbed areas.
- **Stabilized Construction Entrance/Exit:** A stabilized construction entrance and exit will be installed at locations where soil (exposed, disturbed land) or newly constructed roads intersect existing paved roads.
- **Revegetation:** At the completion of land-disturbing activities, the site will be revegetated with an approved seed mix as necessary consistent with the Facility's *Revegetation Plan* and *Noxious Weed Plan* (see respective Attachments P-6 and P-7 to Exhibit P). The seed will be applied with mulch to protect the seeds as the grass establishes. Scarifying and reseeding of affected areas will occur after construction has been completed.
- **Pollutant Management:** Material, waste storage areas, and other nonstormwater controls will be established. During construction, source-control measures will be implemented to reduce the potential of chemical pollution to surface water or groundwater during construction. Chemical pollution could occur from a release of diesel fuel or lubricating oils, or from improper debris and waste handling. As described in Section G.2 of Exhibit G, fuels and oils will be stored in the temporary construction staging area, and onsite fueling will occur only in this area. The handling, storage, and disposal of materials will be consistent with federal, state, and local ordinances, and in a manner that will not cause stormwater contamination.
- **Haul Truck Traffic:** Before land-disturbing activities begin, BMPs will be in place to prevent the tracking of sediment onto public or private roads such as using graveled (or paved) exits (see Stabilized Construction Entrance/Exit) and parking areas, placing gravel on unpaved roads onsite, or using an exit tire wash. Haul truck traffic will be limited to improved access roads and gravel-covered haul roads, limiting deep soil compaction and disturbance. The loads of the haul trucks and heavy equipment, and the resulting induced stress, will be distributed through the gravelly surfacing material, minimizing compaction of the native soils to an anticipated 6 inches or less. Mitigation efforts to reduce impacts from soil compaction will include scarifying and reseeding affected areas after construction is completed.
- **Geotechnical Investigation and Design:** Soil hazards that could impact facilities include primarily shrinking and swelling of fine-grained soils, and frost action. Therefore, during the design phase of the Facility, a geotechnical investigation and testing program will be conducted to evaluate the engineering properties of the soils. The foundation types and pavement thickness for roads will be designed based on engineering properties of the soils and underlying bedrock.
- **Frost Action:** Mitigation for frost action in surficial soils will be addressed by soil improvements, over-excavation down to rock for foundation constructions or post-in-rock foundations, replacement by nonfrost-susceptible soils, and drainage. Other geologic and seismic hazards are discussed and addressed in Exhibit H.
- **Fugitive Dust Abatement:** BMPs will be used to control fugitive dust in accordance with DEQ regulations. Water, soil-binding agents, or other dust control techniques will be implemented as needed to avoid wind-blown soil. For example, the Facility will minimize temporary and permanent impacts from fugitive dust by using measures that include applying water to disturbed ground and roads during construction, imposing appropriate construction

and operation speed limits on site roads, graveling or paving permanent roadways, revegetation after construction, covering temporary stockpiles with fabric or other materials, using chemical dust suppressants and flocculating agents, minimizing the disrupted surface area, and rescheduling work around especially windy days.

- **Facility Retirement:** Retirement requirements will include strict implementation of erosion-control measures when soil is exposed to prevent erosion. In addition to revegetation requirements, erosion-control measures will include the use of silt fences, mulching, check dams, or other similar methods.

I.5 MONITORING PROGRAM

OAR 345-021-0010(1)(i)(E) *The applicant's proposed monitoring program, if any, for adverse impact to soils during construction and operation.*

Response: Erosion and sediment control measures will be inspected and maintained regularly as detailed in the erosion and sediment control plan and 1200-C Construction Stormwater NPDES Permit (see Attachment I-1 for NPDES permit application). The inspections will verify that the structural BMPs described in the plan are in good condition and are minimizing erosion. The inspections will also verify that the procedures used to prevent stormwater contamination from construction materials and petroleum products are effective.

As outlined in the erosion and sediment control plan, the following inspection and maintenance practices will be used to maintain erosion and sediment controls:

- The stabilized construction entrance will be inspected for sediment tracked on the road. Traffic will be directed to use the stabilized entrance when leaving the site.
- Sediment barrier fences (silt fences) will be inspected, and accumulated sediments will be removed when they reach one-third the height of the silt fence. Any areas that develop rills or washouts along the silt fence will be repaired and reanchored to avoid concentrated flows.
- A maintenance inspection report that details corrective actions will be made after each inspection.
- An employee-training program will be developed and implemented to educate employees about the requirements of the erosion and sediment control plan.

I.6 SUMMARY

The evidence presented in this Exhibit demonstrates that Facility construction, operation, and retirement will not cause significant adverse impacts to soils. Construction of roads, photovoltaic arrays, and other Facility components will be regulated by an erosion and sediment control plan and a 1200-C Construction Stormwater NPDES Permit that will require BMPs to minimize possible impacts to soils from wind and water erosion. Implementation of the mitigation measures described in this Exhibit will further minimize that potential. In addition, the rigorous reclamation measures described in this Exhibit will be instituted to restore the temporarily disturbed, near-surface soils at the Facility. On the basis of this evidence, the Energy Facility Siting Council may find that the design, construction, operation, and retirement of the Facility will not likely result in significant adverse impacts to soils.

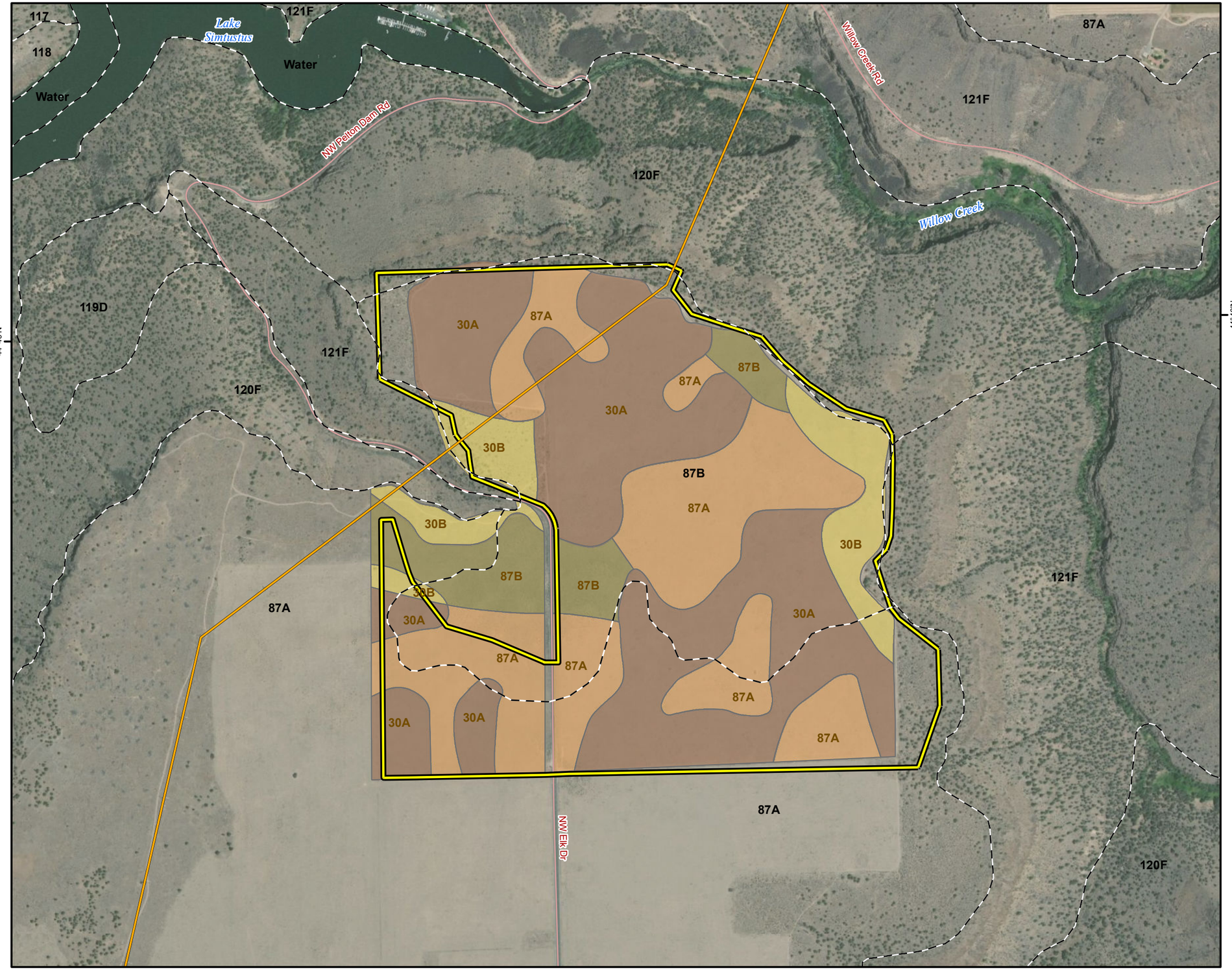
I.7 REFERENCES

Cascade Earth Sciences (CES). 2018. *Site-Specific Soil Survey of Property Located along Elk Drive, also known as T10S, R13E, Section 30, Tax Lot 600 (161.47 acres) and Section 31, Tax Lot 100 (317.98 acres), West of Madras in Jefferson County, Oregon*. Prepared for Ecoplexus, Inc. September.

Myhrum, R., and W. Ferry. 2002. *Soil Survey of Upper Deschutes River Area, Oregon, including parts of Deschutes, Jefferson, and Klamath Counties*. Natural Resources Conservation Service, in cooperation with United States Department of Agriculture, Forest Service; United States Department of the Interior, Bureau of Land Management; and Oregon Agricultural Experiment Station.

Natural Resources Conservation Service (NRCS). 2019. *Web Soil Survey*. United States Department of Agriculture NRCS, Lincoln, Nebraska. Last modified April 9, 2019. Accessed July 25, 2019. https://websoilsurvey.sc.egov.usda.gov/.

Figure



VICINITY MAP

LEGEND

- Madras Solar Energy Facility Site Boundary
- Existing Pelton Dam to Round Butte 230-kV Transmission Line
- Existing Road
- NRCS Soil Map Unit Boundary*

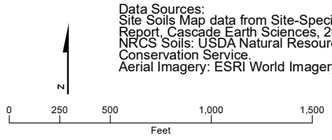
Site Soil Map

- 30A: Cullius loam, 0 to 3 percent slopes
- 30B: Cullius loam, 3 to 8 percent slopes
- 87A: Madras loam, 0 to 3 percent slopes
- 87B: Madras loam, 3 to 8 percent slopes

*NRCS Soil Map Unit Names
117: Ruckles-Simas complex, 40 to 80 percent slopes
118: Ruckles-Simas-Rock outcrop complex, 40 to 80 percent slopes
119D: Simas-Ruckles complex, 15 to 40 percent south slopes
120F: Simas-Ruckles-Rock outcrop complex, 40 to 80 percent north slopes
121F: Simas-Ruckles-Rock outcrop complex, 40 to 80 percent south slopes

Coordinate System: NAD 1983 UTM Zone 10N

Data Sources:
Site Soils Map data from Site-Specific Soil Survey Report, Cascade Earth Sciences, 2018.
NRCS Soils: USDA Natural Resources Conservation Service.
Aerial Imagery: ESRI World Imagery



1 inch equals 750 feet

Figure I-1
Soils Map
Application for Site Certificate
Madras Solar Energy Facility
Jefferson County, OR

JACOBS

Attachment I-1
1200-C Construction Stormwater NPDES Permit Application with Erosion and Sediment Control Plan

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY

APPLICATION FOR NEW NPDES GENERAL PERMIT 1200-C

Instructions for Completion of 1200-C Construction Stormwater Application: For stormwater discharges to surface waters from construction activities, disturbing one acre or more that do not meet automatic coverage requirements (see page 3 for additional information).

A. PROJECT INFORMATION

1. Enter the legal name of the applicant. This must be the legal Oregon name (i.e., Acme Products, Inc.) or the legal representative of the company if it operates under an assumed business name (i.e., John Smith, dba Acme Products). The name must be a legal, active name registered with the Oregon Department of Commerce, Corporation Division (503) 378-4752, (http://egov.sos.state.or.us/br/pkg_web_name_srch_inq.login), unless otherwise exempted by their regulations. The permit will be issued to the legal name of the applicant.
    - Permit coverage may be transferred from one party to another. For example, a developer may apply for a permit and then transfer the permit to a contractor. Transfer forms: http://www.oregon.gov/deq/wq/wqpermits/Pages/Forms.aspx
2. Provide invoice contact information for billing of DEQ annual permit fee if different from the applicant in #1 above. This is the person or entity legally responsible for payment of the annual fee invoice. This must be the same company as the applicant. not a third party independent of the applicant.
3. Provide contact information for the Architect or Consulting Engineer who designed the Erosion and Sediment Control Plan (ESCP) and Dewatering Plan, if applicable.
4. Provide information on the Erosion and Sediment Control Inspector. This is not a DEQ or DEQ Agent inspector; this is an inspector employed by the applicant. As of January 1, 2017, for project 5 acres or more include inspectors' qualification program, certification number and expiration date.
5. Provide the common name of the project (for example, the name of the subdivision), the location of the site, and, if available, a street address.
6. Check the box that best describes the nature of the construction activity. If "other" is selected, describe the use and include a Standard Industrial Classification Code (visit http://www.osha.gov/pls/imis/sicsearch.html for codes). For projects that have submitted a joint permit application, please provide the US Army Corps of Engineers assigned number.
7. Enter latitude and longitude for the approximate center of the site, to the nearest 15 seconds. Latitude and longitude can be obtained from DEQ's location finder web site at http://deqapp1/website/lit/data.asp. To get the longitude and latitude to appear you can also zoom in and re-center until you find the area. You may want to turn off DEQ interests to eliminate the yellow dots and you may want to turn on the Aerial Photos to help you locate the site (note that the aerial photos are over ten years old). The latitude and longitude will be indicated on the left side of the page once you have checked the locate place at the top of the page and clicked on a location.
8. If known, specify approximate start date. Provide information on the project size as indicated (based on the total project and not just a single phase).
9. For projects that anticipate dewatering or the need for active treatment system, additional details of BMPs and an operation and maintenance plan is required. This includes a plan review fee (Table 70H) for treatment of contaminants beyond sediment. Fee table
10. Indicate the name(s) of the receiving water(s) (i.e., indicate where stormwater runoff during construction will flow). Request information from local authority or other resource to determine the name of the receiving waterbody. Your receiving water may be a lake, stream, river, wetland or other waterbody, and may or may not be located adjacent to the site. Your stormwater may discharge directly to the receiving water or indirectly via a storm sewer system, an open drain or ditch, or other conveyance structure. Do NOT list a man-made conveyance, such as a storm sewer system, as your receiving water. If you discharge to an irrigation channel or ditch you must also indicate the owner or operator of the irrigation channel or ditch. Indicate the first natural receiving water your stormwater discharge enters.

    For example, if your discharge enters a storm sewer system, that empties into Trout Creek, which flows into Pine River, your receiving water is Trout Creek, because it is the first natural waterbody your discharge will reach. Similarly, a discharge into a ditch that feeds Spring Creek should be identified as "Spring Creek" since the ditch is a manmade conveyance. If you discharge into a municipal separate storm sewer system (MS4), you must identify the waterbody into which that portion of the storm sewer discharges. That information should be readily available from the operator of the MS4.

11. Indicate whether stormwater runoff during construction will discharge directly to or through a storm sewer or drainage system that discharges to a Total Maximum Daily Load (TMDL) **or** 303(d) listed waterbody for turbidity or sedimentation. To make this determination, the following tools are available on DEQ's website:
    - WQ Assessment page: http://www.deq.state.or.us/wq/assessment/rpt2012/search.asp to use scroll down to search criteria: waterbody and listing status Category 5 (303d) and Category 4a (TMDL approved).

B. SIGNATURE OF LEGALLY AUTHORIZED REPRESENTATIVE

DEFINITION OF LEGALLY AUTHORIZED REPRESENTATIVE:

Please also provide the information requested in brackets *[ ]*

- **Corporation** - president, secretary, treasurer, vice-president, or any person who performs principal business functions; or a manager of one or more facilities that is authorized in accordance to corporate procedure to sign such documents.
- **Partnership** - General partner *[list of general partners, their addresses, and telephone numbers]*.
- **Sole Proprietorship** - Owner(s) *[each owner must sign the application]*.
- **City, County, State, Federal, or other Public Facility** - Principal executive officer or ranking elected official.
- **Limited Liability Company** - Member *[articles of organization]*.
- **Trusts –** Acting trustee *[list of trustees, their addresses, and telephone numbers]*.

(please see 40 CFR §122.22 for more detail, if needed)

APPLICATION AND FEE SUBMITTAL

To authorize permit registration, the following must be completed and submitted to the appropriate DEQ regional office or DEQ Agent

- ☐ DEQ application form signed by the Legally Authorized Representative and meeting the signature requirements above.
- ■ DEQ LUCS and associated Findings.
- ■ Stormwater Erosion and Sediment Control Plan Narrative, if applicable.
- ☐ Dewatering and/or Treatment Plan, if applicable.
- ■ Stormwater Erosion and Sediment Control Plan Drawings; full-sized hard copy and electronic file.
- ☐ Applicable permit fee. Appropriate fees are available at http://www.oregon.gov/deq/Rulemaking%20Docs/340-045-0075WQFeeTables.pdf. All stormwater permits charge an application fee and an annual fee upon registration. DEQ will invoice the annual fee amount if your project coverage extends more than a year. **Please note:** if submitting a dewatering or active treatment O&M Plan to address contaminants beyond sediment, a disposal system plan review fee may be charged as indicated in Table 70H.

APPLICATION AND FEE SUBMITTAL

Submit this application, Narrative Parts I, II & III (if applicable), LUCS, Erosion and Sediment Control Plan (full-sized hard copies and electronic copy), Dewatering and/or Treatment Plan and the applicable fee to the appropriate DEQ regional office or DEQ Agent listed below. Contact the appropriate DEQ regional office or DEQ Agent for the best way to submit the electronic version of the ESCP.

AGENTS AND REGIONAL OFFICES CONTACTS

City of Eugene 99 W. 10th Avenue Eugene, OR 97401 541-682-2706	**City of Hermiston** 215 Gladys Avenue Hermiston, OR 97838 541-667-5025	**City of Troutdale** 342 SW 4th Street Troutdale, OR 97060 503-674-3300
Clean Water Services 2550 SW Hillsboro Highway Hillsboro, OR 97123 503-681-5101 *Includes Banks, Beaverton, Cornelius, Durham, Forest Grove, Gaston, Hillsboro, King City, North Plains, Sherwood, Tigard, Tualatin, and portions of Washington Co.*		**Rogue Valley Sewer Services** 138 West Vilas Road, PO Box 3130 Central Point, OR 97502 541-664-6300

DEQ Northwest Region	DEQ Western Region		DEQ Eastern Region		
700 Lloyd Building at 700 NE Multnomah St., Suite #600, Portland, OR 97232 503-229-5263 or 1-800-452-4011	165 East 7th Avenue, Suite 100 Eugene, OR 97401 541-686-7930 or 1-800-844-8467		800 SE Emigrant Avenue, Suite 330 Pendleton, OR 97801 541-278-4605 or 1-800-304-3513		
Clackamas	Benton	Lane	Baker	Hood River	Sherman
Clatsop	Coos	Lincoln	Crook	Jefferson	Umatilla
Columbia	Curry	Linn	Deschutes	Klamath	Union
Multnomah	Douglas	Marion	Gilliam	Lake	Wallowa
Tillamook	Jackson	Polk	Grant	Malheur	Wasco
Washington	Josephine	Yamhill	Harney	Marrow	Wheeler

DEQ USE ONLY

File #:

Application #:

LLID/RM:

River Mile:

Legal Name Confirmed: ☐

Notes:

State of Oregon Department of Environmental Quality

DEPARTMENT Of ENVIRONMENTAL QUALITY

APPLICATION FOR NEW NPDES GENERAL PERMIT 1200-C

For stormwater discharges to surface waters from construction activities disturbing one acre or more that do not meet automatic coverage requirements.*

DEQ USE ONLY

Date Received:

Amount: $

Check #:

Check Name:

Deposit #:

Receipt #:

Notes:

*A project *may* be eligible for "automatic coverage" under NPDES general permit 1200-CN if stormwater *does not* discharge to a waterbody with a TMDL or 303(d) listing for sediment or turbidity *and* it meets one of the following criteria (see 1200-CN at http://www.oregon.gov/deq/FilterPermitsDocs/1200cnPermit.pdf:

1) Disturbs less than one acre and is located in Gresham, Troutdale, or Wood Village.
2) Disturbs less than five acres and is located in Albany, Corvallis, Eugene, Milwaukie, Multnomah Co. (unincorporated areas), Springfield, West Linn, or Wilsonville.
3) Disturbs less than five acres and is within the jurisdictions of Clackamas Co. Water Environment Services [Gladstone, areas within Clackamas Co. Service Dist. #1 (excluding Happy Valley), and areas within the Surface Water Management Agency of Clackamas Co. (including Rivergrove)], Clean Water Services (Banks, Beaverton, Cornelius, Durham, Forest Grove, Hillsboro, King City, North Plains, Sherwood, Tigard, Tualatin, and Washington Co. within Urban Growth Boundary), or Rogue Valley Sewer Services.

A. PROJECT INFORMATION

1. Madras PV1, LLC
Applicant (entity legally responsible for permit)

Jon Bortle
Contact Name (if different from applicant)

101 Second Street, Suite 1250
Address

San Francisco | CA | 94105
City | State | Zip

928-699-2090 | jbortle@ecoplexus.com
Telephone | E-Mail Address

2. Invoicing information (person or entity legally responsible for payment of annual fee invoice; not a third party independent of the applicant)

Nathan Rogers
Invoice Contact Name (if different from applicant)

101 Second Street, Suite 1250
Address

San Francisco | CA | 94105
City | State | Zip

415-745-0541 | nrogers@ecoplexus.com
Telephone | E-Mail Address

3. Jacobs
Architect/Engineering Firm (Erosion & Sediment Control Plan)

Paul Seilo
Project Manager

503-736-4012 | paul.seilo@jacobs.com
Telephone | E-Mail Address

4. Shannon Bartow
Applicant's Designated Erosion and Sediment Control Inspector

Jacobs
Company Name

503-872-4813 | shannon.bartow@jacobs.com
Telephone | E-Mail Address

ECO-3 Erosion and Sediment Control Inspector, ECO-3-6291807 exp 6/29/2021
Qualification program, certification number and expiration date

5. Madras Solar Energy Facility
Name of Project

NW Elk Dr and NW Pelton Dam Rd
Address or Cross Street

City	State	Zip
	OR	97741

Jefferson
County

6. Nature of Construction Activity
- ☐ Single Family (SIC Code 1521)
- ☐ Multi-Family Residential (SIC Code 1522)
- ☐ Commercial (SIC Code 1542)
- ☐ Industrial (SIC Code 1541)
- ☐ Highway (SIC Code 1611)
- ☐ Restoration (SIC Code 1629)
- ☐ Utilities (SIC Code 1623): _____
- ■ Other (SIC Code required): 1629 Heavy Construction (power plant)

Army Corps No. (if any): _____

7. Approximate location of center of site

Latitude: 44.65 Longitude: -121.25

For assistance: DEQ Location Improvement Tool at: http://deqapp1/website/lit/data.asp

8. Approximate start date: June 2021

Project Size
Total Site Acreage (acres): 284

Total Disturbed Area (acres): 284

Total Number of Lots: 2

9. Is there soil or groundwater contamination located within the site boundary? ☐ YES ■ NO

Will you be dewatering during construction (plan review fee may apply)? ☐ YES ■ NO

Depth to groundwater: Unknown Data Source: _____

10. Receiving waterbody - Must identify final discharge location of construction stormwater flows.
- ■ Waters of the State (name or description) Simtustus Lake, Deschutes River
- ☐ Municipal storm sewer or drainage system (include downstream receiving waterbody):
- ☐ Ditch (include downstream receiving waterbody):
- ☐ Irrigation channel or ditch (include owner or operator):
- ☐ Infiltration device(s) (construction stormwater discharge to underground injection control/drywell is prohibited)
- ☐ Other:

11. Stormwater runoff during construction discharges directly to or through a storm sewer or drainage system that discharges to a waterbody with a Total Maximum Daily Load (TMDL) **or** 303(d) listing for turbidity or sedimentation? ☐ YES ■ NO

***For assistance: DEQ assessment database page at* http://www.deq.state.or.us/wq/assessment/rpt2012/search.asp

B. SIGNATURE OF LEGALLY AUTHORIZED REPRESENTATIVE

The legally authorized representative *must* sign the application (see instructions – Section C).

I hereby certify that the information contained in this application is true and correct to the best of my knowledge and belief. In addition, I agree to pay all permit fees required by Oregon Administrative Rules 340-045. This includes a compliance determination fee invoiced annually by DEQ to maintain the permit.

Scott Piscitello	Vice President
Name of Legally Authorized Representative (Type or Print)	**Title**
E.S. Piscitello	11/18/2019
Signature of Legally Authorized Representative	**Date**

Land Use Compatibility Statements

Land Use Compatibility Statement

SECTION 1 - TO BE COMPLETED BY APPLICANT

1A. Applicant Name: Madras PV1, LLC	**1B. Project Name:** Madras Solar Energy Facility
Contact Name: Nathan Rogers	**Physical Address:** NW Elk Dr and NW Pelton Dam Rd
Mailing Address: 101 Second Street. Suite 1250	**City, State, Zip:** Unincorporated Jefferson County, OR,
City, State, Zip: San Francisco, CA, 94105	**Tax Lot #:** T10 R13 S31 Lot 100 and T10 R13 S30 Lot 600
Telephone: (415) 626-1802	**Township:** see above **Range:** see above **Section:** see above
Tax Account #: 1522565-91 (Business registry number)	**Latitude:** 44.65
	Longitude: -121.25

1C. Describe the project, include the type of development, business, or facility and services or products provided (attach additional information if necessary):

The Applicant proposes to construct a solar energy facility (Facility) in unincorporated Jefferson county in Oregon. The Facility will consist of approximately 63 megawatts (MW) of nominal and average electric generating capacity. The proposed Facility site boundary spans two tax lots in Jefferson County, Oregon in the following sections: Township 10 North, Range 13E, Sections 30 and 31. The DEQ permits being applied for are to construct the Facility, specifically for general construction stormwater management and an on-site temporary concrete batch plant.

1D. Check the type of DEQ permit(s) or approval(s) being applied for at this time.

- ☐ Air Quality Notice of Construction
- ☒ Air Contaminant Discharge Permit *(excludes portable facility permits)*
- ☐ Air Quality Title V Permit
- ☐ Air Quality Indirect Source Permit
- ☐ Parking/Traffic Circulation Plan
- ☐ Solid Waste Land Disposal Site Permit
- ☐ Solid Waste Treatment Facility Permit
- ☐ Solid Waste Composting Facility Permit (includes Anaerobic Digester)
- ☐ Conversion Technology Facility Permit
- ☐ Solid Waste Letter Authorization Permit
- ☐ Solid Waste Material Recovery Facility Permit
- ☐ Solid Waste Energy Recovery Facility Permit
- ☐ Solid Waste Transfer Station Permit
- ☐ Waste Tire Storage Site Permit
- ☐ Pollution Control Bond Request
- ☐ Hazardous Waste Treatment, Storage, or Disposal Permit
- ☐ Clean Water State Revolving Fund Loan Request
- ☐ Wastewater/Sewer Construction Plan/Specifications *(includes review of plan changes that require use of new land)*
- ☐ Water Quality NPDES Individual Permit
- ☐ Water Quality WPCF Individual Permit *(for onsite construction-installation permits use the DEQ Onsite LUCS form)*
- ☒ Water Quality NPDES Stormwater General Permit *(1200-A, 1200-C, 1200-CA, 1200-COLS, and 1200-Z)*
- ☒ Water Quality General Permit *(all general permits, except 600, 700-PM, 1700-A, and 1700-B when they are mobile.)*
- ☐ Water Quality 401 Certification for federal permit or license

1E. This application is for: ☐ Permit Renewal ☒ New Permit ☐ Permit Modification ☐ Other:

SECTION 2 - TO BE COMPLETED BY CITY OR COUNTY PLANNING OFFICIAL

Instructions: Written findings of fact for all local decisions are required; written findings from previous actions are acceptable. For uses allowed outright by the acknowledged comprehensive plan, DEQ will accept written findings in the form of a reference to the specific plan policies, criteria, or standards that were relied upon in rendering the decision with an indication of why the decision is justified based on the plan policies, criteria, or standards.

2A. The project proposal is located: ☐ Inside city limits ☐ Inside UGB ☒ Outside UGB

2B. Name of the city or county that has land use jurisdiction (the legal entity responsible for land use decisions for the subject property or land use): Jefferson County

Land Use Compatibility Statement

SECTION 2 - TO BE COMPLETED BY CITY OR COUNTY PLANNING OFFICIAL

Applicant Name: Madras PV1, LLC | **Project Name:** Madras Solar Energy Facility

2C. Is the activity allowed under Measure 49 (2007)? ☒ No, Measure 49 is not applicable ☐ Yes; if yes, then check one:

☐ Express; approved by DLCD order #:

☐ Conditional; approved by DLCD order #:

☐ Vested; approved by local government decision or court judgment docket or order #:

2D. Is the activity a composting facility?
☒ No ☐ Yes; Senate Bill 462 (2013) notification requirements have been met.

2E. Is the activity or use compatible with your acknowledged comprehensive plan as required by OAR 660-031?
Please complete this form to address the activity or use for which the applicant is seeking approval (see 1.C on the previous page). If the activity or use is to occur in multiple phases, please ensure that your approval addresses the phases described in 1.C. For example, if the applicant's project is described in 1.C as a subdivision and the LUCS indicates that only clearing and grading are allowed outright but does not indicate whether the subdivision is approved, DEQ will delay permit issuance until approval for the subdivision is obtained from the local planning official.

☐ The activity or use is specifically exempt by the acknowledged comprehensive plan; explain:

☐ **Yes,** the activity or use is pre-existing nonconforming use allowed outright by *(provide reference for local ordinance)*:

☐ **Yes,** the activity or use is allowed outright by *(provide reference for local ordinance)*:

☒ **Yes,** the activity or use received preliminary approval that includes requirements to fully comply with local requirements; ~~findings are attached.~~ APPLICATION TO THE ODOE/EFSC IS ANTICIPATED FOR APPROVAL BY EFSC.

☐ **Yes,** the activity or use is allowed; findings are attached.

☐ **No,** see 2.C above, activity or use allowed under Measure 49; findings are attached.

☐ **No,** *(complete below or attach findings for noncompliance and identify requirements the applicant must comply with before compatibility can be determined)*:

Relevant specific plan policies, criteria, or standards:

Provide the reasons for the decision:

JEFFERSON COUNTY
COMMUNITY DEVELOPMENT DEPT.
85 S.E. "D" STREET
MADRAS, OREGON 97741

Additional comments (attach additional information as needed):
ALLOWED SUBJECT TO A SITE CERTIFICATE FROM THE OREGON ENERGY FACILITY SITING COUNCIL UNDER ORS 469.320, 469.378 AND 469.401.

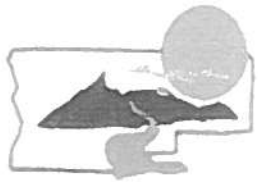
Planning Official Signature: [signature] **Title:** JEFFERSON COUNTY COMMUNITY DEVELOPMENT DIRECTOR

Print Name: PHIL STENBECK **Telephone #:** (541) 475-4462 **Date:** 9/5/19

If necessary, depending upon city/county agreement on jurisdiction outside city limits but within UGB:

Planning Official Signature: N/A **Title:**

Print Name: **Telephone #:** **Date:**



www.co.jefferson.or.us

Transaction Receipt

451-19-000094-NQRY

Receipt Number: 15893

Receipt Date: 9/5/19

Jefferson County Planning Department

85 SE D St.
Madras, OR 97741
541-475-4462
Fax: 541-325-5004
permits@co.jefferson.or.us

Parcel: 192

Fees Paid

Transaction date	Units	Description	Account code	Fee amount	Paid amount
9/5/19	1.00 Ea	Agency sign-off incl LUC Statement, DMV, water right, etc	503-100-343-4322	$41.00	$41.00

Payment Method: Credit card authorization: 089793 Payer: JORDAN GRACE Payment Amount: $41.00

Cashier: Tanya Cloutier

Receipt Total: $41.00

Erosion and Sediment Control Plan

ESCP PARTS I THROUGH III FORMS

The information that is required in the ***Part I, and Part II ESCP Narrative Forms*** could be included on the required ***ESCP Drawings*** instead of submittal of the ***Narrative Forms.*** The ***Narrative Part III Section 1*** form is a checklist for use in making sure that all of the required information is provided in the submittal documents and as such does not need to be submitted to DEQ.

Narrative Part III Section 2 must be included on the ***ESCP Drawings***. The set of ***Example Construction Plan Drawings*** (examples to be used as an alternative to the Narrative Forms) are provided at: http://www.deq.state.or.us/wq/stormwater/constappl.htm.

PART 1: ESCP NARRATIVE FORM

1. Permit Registration Information

Date: 11/18/2019

Project Name: Madras PV1

Prepared By: Brad Ostapkowicz

Company Name: Jacobs

E-mail Address: brad.ostapkowicz@jacobs.com

Please answer the following questions as indicated. If needed, additional space is provided for you at the end of this form. You may also attach any information you feel is pertinent to the project.

2. Oregon Professional Certification Information

Is your Erosion and Sediment Control Plan (ESCP) for an activity that covers 20 acres or more of disturbed land (Schedule A.12.a.i)

☒ Yes ☐ No

Does your Erosion and Sediment Control Plan require engineered facilities such as settling basins and/or diversion structures? (Schedule A.12.a.ii)

☐ Yes ☒ No

If you answered "Yes" to question #1, the ESCP must be prepared and stamped by an Oregon Registered Profession Engineer, Oregon Registered Landscape Architect, Oregon Certified Engineering Geologist, or Certified Professional in Erosion and Sediment Control (Soil and Water Conservation Society). If you answered "Yes" to question #2, the ESCP must be prepared and stamped by an Oregon Registered Professional Engineer. Please provide the following information and use the space provided to imprint your seal.

Name: Brad Ostapkowicz

Address: 202 SW 4th Ave Suite 300

Telephone: 503-235-5022

Imprint Seal Above

3. Inspector Qualification Information

Provide the following information on the Erosion and Sediment Control Inspector. This is a person that works for the applicant and not a government employee. The consultant, general contractor, project manager, or person who prepared the ESCP may be designated with their agreement as the initial or final ESC Inspector. Upon designating an inspector(s), submit to DEQ or Agent their name(s), and contact information. All designated ESC Inspectors must be qualified through certification, training, and/or experience in erosion and sediment control. Please provide the number of hours of training, days, months, and/or years of experience in erosion and sediment control design, installation, maintenance, and/or inspection (specify which or all). (NPDES 1200-C Permit Schedule A.12.b.iii).

The inspector is a person with training and experience in erosion prevention and sediment controls and best management practices and should have one of the following levels of skill. A copy of a certification, training, or level/hours of experience should be provided to DEQ or Agent in the form below:

Acceptable Certification (Schedule A.12.b.iii.2):

a. Certified Professional in Erosion and Sediment Control (CPESC),
b. Certified Professional in Storm Water Quality (CPSWQ),
c. Washington Department of Ecology's Certified Erosion and Sediment Control Lead (CESCL) Certification,
d. Rogue Valley Sewer Services Erosion and Sediment Control Certification.

*After January 1, 2017, for projects that are five or more acres, inspectors must have at least one of these acceptable certifications.

Acceptable Training:

a. Certification/training program designed for persons involved in any phase of erosion and sediment control work. Areas covered must include information on soils, the erosion process, sedimentation process, standards and specifications for vegetative and structural erosion control practices, laws, regulations, construction inspection and field investigation; or

b. Attendance at a seminar or training class in Erosion and Sediment Control Best Management Practices (BMPs).

Qualified Experience:

a. Designing Erosion and Sediment Control Plans and/or

b. Installation of erosion and sediment controls and/or

c. Maintenance of erosion and sediment controls and/or

d. Inspection of erosion and sediment controls

Name: Shannon Bartow Telephone: 503-872-4813

Address: _____ E-mail: _____

Certificate Program and number: _____

Training: _____

Experience: _____

4. Narrative Site Description

a. Describe the nature of the construction activity and the final use of the site, that is, what will the site be used for at the completion of the construction. (Schedule A.12.b.iv):

b. Describe the origin and nature of fill material to be used and soils prior to disturbance. (Schedule A.12.b.iv.4):

5. Water Quality Requirements for TMDL and 303(d) Listed Waterbodies (skip if not applicable)

If there is a potential for discharge of stormwater to directly discharge or discharge through a conveyance system to a portion of a waterbody that is listed for turbidity or sedimentation or that has an established Total Maximum Daily Load (TMDL) for sedimentation or turbidity from the construction site, then one or more of the BMPs listed below must be implemented. Identify the selected BMP(s) in the ESCP as one that addresses this condition of the permit, and provide the rationale for choosing the selected BMP(s). (Schedule A.11.) The 303 (d) list can be found at: http://www.deq.state.or.us/wq/assessment/rpt2010/search.asp. Search under Category 5 (303(d)) and Category 4a (TMDL approved).

Will implement one or more of the following BMPs to control and treat sediment and turbidity:

i. Compost berms, compost blankets, or compost socks;
ii. Erosion control mats;
iii. Tackifiers used in combination with perimeter sediment control BMPs;
iv. Established vegetated buffers sized at 50 feet perpendicular to the slope plus an additional 25 feet perpendicular to the slope per 5 degrees of slope full width of the disturbed slope
v. Water treatment by electro-coagulation, flocculation, filtration; or
vi. Other substantially equivalent sediment or turbidity BMP approved by DEQ or Agent.

BMP	**Rationale**
N/A	

6. Natural Buffer Zone

a. If a waters of the state is within the project site or within 50 feet of the project boundary, and a natural buffer exists within 50 feet of the water of the state, the ESCP must delineate and protect this area with orange fencing or flagging and maintain existing buffer until completion of project. All discharge must be filtered prior to entering the natural buffer to avoid sediment build up. If scour is an issue, an energy dissipater may need to be installed.

Natural Buffer means, for the purposes of this permit, an area of undisturbed natural cover surrounding surface waters within which construction activities are restricted. Natural cover includes the natural vegetation, exposed rock, and barren ground that existed prior to commencement of earth-disturbing activities.

b. If project will reduce natural buffer zone under 50 feet of waters of the state, the ESCP must include one or more of the following BMPs to control and treat sediment and turbidity:

i. Compost berms, compost blankets, or compost socks;
ii. Erosion control mats;
iii. Tackifiers used in combination with perimeter sediment control BMPs;
iv. Water treatment by electro-coagulation, flocculation, filtration; or
v. Other substantially equivalent sediment or turbidity BMP approved by DEQ or Agent.

BMP	**Rationale**
N/A	

c. The Natural Buffer Zone requirements do not apply if:
   (1) No natural buffer exists due to development that occurred prior to the initiation of planning for the current project; or
   (2) There is no discharge of stormwater to the water of the state through the area between the disturbed portions of the site and the surface water located within the project site or within 50 feet of the site. This includes situations where the permit registrant has implemented control measures, such as a berm or other barrier, that will prevent such discharges; or
   (3) There is a CWA Section 404 permit and 401 WQC issued for the project; or
   (4) Construction is for a water-dependent structure or water access areas (for example, pier, boat ramp, or trail).

PART II: BMPS WITH ESCP IMPLEMENTATION SCHEDULE FORM

The following controls and practices (BMPs), if appropriate for the site, are required in the ESCP. Submission of all ESCP revisions to DEQ are not required. ESCP revisions must be submitted in 10 days for specific conditions. See 1200-C permit (Schedule A.12.c.iv).

YEAR:	2021-2022																		
BMPs **MONTH #:**	6	7	8	9	10	11	12	1	2	3									
Biobags																			
Bioswales																			
Check Dams																			
Compost Berm																			
Compost Blankets																			
Compost Socks																			
Concrete Truck Washout	X	X	X	X	X	X	X												
Construction Entrance	X	X	X	X	X	X	X	X	X	X									
Dewatering (treatment location, schematic, & sampling plan required)																			
Drainage Swales																			
Earth Dikes (Stabilized)																			
Energy Dissipaters																			
Erosion Control Blankets & Mats (Specify type) - Jute	X	X	X	X	X	X	X	X	X	X									
Hydroseeding	X	X	X	X	X	X	X	X	X	X									
Inlet Protection																			
Mulches (Specify Type) - Straw	X	X	X	X	X	X	X	X	X	X									
Mycorrhizae/ Biofertilizers																			
Natural Buffer Zone																			
Orange fencing (protecting sensitive/preserved areas)	X	X	X	X	X	X	X												
Outlet Protection																			
Permanent Seeding and Planting								X	X	X									
Pipe Slope Drains																			
Plastic Sheeting	X	X	X	X	X	X	X												
Preserve Existing Vegetation	X	X	X	X	X	X	X												
Sediment Fencing	X	X	X	X	X	X	X												
Sediment Barrier																			
Sediment Trap																			
Sodding																			
Soil Tackifiers	X	X	X	X	X	X	X												
Storm Drain Inlet Protection																			
Straw Wattles (or other materials)	X	X	X	X	X	X	X												
Temporary Diversion Dikes																			
Temporary or Permanent Sedimentation Basins																			
Temporary Seeding and Planting	X	X	X	X	X	X	X												
Treatment System (O & M plan required)																			
Unpaved roads graveled or other BMP on the road	X	X	X	X	X	X	X												
Vegetative Buffer Strips																			

GENERAL PROJECT INFORMATION

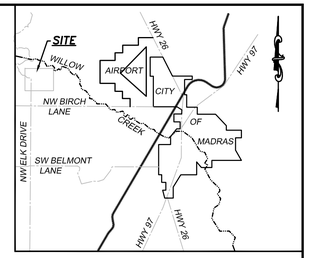
PROJECT NAME:	MADRAS PV1
PROJECT ADDRESS:	LAT.: 44.65°, LON.:-121.25°
DEVELOPER NAME:	ECOPLEXUS
DEVELOPER ADDRESS:	101 2ND ST., STE. 1250, SAN FRANCISCO, CA 94105

PROJECT LOCATION

THE PROPOSED PROJECT IS LOCATED ON AN UNCULTIVATED SITE IN AN UNINCORPORATED AREA OF JEFFERSON COUNTY, OREGON.

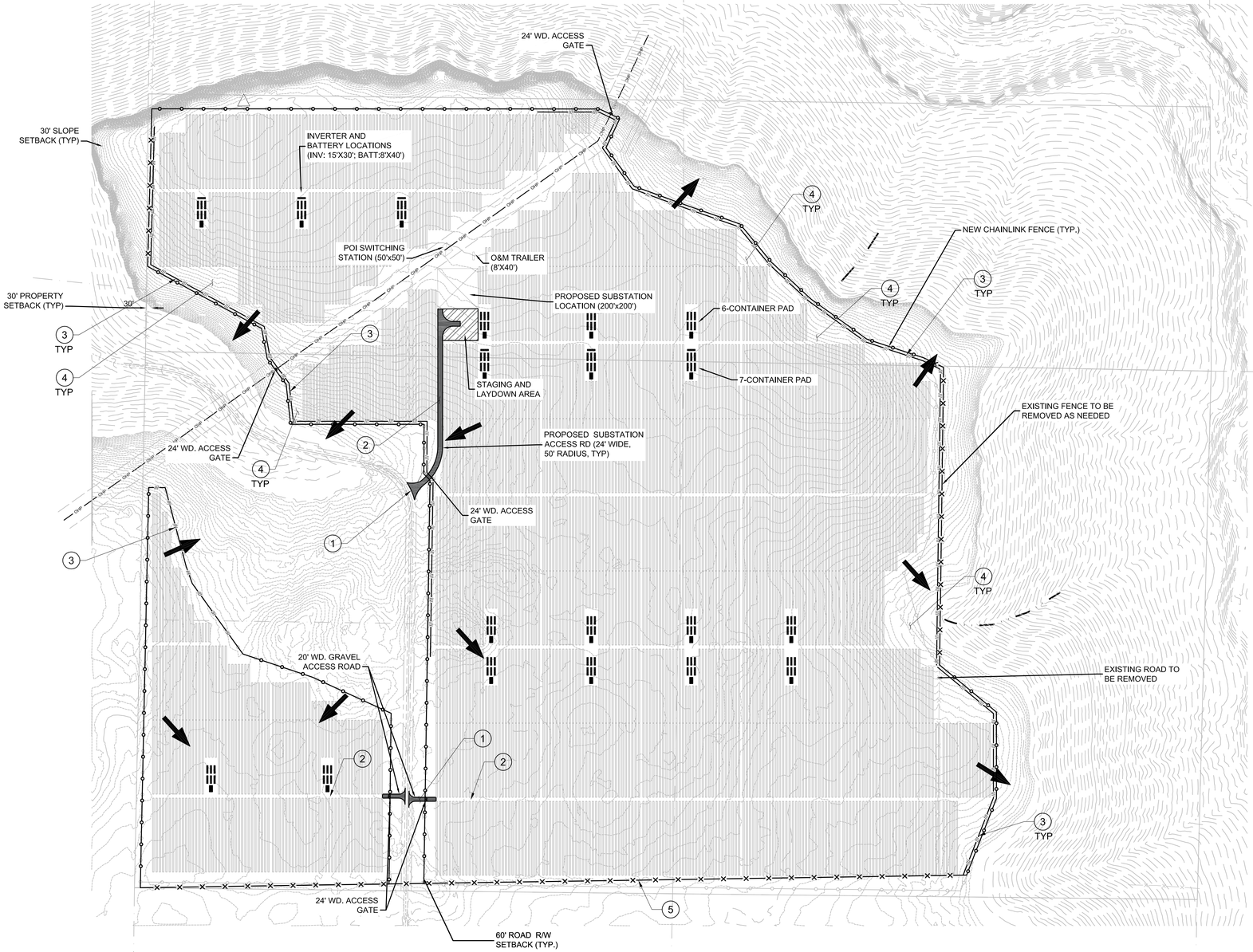
NARRATIVE DESCRIPTION

THE PROPOSED PROJECT INCLUDES THE CONSTRUCTION OF A 63-MEGAWATT PHOTOVOLTAIC (PV) SOLAR POWER GENERATION FACILITY. THE FACILITY WILL GENERATE ELECTRICITY USING SOLAR PV MODULES CONNECTED TO INVERTERS, TRANSFORMERS, AND A SUBSTATION. CONSTRUCTION ACTIVITIES INCLUDE GRADING, CLEARING, AND CONCRETE SLAB PRODUCTION.



VICINITY MAP

NOT TO SCALE



KEYED NOTES

1. PREVENT TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS USING BMPS SUCH AS: CONSTRUCTION ENTRANCE, GRAVELED (OR PAVED) EXITS AND PARKING AREAS, GRAVEL ALL UNPAVED ROADS LOCATED ONSITE, OR USE AN EXIT TIRE WASH. THESE BMPS MUST BE IN PLACE PRIOR TO LAND-DISTURBING ACTIVITIES.
2. WHERE PERMANENT ACCESS ROADS OR IMPROVED TEMPORARY CONSTRUCTION ACCESS ROADS ARE REQUIRED, CLEAN ANGULAR ROCK WILL BE USED AND MAINTAINED THROUGHOUT CONSTRUCTION DURATION TO PREVENT ROADS FROM BECOMING A SOURCE OF SEDIMENTATION. RESTORATION OF TEMPORARY CONSTRUCTION ACCESS ROADS WILL INCLUDE EITHER SPREADING MULCH, USING A TACKIFIER AND SEEDING, AND WILL OCCUR FOLLOWING CONSTRUCTION ACTIVITIES.
3. INSTALL SILT FENCE ON CONTOUR, ON AREAS DOWNGRADE OF AND PRIOR TO LAND DISTURBING ACTIVITIES.
4. STABILIZE STEEPER SLOPES DISTURBED DURING CONSTRUCTION WITH SOIL ROUGHENING, STRAW WATTLES OR JUTE MATTING (SEE DETAILS ON SHEET EC-03). WATTLES WILL BE INSTALLED PERPENDICULAR TO FLOW AND PARALLEL TO THE SLOPE CONTOUR.
5. MAINTAIN EXISTING FENCE AS BOUNDARY FOR CONSTRUCTION AND LAND DISTURBING ACTIVITIES. SILT FENCE MAY FOLLOW FENCE WHERE APPLICABLE.

LEGEND & SYMBOLS

- SECTION OR SECTION SUBDIVISION LINE
- PARCEL BOUNDARY
- ROADWAY CENTERLINE
- RIGHT OF WAY BOUNDARY
- EASEMENT BOUNDARY
- EXISTING FENCE TO BE USED AS CONSTRUCTION FENCE
- SILT FENCE
- CONSTRUCTION FENCE
- OVERHEAD POWER LINE
- EDGE OF ASPHALT ROAD
- EDGE OF DIRT ROAD
- ONSITE STREAM DETERMINED BY OTHERS
- 10-FOOT CONTOUR LINE
- 10-FOOT CONTOUR LINE
- 100-FOOT CONTOUR LINE
- UTILITY POLE
- FOUND MONUMENT AS NOTED
- DRAINAGE FLOW DIRECTION

NOTE:

THIS MAP OR PLAT AND THE SURVEY PROVIDED BY PBS ENGINEERING AND ENVIRONMENTAL INC., BY GREG E. FLOWERS, ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 2, 3, 4, 5, 8, 9, 11, 13, 18, AND 20 OF TABLE A THEREOF. THE FIELD WORK WAS BEGUN ON OCTOBER 25, 2018, AND CONCLUDED ON NOVEMBER 7, 2018. DATE OF PLAT OR MAP: FEBRUARY 1, 2019

300' 150' 0 300'

SCALE: 1" = 300'

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REV	DATE	DESCRIPTION

MADRAS PV1

JEFFERSON COUNTY OREGON

APPROVED BY:	BO
DESIGNED BY:	SB
DRAWN BY:	BG
SCALE:	1" = 300'
DATE:	11/5/2019

DRAWING DESCRIPTION:

ESCP PLAN

LEVEL C

DRAWING No:

EC-01

INSPECTION FREQUENCY

SITE CONDITION	MINIMUM FREQUENCY
1. ACTIVE PERIOD	DAILY WHEN STORMWATER RUNOFF, INCLUDING RUNOFF FROM SNOW MELT, IS OCCURRING. AT LEAST ONCE EVERY 14 DAYS, REGARDLESS OF WHETHER STORMWATER RUNOFF IS OCCURRING.
2. PRIOR TO THE SITE BECOMING INACTIVE OR IN ANTICIPATION OF SITE INACCESSIBILITY	ONCE TO ENSURE THAT EROSION AND SEDIMENT CONTROL MEASURE ARE IN WORKING ORDER. ANY NECESSARY MAINTENANCE AND REPAIR MUST BE MADE PRIOR TO LEAVING THE SITE.
3. INACTIVE PERIODS GREATER THAN FOURTEEN (14) CONSECUTIVE CALENDAR DAYS	ONCE EVERY MONTH.
4. PERIODS DURING WHICH THE SITE IS INACCESSIBLE DUE TO INCLEMENT WEATHER	IF PRACTICAL, INSPECTIONS MUST OCCUR DAILY AT A RELEVANT AND ACCESSIBLE DISCHARGE POINT OR DOWNSTREAM LOCATION.
5. PERIODS DURING WHICH DISCHARGE IS UNLIKELY DUE TO FROZEN CONDITIONS.	MONTHLY. RESUME MONITORING IMMEDIATELY UPON MELT, OR WHEN WEATHER CONDITIONS MAKE DISCHARGES LIKELY.

SOIL TYPES

FOUR PREDOMINANT SOIL TYPES ARE FOUND AT THE SITE: CULLIUS LOAM (0 TO 3 PERCENT SLOPES, UNIT 30A), CULLIUS LOAM (3 TO 8 PERCENT SLOPES, UNIT 30B), MADRAS LOAM (0 TO 3 PERCENT SLOPES, UNIT 87A), AND MADRAS LOAM (3 TO 8 PERCENT SLOPES, UNIT 87B).

RATIONALE STATEMENT

A COMPREHENSIVE LIST OF AVAILABLE BEST MANAGEMENT PRACTICES (BMP) OPTIONS BASED ON DEQ'S 1200-C PERMIT APPLICATION AND ESCP GUIDANCE DOCUMENT HAS BEEN REVIEWED TO COMPLETE THIS EROSION AND SEDIMENT CONTROL PLAN. SOME OF THE ABOVE LISTED BMPS WERE NOT CHOSEN BECAUSE THEY WERE DETERMINED TO NOT EFFECTIVELY MANAGE EROSION PREVENTION AND SEDIMENT CONTROL FOR THIS PROJECT BASED ON SPECIFIC SITE CONDITIONS, INCLUDING SOIL CONDITIONS, TOPOGRAPHIC CONSTRAINTS, ACCESSIBILITY TO THE SITE, AND OTHER RELATED CONDITIONS. AS THE PROJECT PROGRESSES AND THERE IS A NEED TO REVISE THE ESCP, AN ACTION PLAN WILL BE SUBMITTED.

THE SITE SPECIFIC EROSION CONTROL NOTES ARE THE BMPS THAT WERE CHOSEN FOR THIS SITE, AND REPRESENT THE BMPS THAT SHOULD BE FOLLOWED.

_________ INITIAL

ATTENTION EXCAVATORS

OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. YOU MAY OBTAIN COPIES OF THESE RULES FROM THE CENTER BY CALLING 503-232-1987. IF YOU HAVE ANY QUESTIONS ABOUT THE RULES, YOU MAY CONTACT THE CENTER. YOU MUST NOTIFY THE CENTER AT LEAST TWO BUSINESS DAYS BEFORE COMMENDING AN EXCAVATION. CALL 503-246-6699.

STANDARD EROSION AND SEDIMENT CONTROL PLAN DRAWING NOTES

1. HOLD A PRE-CONSTRUCTION MEETING OF PROJECT CONSTRUCTION PERSONNEL THAT INCLUDES THE INSPECTOR TO DISCUSS EROSION AND SEDIMENT CONTROL MEASURES AND CONSTRUCTION LIMITS. (SCHEDULE A.8.C.I.(3))
2. ALL INSPECTIONS MUST BE MADE IN ACCORDANCE WITH DEQ 1200-C PERMIT REQUIREMENTS. (SCHEDULE A.12.B AND SCHEDULE B.1)
3. INSPECTION LOGS MUST BE KEPT IN ACCORDANCE WITH DEQ'S 1200-C PERMIT REQUIREMENTS. (SCHEDULE B.1.C AND B.2)
4. RETAIN A COPY OF THE ESCP AND ALL REVISIONS ON SITE AND MAKE IT AVAILABLE ON REQUEST TO DEQ, AGENT, OR THE LOCAL MUNICIPALITY. DURING INACTIVE PERIODS OF GREATER THAN SEVEN (7) CONSECUTIVE CALENDAR DAYS, THE ABOVE RECORDS MUST BE RETAINED BY THE PERMIT REGISTRANT BUT DO NOT NEED TO BE AT THE CONSTRUCTION SITE. (SCHEDULE B.2.C)
5. ALL PERMIT REGISTRANTS MUST IMPLEMENT THE ESCP. FAILURE TO IMPLEMENT ANY OF THE CONTROL MEASURES OR PRACTICES DESCRIBED IN THE ESCP IS A VIOLATION OF THE PERMIT. (SCHEDULE A 8.A)
6. THE ESCP MUST BE ACCURATE AND REFLECT SITE CONDITIONS. (SCHEDULE A.12.C.I)
7. SUBMISSION OF ALL ESCP REVISIONS IS NOT REQUIRED. SUBMITTAL OF THE ESCP REVISIONS IS ONLY UNDER SPECIFIC CONDITIONS. SUBMIT ALL NECESSARY REVISION TO DEQ OR AGENT WITHIN 10 DAYS. (SCHEDULE A.12.C.IV. AND V)
8. PHASE CLEARING AND GRADING TO THE MAXIMUM EXTENT PRACTICAL TO PREVENT EXPOSED INACTIVE AREAS FROM BECOMING A SOURCE OF EROSION. (SCHEDULE A.7.A.III)
9. IDENTIFY, MARK, AND PROTECT (BY CONSTRUCTION FENCING OR OTHER MEANS) CRITICAL RIPARIAN AREAS AND VEGETATION INCLUDING IMPORTANT TREES AND ASSOCIATED ROOTING ZONES, AND VEGETATION AREAS TO BE PRESERVED. IDENTIFY VEGETATIVE BUFFER ZONES BETWEEN THE SITE AND SENSITIVE AREAS (E.G., WETLANDS), AND OTHER AREAS TO BE PRESERVED, ESPECIALLY IN PERIMETER AREAS. (SCHEDULE A.8.C.I.(1) AND (2))
10. PRESERVE EXISTING VEGETATION WHEN PRACTICAL AND RE-VEGETATE OPEN AREAS. RE-VEGETATE OPEN AREAS WHEN PRACTICABLE BEFORE AND AFTER GRADING OR CONSTRUCTION. IDENTIFY THE TYPE OF VEGETATIVE SEED MIX USED. (SCHEDULE A.7.A.V)
11. MAINTAIN AND DELINEATE ANY EXISTING NATURAL BUFFER WITHIN THE 50-FEET OF WATERS OF THE STATE. (SCHEDULE A.7.B.I.AND (2(A)(B))
12. INSTALL PERIMETER SEDIMENT CONTROL, INCLUDING STORM DRAIN INLET PROTECTION AS WELL AS ALL SEDIMENT BASINS, TRAPS, AND BARRIERS PRIOR TO LAND DISTURBANCE. (SCHEDULE A.8.C.I.(5))
13. CONTROL BOTH PEAK FLOW RATES AND TOTAL STORMWATER VOLUME, TO MINIMIZE EROSION AT OUTLETS AND DOWNSTREAM CHANNELS AND STREAMBANKS. (SCHEDULE A.7.C)
14. CONTROL SEDIMENT AS NEEDED ALONG THE SITE PERIMETER AND AT ALL OPERATIONAL INTERNAL STORM DRAIN INLETS AT ALL TIMES DURING CONSTRUCTION, BOTH INTERNALLY AND AT THE SITE BOUNDARY. (SCHEDULE A.7.D.I
15. ESTABLISH CONCRETE TRUCK AND OTHER CONCRETE EQUIPMENT WASHOUT AREAS BEFORE BEGINNING CONCRETE WORK. (SCHEDULE A.8.C.I.(6))
16. APPLY TEMPORARY AND/OR PERMANENT SOIL STABILIZATION MEASURES IMMEDIATELY ON ALL DISTURBED AREAS AS GRADING PROGRESSES. TEMPORARY OR PERMANENT STABILIZATIONS MEASURES ARE NOT REQUIRED FOR AREAS THAT ARE INTENDED TO BE LEFT UNVEGETATED, SUCH AS DIRT ACCESS ROADS OR UTILITY POLE PADS.(SCHEDULE A.8.C.II.(3))
17. ESTABLISH MATERIAL AND WASTE STORAGE AREAS, AND OTHER NON-STORMWATER CONTROLS. (SCHEDULE A.8.C.I.(7))
18. PREVENT TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS USING BMPS SUCH AS: CONSTRUCTION ENTRANCE, GRAVELED (OR PAVED) EXITS AND PARKING AREAS, GRAVEL ALL UNPAVED ROADS LOCATED ONSITE, OR USE AN EXIT TIRE WASH. THESE BMPS MUST BE IN PLACE PRIOR TO LAND-DISTURBING ACTIVITIES. (SCHEDULE A 7.D.II AND A.8.C.I(4))
19. WHEN TRUCKING SATURATED SOILS FROM THE SITE, EITHER USE WATER-TIGHT TRUCKS OR DRAIN LOADS ON SITE. (SCHEDULE A.7.D.II.(5))
20. CONTROL PROHIBITED DISCHARGES FROM LEAVING THE CONSTRUCTION SITE, I.E., CONCRETE WASH-OUT, WASTEWATER FROM CLEANOUT OF STUCCO, PAINT AND CURING COMPOUNDS. (SCHEDULE A.6)
21. USE BMPS TO PREVENT OR MINIMIZE STORMWATER EXPOSURE TO POLLUTANTS FROM SPILLS; VEHICLE AND EQUIPMENT FUELING, MAINTENANCE, AND STORAGE; OTHER CLEANING AND MAINTENANCE ACTIVITIES; AND WASTE HANDLING ACTIVITIES. THESE POLLUTANTS INCLUDE FUEL, HYDRAULIC FLUID, AND OTHER OILS FROM VEHICLES AND MACHINERY, AS WELL AS DEBRIS, FERTILIZER, PESTICIDES AND HERBICIDES, PAINTS, SOLVENTS, CURING COMPOUNDS AND ADHESIVES FROM CONSTRUCTION OPERATIONS. (SCHEDULE A.7.E.I.(2))
22. IMPLEMENT THE FOLLOWING BMPS WHEN APPLICABLE: WRITTEN SPILL PREVENTION AND RESPONSE PROCEDURES, EMPLOYEE TRAINING ON SPILL PREVENTION AND PROPER DISPOSAL PROCEDURES, SPILL KITS IN ALL VEHICLES, REGULAR MAINTENANCE SCHEDULE FOR VEHICLES AND MACHINERY, MATERIAL DELIVERY AND STORAGE CONTROLS, TRAINING AND SIGNAGE, AND COVERED STORAGE AREAS FOR WASTE AND SUPPLIES. (SCHEDULE A. 7.E.III.)
23. USE WATER, SOIL-BINDING AGENT OR OTHER DUST CONTROL TECHNIQUE AS NEEDED TO AVOID WIND-BLOWN SOIL. (SCHEDULE A 7.A.IV)
24. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS TO MINIMIZE NUTRIENT RELEASES TO SURFACE WATERS. EXERCISE CAUTION WHEN USING TIME-RELEASE FERTILIZERS WITHIN ANY WATERWAY RIPARIAN ZONE. (SCHEDULE A.9.B.III)
25. IF AN ACTIVE TREATMENT SYSTEM (FOR EXAMPLE, ELECTRO-COAGULATION, FLOCCULATION, FILTRATION, ETC.) FOR SEDIMENT OR OTHER POLLUTANT REMOVAL IS EMPLOYED, SUBMIT AN OPERATION AND MAINTENANCE PLAN (INCLUDING SYSTEM SCHEMATIC, LOCATION OF SYSTEM, LOCATION OF INLET, LOCATION OF DISCHARGE, DISCHARGE DISPERSION DEVICE DESIGN, AND A SAMPLING PLAN AND FREQUENCY) BEFORE OPERATING THE TREATMENT SYSTEM. OBTAIN PLAN APPROVAL BEFORE OPERATING THE TREATMENT SYSTEM. OPERATE AND MAINTAIN THE TREATMENT SYSTEM ACCORDING TO MANUFACTURER'S SPECIFICATIONS. (SCHEDULE A.9.D)
26. TEMPORARILY STABILIZE SOILS AT THE END OF THE SHIFT BEFORE HOLIDAYS AND WEEKENDS, IF NEEDED. THE REGISTRANT IS RESPONSIBLE FOR ENSURING THAT SOILS ARE STABLE DURING RAIN EVENTS AT ALL TIMES OF THE YEAR. (SCHEDULE A 7.B)
27. AS NEEDED BASED ON WEATHER CONDITIONS, AT THE END OF EACH WORKDAY SOIL STOCKPILES MUST BE STABILIZED OR COVERED, OR OTHER BMPS MUST BE IMPLEMENTED TO PREVENT DISCHARGES TO SURFACE WATERS OR CONVEYANCE SYSTEMS LEADING TO SURFACE WATERS. (SCHEDULE A 7.E.II.(2))
28. CONSTRUCTION ACTIVITIES MUST AVOID OR MINIMIZE EXCAVATION AND BARE GROUND ACTIVITIES DURING WET WEATHER. (SCHEDULE A.7.A.I)
29. SEDIMENT FENCE: REMOVE TRAPPED SEDIMENT BEFORE IT REACHES ONE THIRD OF THE ABOVE GROUND FENCE HEIGHT AND BEFORE FENCE REMOVAL. (SCHEDULE A.9.C.I)
30. OTHER SEDIMENT BARRIERS (SUCH AS BIOBAGS): REMOVE SEDIMENT BEFORE IT REACHES TWO INCHES DEPTH ABOVE GROUND HEIGHT AND BEFORE BMP REMOVAL. (SCHEDULE A.9.C.I)
31. CATCH BASINS: CLEAN BEFORE RETENTION CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT. SEDIMENT BASINS AND SEDIMENT TRAPS: REMOVE TRAPPED SEDIMENTS BEFORE DESIGN CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT AND AT COMPLETION OF PROJECT. (SCHEDULE A.9.C.III& IV)
32. WITHIN 24 HOURS, SIGNIFICANT SEDIMENT THAT HAS LEFT THE CONSTRUCTION SITE, MUST BE REMEDIATED. INVESTIGATE THE CAUSE OF THE SEDIMENT RELEASE AND IMPLEMENT STEPS TO PREVENT A RECURRENCE OF THE DISCHARGE WITHIN THE SAME 24 HOURS. ANY IN-STREAM CLEAN-UP OF SEDIMENT SHALL BE PERFORMED ACCORDING TO THE OREGON DIVISION OF STATE LANDS REQUIRED TIMEFRAME. (SCHEDULE A.9.B.I)
33. THE INTENTIONAL WASHING OF SEDIMENT INTO STORM SEWERS OR DRAINAGE WAYS MUST NOT OCCUR. VACUUMING OR DRY SWEEPING AND MATERIAL PICKUP MUST BE USED TO CLEANUP RELEASED SEDIMENTS. (SCHEDULE A.9.B.II)
34. THE ENTIRE SITE MUST BE TEMPORARILY STABILIZED USING VEGETATION OR A HEAVY MULCH LAYER, TEMPORARY SEEDING, OR OTHER METHOD SHOULD ALL CONSTRUCTION ACTIVITIES CEASE FOR 30 DAYS OR MORE. (SCHEDULE A.7.F.I)
35. PROVIDE TEMPORARY STABILIZATION FOR THAT PORTION OF THE SITE WHERE CONSTRUCTION ACTIVITIES CEASE FOR 14 DAYS OR MORE WITH A COVERING OF BLOWN STRAW AND A TACKIFIER, LOOSE STRAW, OR AN ADEQUATE COVERING OF COMPOST MULCH UNTIL WORK RESUMES ON THAT PORTION OF THE SITE. (SCHEDULE A.7.F.II)
36. DO NOT REMOVE TEMPORARY SEDIMENT CONTROL PRACTICES UNTIL PERMANENT VEGETATION OR OTHER COVER OF EXPOSED AREAS IS ESTABLISHED. ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED, ALL TEMPORARY EROSION CONTROLS AND RETAINED SOILS MUST BE REMOVED AND DISPOSED OF PROPERLY, UNLESS DOING SO CONFLICTS WITH LOCAL REQUIREMENTS. (SCHEDULE A.8.C.III(1) AND D.3.C.II AND III)

GENERAL NOTES

1. THE PREDOMINANT SOIL TYPE IN THIS AREA HAS MODERATE TO HIGH SUSCEPTIBILITY TO WIND EROSION AND IS MODERATELY PRONE TO WATER EROSION. THEREFORE, THE IMPLEMENTATION OF EROSION CONTROL PRACTICES MUST BE AN INTEGRAL PART OF ALL PHASES OF CONSTRUCTION.
2. THE IMPLEMENTATION OF THESE EROSION CONTROL PLANS AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED, APPROVED, AND VEGETATION/LANDSCAPING IS ESTABLISHED.
3. THE EROSION CONTROL FACILITIES OR MEASURES SHOWN ON THESE PLANS MUST BE CONSTRUCTED IN CONNECTION WITH ALL CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO INSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT ENTER THE DRAINAGE SYSTEM OR ROADWAYS OUTSIDE OF PROJECT LIMITS, AND VIOLATE APPLICABLE WATER STANDARDS.
4. THE EROSION CONTROL FACILITIES OR MEASURES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE FACILITIES SHALL BE MAINTAINED AND UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT LEAVE THE SITE.
5. PRIOR TO CONSTRUCTION A PRE-CONSTRUCTION MEETING WILL BE HELD TO DISCUSS ALL EROSION CONTROL FACILITIES OR MEASURES WITHIN THIS ESCP AND CONSTRUCTION LIMITS.
6. PRIOR TO ANY LAND DISTURBING ACTIVITIES EACH SITE MUST HAVE GRAVELED, PAVED, OR CONSTRUCTED ENTRANCES, EXITS AND PARKING AREAS TO REDUCE THE TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS.
7. PHASE CLEARING AND GRADING TO THE MAXIMUM EXTENT PRACTICAL TO PREVENT EXPOSED INACTIVE AREAS FROM BECOMING A SOURCE OF EROSION.
8. LIMIT EXTENT OF TEMPORARY ACCESS ROAD IMPROVEMENT/CONSTRUCTION TO MINIMIZE LAND DISTURBING ACTIVITIES REQUIRING RESTORATION.
9. PRESERVE EXISTING VEGETATION WHEN PRACTICAL AND RE-VEGETATE OPEN AREAS. RE-VEGETATE OPEN AREAS WHEN PRACTICABLE BEFORE AND AFTER GRADING OR CONSTRUCTION. IDENTIFY THE TYPE OF VEGETATIVE SEED MIX USED.
10. TEMPORARILY STABILIZE EXISTING BARE SOIL AREAS BY SPREADING STRAW MULCH AND PUNCHING IT IN TO THE GROUND WITH A DISC OR A HYDROSEEDER. THE APPLICATION RATE FOR STRAW MULCH IS 2500 LBS/ACRE. A SOIL BINDER OR TACKIFIER MAY BE INCORPORATED INTO STRAW OR MULCH. IN THE FALL, WHEN SOIL MOISTURE IS ADEQUATE, SEED ALL IMPACTED AREAS WITH THE SEED MIXTURE APPROVED FOR USE ON SITE. SEED MIXTURE WILL GENERALLY BE THAT APPROVED BY ODFW AND THE COUNTY, HOWEVER SPECIFIC SEED MIXTURES WILL BE APPLIED WHERE ADDITIONAL AGREEMENTS APPLY. EXAMPLE SEED MIXTURES FOR PERMANENT AND TEMPORARY SEEDING ARE AS FOLLOWS:

BOTANICAL NAME	COMMON NAME	% BY WEIGHT	ACTUAL % BY SEED SIZE	REQUESTED %
LOLIUM PERENNE	PERENNIAL RYEGRASS	39%	9.07%	30%
FESTUCA RUBRA	CREEPING RED FESCUE	25%	11.9%	20%
LOLIUM MULTIFLORUM	ANNUAL RYEGRASS	25%	11.24%	20%
AGROSTIS CAPILLARIS VAR HIGHLAND	HIGHLAND COLONIAL BENTGRASS	7%	64.41%	20%
TRIFOLIUM REPENS	WHITE CLOVER	4%	3.38%	10%
TOTALS		100%	100%	100%
SEEDING RATE: 1 PLS LBS. PER 1000 SQ. FT. 40 PLS LBS. PER ACRE IF APPLIED VIA HYDROSEEDING				

11. THE CONSTRUCTION MANAGER IS RESPONSIBLE FOR LOCATING ANY NECESSARY TEMPORARY DISPOSAL SITES. TO CONTROL THE RELEASE OF SEDIMENT FROM THE DISPOSAL SITES, SILT FENCE SHALL BE INSTALLED ON THE DOWNSLOPE SIDE OF ALL DISPOSAL AREAS ON CONTOUR. SEE DETAIL SHEET EC-03. IF ADDITIONAL SEDIMENT OR EROSION CONTROL MEASURES ARE DETERMINED TO BE NECESSARY TO CONTROL THE RELEASE OF SEDIMENT FROM THE TEMPORARY DISPOSAL SITES, THE CONSTRUCTION MANAGER SHALL BE RESPONSIBLE FOR IMPLEMENTING THESE MEASURES.
12. TEMPORARY STABILIZATION MEASURES WILL BE TAKEN TO ENSURE THAT SEDIMENT-LADEN STORMWATER DOES NOT IMPACT WATER QUALITY STANDARDS OF RECEIVING WATER BODIES. TEMPORARY STABILIZATION WILL INCLUDE MULCHING AND SEEDING OF DISTURBED AREAS, PERIMETER CONTROL OF STOCKPILE AREAS, AND COVERING TEMPORARY STOCKPILES WITH PLASTIC OR STABILIZING TEMPORARY STOCKPILES WITH STRAW MULCH.
13. WASHOUT CONCRETE TRUCK CHUTES AT DESIGNATED CONCRETE WASHOUT FACILITIES AWAY FROM PERMANENT STORM WATER MANAGEMENT FACILITIES AND ALLOW TO HARDEN FOR OFFSITE DISPOSAL (DETAIL SHEET EC-03).
14. WATTLES SHALL BE INSTALLED ALONG SLOPE CONTOURS OF DISTURBED SLOPES TO DECREASE RUNOFF VELOCITY. WATTLES WILL BE INSTALLED PERPENDICULAR TO FLOW AND PARALLEL TO THE SLOPE CONTOUR.
15. A COMPREHENSIVE LIST OF AVAILABLE BMP OPTIONS BASED ON THE ODEQ 1200-C PERMIT APPLICATION AND ESCP GUIDANCE DOCUMENT HAVE BEEN REVIEWED TO COMPLETE THIS EROSION AND SEDIMENT CONTROL PLAN. SOME OF THE BMPS THAT WILL BE UTILIZED ARE NOT DETAILED ON THIS PRELIMINARY EROSION AND SEDIMENT CONTROL PLAN. AS THE PROJECT PROGRESSES AND THERE IS A NEED TO REVISE THE EROSION AND SEDIMENT CONTROL PLAN THESE DETAILS WILL BE PROVIDED.
16. BMPS WILL FOCUS ON EROSION PREVENTION RATHER THAN SEDIMENT CONTROL.

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REV	DATE	DESCRIPTION

MADRAS PV1

JEFFERSON COUNTY
OREGON

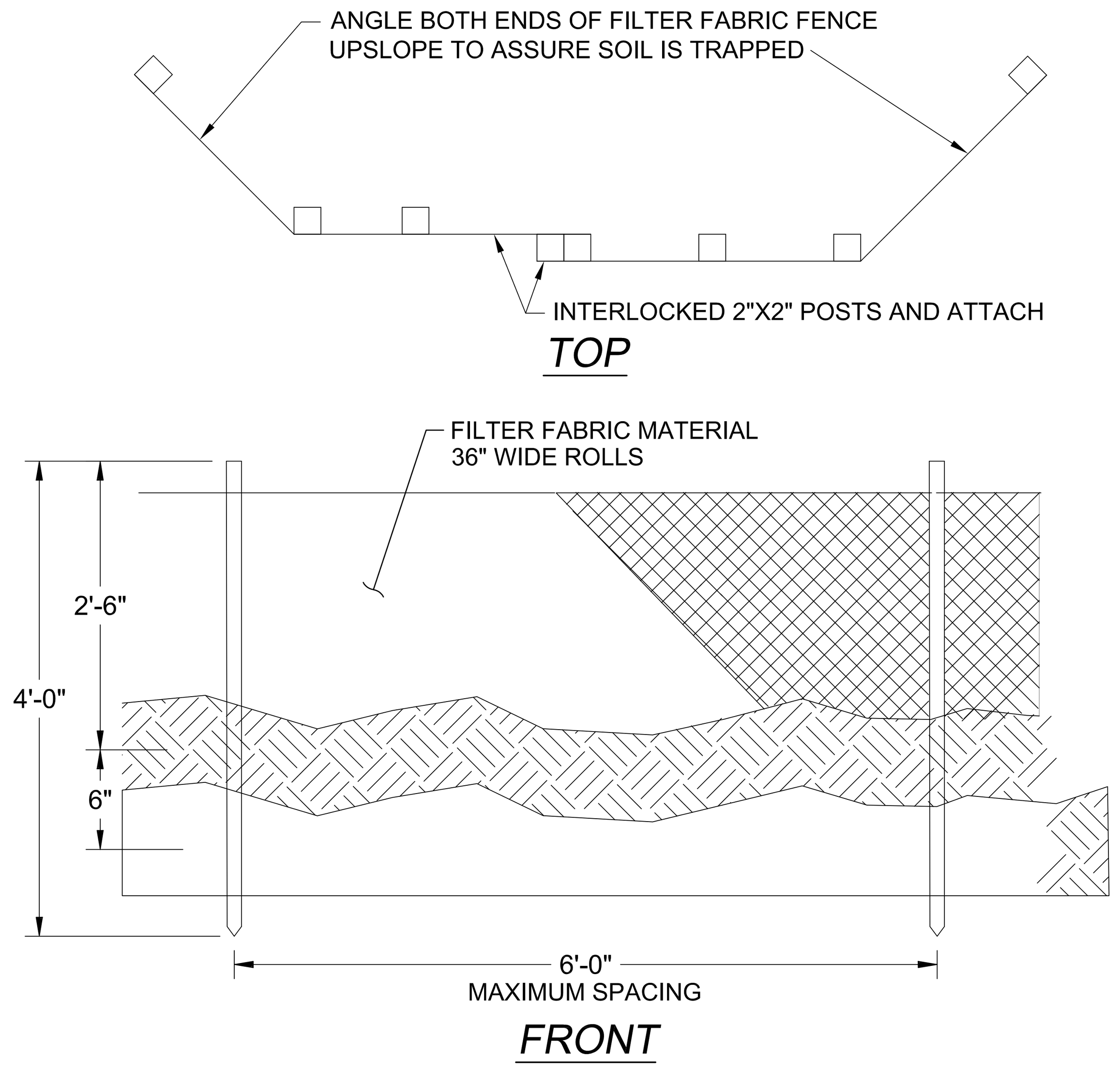
APPROVED BY:	BO
DESIGNED BY:	SB
DRAWN BY:	BG
SCALE:	NTS
DATE:	11/5/2019

DRAWING DESCRIPTION:

ESCP
NOTES

LEVEL C
DRAWING No:

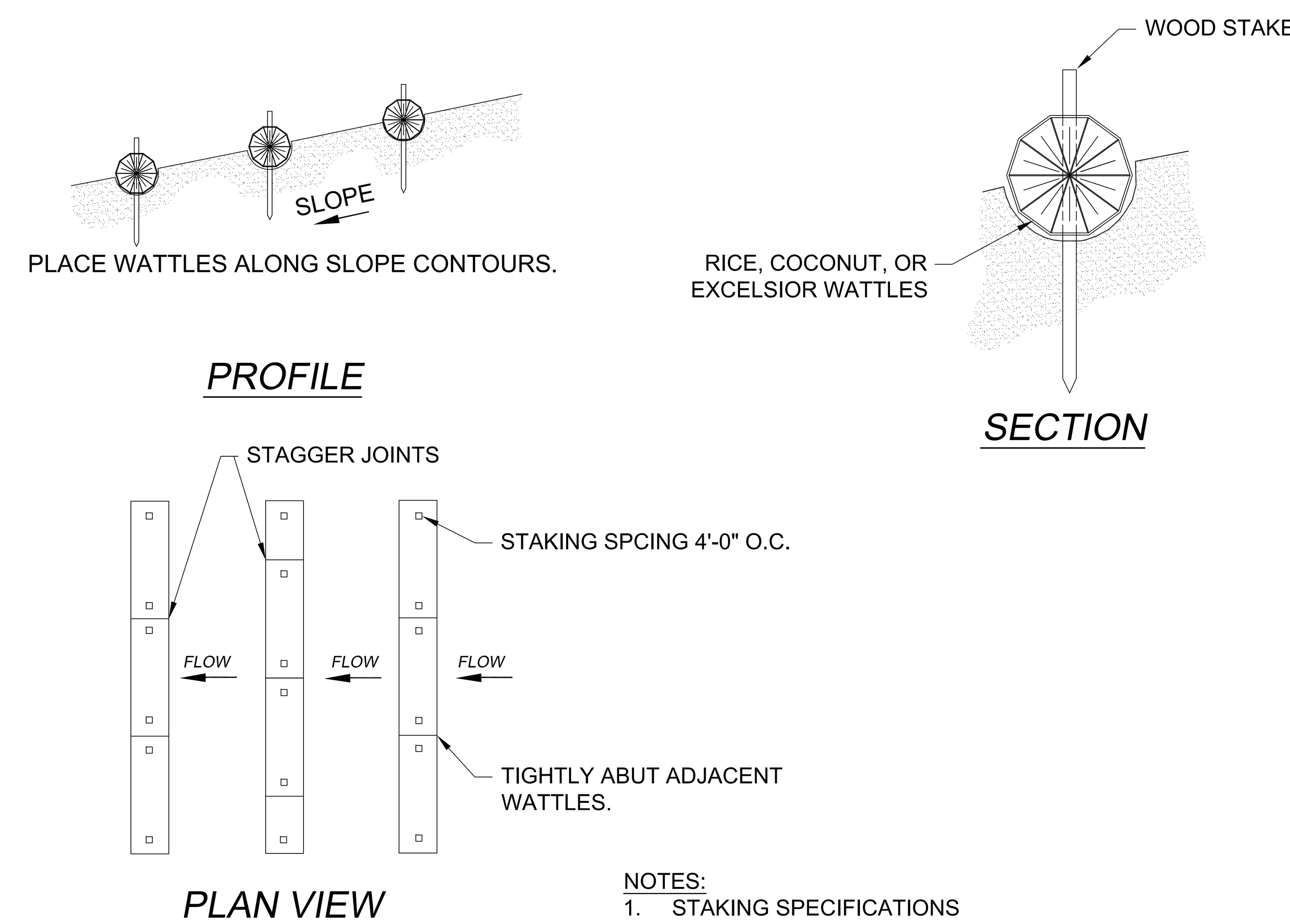
EC-02



NOTES:
1. BURY BOTTOM OF FILTER FABRIC 6" VERTICALLY BELOW FINISHED GRADE.
2. 2" x 2" FIR, PINE, OR STEEL FENCE POSTS.
3. STITCHED LOOPS TO BE INSTALLED UP HILL SIDE OF SLOPE.
4. COMPACT ALL AREAS OF FILTER FABRIC TRENCH.

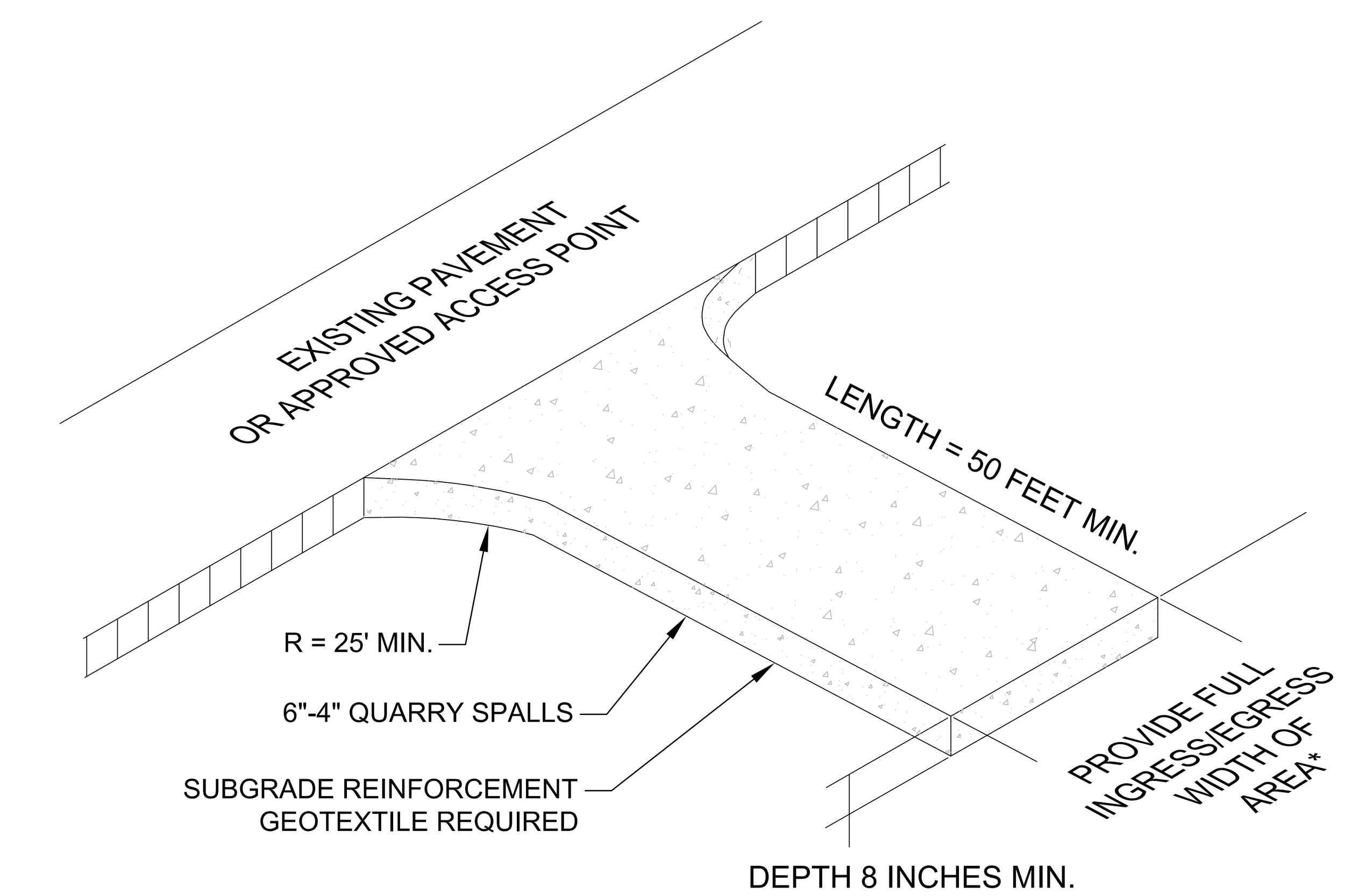
INSTALL ALONG CONTOURS AS FOLLOWS	
% SLOPE	MAXIMUM SPACING
10% OR FLATTER	300
10% TO 15%	150
15% TO 20%	100
20% TO 30%	50
30% TO 50%	25

FIELD FABRICATED SILT FENCE
NTS



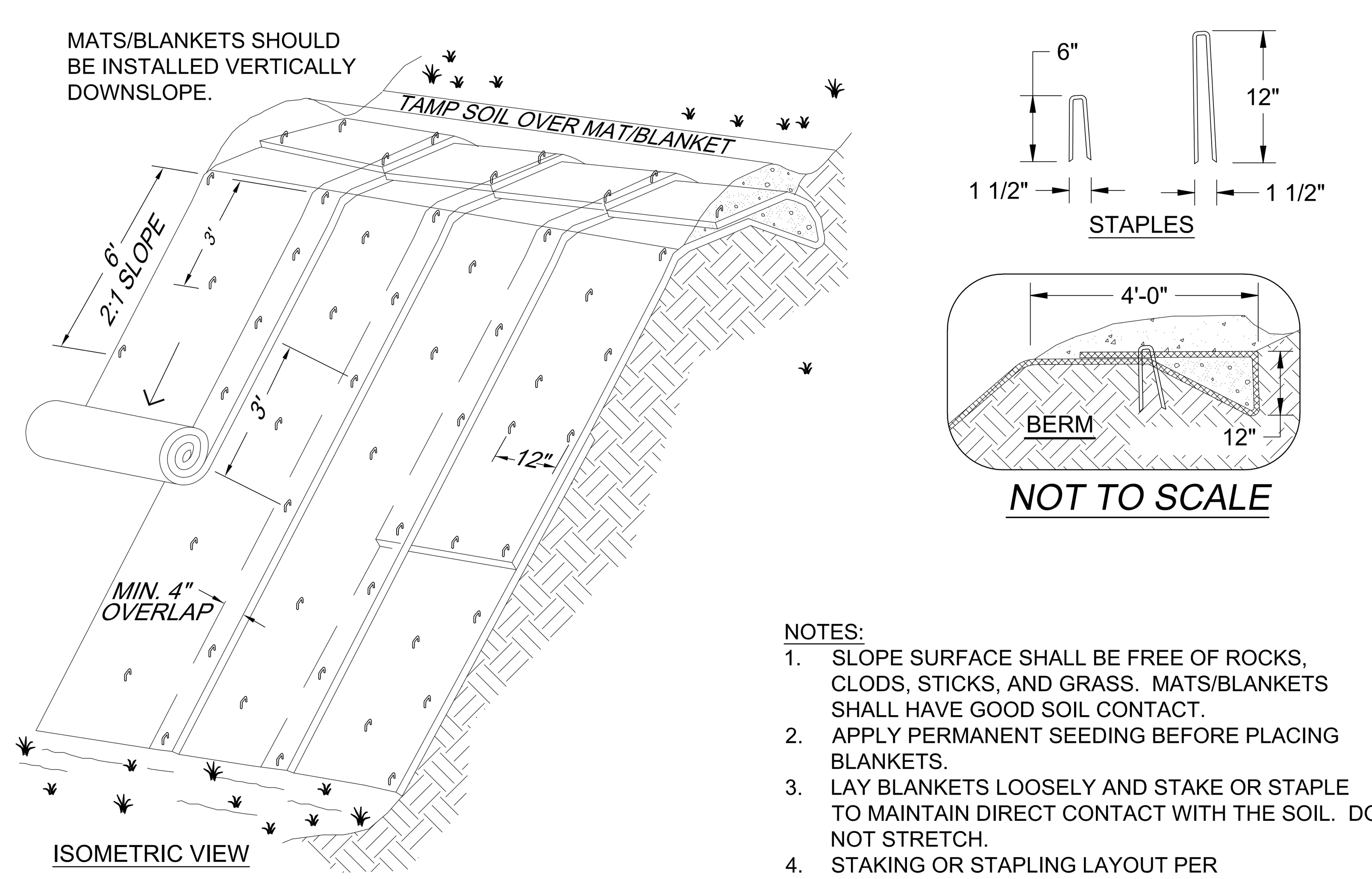
NOTES:
1. STAKING SPECIFICATIONS
   A. 1"X2" WOODEN STAKES
   B. ADDITIONAL STAKES MAY BE INSTALLED ON DOWNHILL SIDE OF WATTLES, ON STEEP SLOPE OR HIGHLY EROSIVE SOILS.
2. SPACING IN ACCORDANCE WITH DETAIL 940.

WATTLES
NTS



*20' MIN. FOR SINGLE FAMILY AND DUPLEX RESIDENTIAL

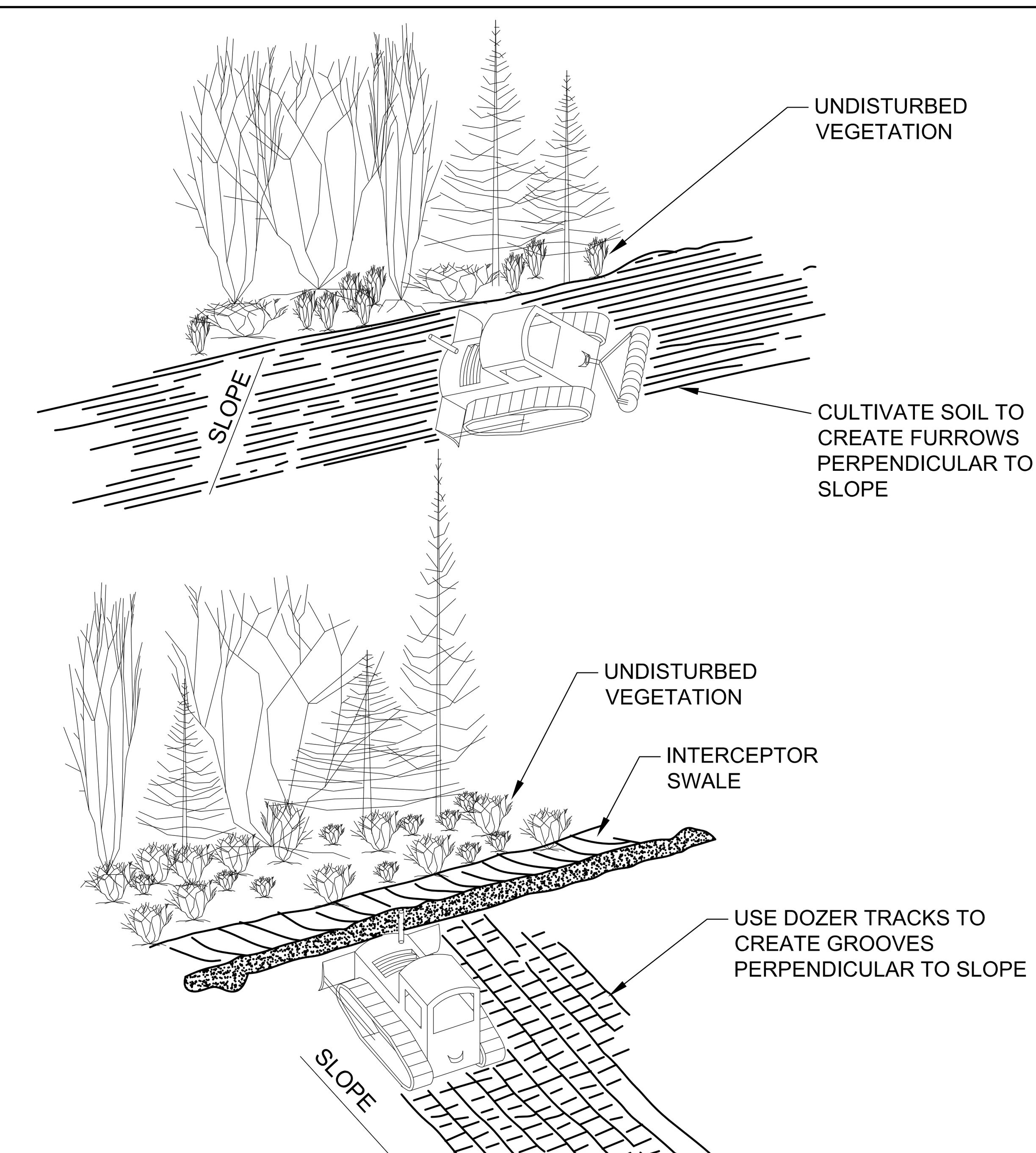
CONSTRUCTION ENTRANCE
NTS



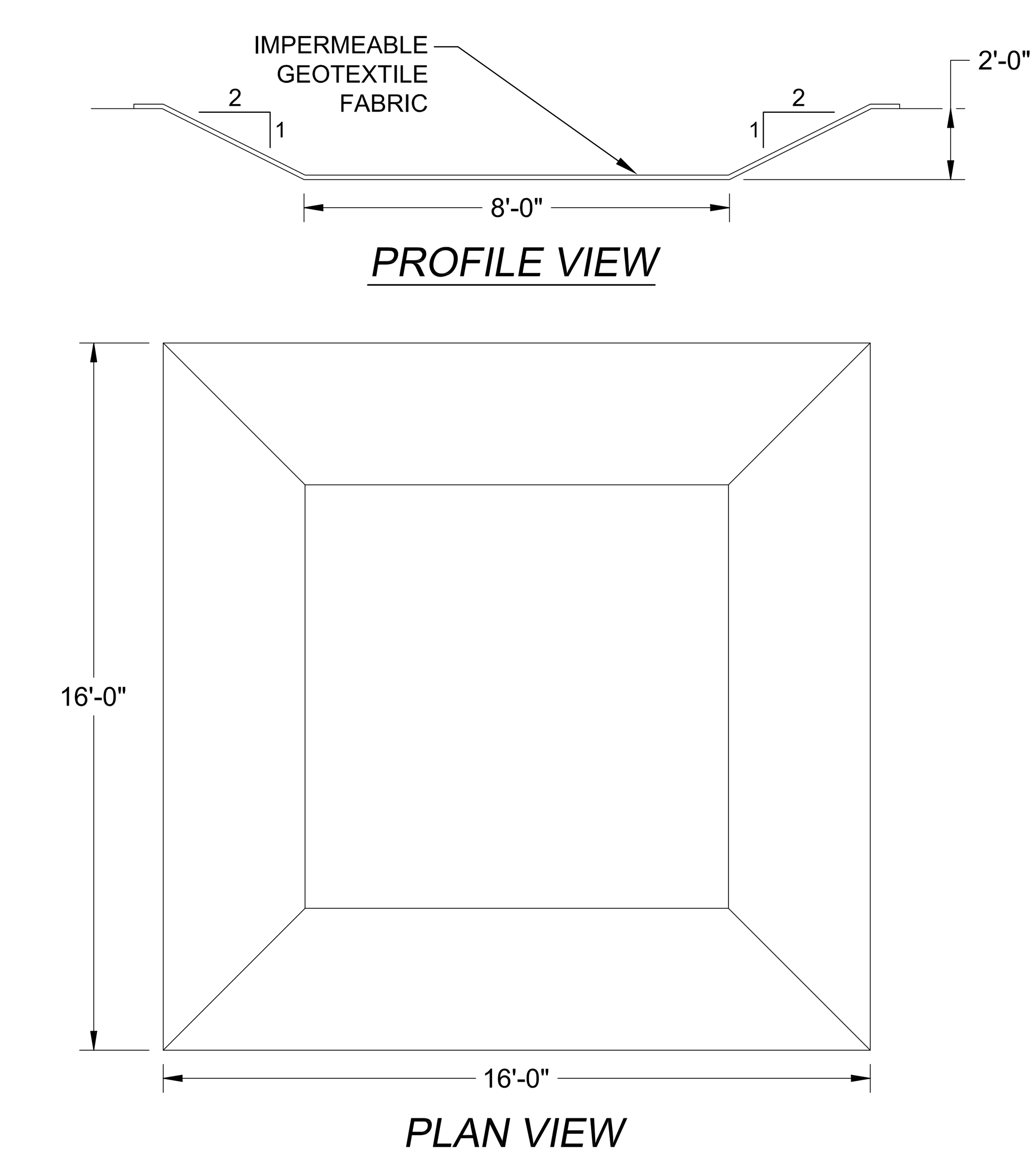
TYPICAL SLOPE SOIL STABILIZATION

NOTES:
1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS, AND GRASS. MATS/BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.
4. STAKING OR STAPLING LAYOUT PER MANUFACTURERS SPECIFICATIONS.

MATTING SLOPE INSTALLATION
NTS



SURFACE ROUGHENING - CAT TRACKING
NTS



NOTES:
1. PLACE IMPERMEABLE GEOTEXTILE FABRIC IN WASHOUT AREA.
2. ALLOW CONCRETE TO HARDEN AND WATER TO EVAPORATE IN WASHOUT AREA.
3. REMOVE IMPEREABLE GEOTEXTILE FABRIC WHEN WASHOUT AREA IS 2/3 FULL OF CONCRETE AND REPLACE WITH NEW FABRIC.

CONCRETE WASHOUT AREA
NTS

ecoplexus
ECOPLEXUS, Inc.
101 Second Street, Ste. 1250
San Francisco, CA 94105
Ph: 415-626-1802
Fx: 415-449-3466

REV	DATE	DESCRIPTION

MADRAS PV1
JEFFERSON COUNTY
OREGON

APPROVED BY:	BO
DESIGNED BY:	SB
DRAWN BY:	BG
SCALE:	NTS
DATE:	11/5/2019

DRAWING DESCRIPTION:
ESCP DETAILS

LEVEL C
DRAWING No:
EC-03

Attachment I-2
Letter from Oregon Department of Environmental Quality Confirming Receipt of NPDES Permit Application

To be submitted with final, complete application.

Attachment I-3
Site-specific Soil Survey
(Cascade Earth Sciences, 2018)

3511 Pacific Boulevard SW
Albany, OR 97321-7727 USA
P: 541.926.7737 | cascade-earth.com

September 7, 2018

Terrance Unrein
Ecoplexus, Inc.
101 2nd Street, Suite 1250
San Francisco, CA 94105

SUBJECT: Site-Specific Soil Survey of Property Located along Elk Drive, also known as T10S, R13E, Section 30, Tax Lot 600 (161.47 acres) and Section 31, Tax Lot 100 (317.98 acres), West of Madras in Jefferson County, Oregon

Dear Terrance:

Cascade Earth Sciences (CES) was retained to conduct a site-specific soil survey on a substantial portion of the above referenced parcels (Site) consisting of approximately 289 acres. The subject acreage is zoned Exclusive Farm Use (EFU) and consists of a total of 479.45 acres. Those areas not specifically evaluated generally consisted of steeper slopes with rocky soils leading into adjacent canyons. We understand that an application to Jefferson County is being prepared to request authorization for construction of a photovoltaic solar power station. The soil-related criteria for siting a solar facility are contained in OAR 660-033. The policy goals appear to favor siting solar facilities on "nonarable land" which is defined as being predominantly comprised of "nonarable soils." Nonarable soils are defined as all soils in land capability classes V through VIII with no history of irrigation. The primary purpose of this soil survey is to determine the land capability classification of soils at this Site and whether the Site is predominantly comprised of soils rated Class V through VIII and would therefore be considered "nonarable land." CES reviewed the published soil survey information and performed direct observations of soil conditions at representative locations throughout the subject property. CES has determined that the Site is predominantly comprised Class VI "nonarable soils" and is therefore "nonarable land."

The landowner stated to Ecoplexus that the relatively open area evaluated for this report was, at one time, cultivated for dryland crops (wheat and barley). The last attempt at cultivation was over 30 years ago (about 1987), according to the landowner. The Site does not have any water rights and there is no realistic potential for water rights in the future. The Site, therefore, has no history of irrigation.

PREVIOUS MAPPING AND BACKGROUND INFORMATION

Field work for the published soil survey was conducted in the early 1990s based on aerial photographs taken between 1976 and 1982, with final publication of the survey in 2002. Access by the soil scientists conducting the soil survey may have been limited at any given location due to a lack of accessibility (private property). The scale of the published soils map was 1:24,000 or 1 inch equal to 2,000 feet. The published soil survey is considered a second order or third order survey, depending on location.

A summary of published soil map units and key characteristics in and around the Site are presented in Table 1. Topographic information used in developing the soil survey was limited to interpretations of stereo pairs of the baseline aerial photos and previously published topographic maps. The topographic

map for the area (Madras West, Oregon. 7.5 minute quadrangle) was published in 1992 with a limited resolution (20-foot contour interval) for determining slope gradients. General topographic information for the area around the Site is shown on an excerpt of the U.S. Geological Survey (USGS) topographic map contained in Figure 1. An excerpt of the appropriate published soil survey map is contained in Figure 2. The published map units and associated acreages (estimated by the web soil survey), as well as relevant interpretations, are presented in Table 2. The portion of the tax lot map showing the parcels is provided in Figure 3.

Geology

The Site is shown within a geologic map published by the State of Oregon Department of Geology and Mineral Industries titled Geologic Map of the Madras West and Madras East Quadrangles, Jefferson County, Oregon. The geologic map units for the Site and surrounding area are Td and Tdtb.

Td is defined as

> *"**Deschutes Formation (upper Miocene and lower Pliocene)**—Coarse-grained volcanic sandstones, conglomerates, and debris-flow breccias interbedded with silicic ignimbrites (Tdi), air-fall lapillistones, and basalt (Tdb) and basaltic andesite (Tdba) lava flows. Volcanic units are mapped separately where exposed. No attitudes are shown within this unit on the map, although all units are gently inclined toward the basin axis as a reflection of primary dip (the slight dip of a bedded deposit at its moment of deposition), slight subsequent deformation, or both. For detailed description of Deschutes Formation in the map area, see Jay (1982) and Smith (1986b)".*

Tdtb is defined as

> *"**Tetherow Butte member, Agency Plains basalt flow (upper Miocene and lower Pliocene)**—Black fine-grained basalt with phenocrysts and glomerophenocrysts of plagioclase and augite. One of two flows erupted from Tetherow Butte, 35 km south of map area and, and dated at 5.31 +/- 0.05 m.y. B.P.; normal magnetic polarity".*

Hydrology

The subject acreage occurs on the upland terrace about a mile west of the Deschutes River canyon. The head of Hurbers Canyon begins in the northwest part of the Site. The rim along Dry Canyon occurs along the eastern boundary of the Site and the rim of Willow Canyon occurs along the northern boundary of the Site. There are no visible drainages within the study area although each of the referenced canyons likely carry water during periods of rapid snowmelt and/or heavy rain. Elevations within the study area range from about 2,400 feet near the northwest corner of the study area to about 2,370 feet near the southeast corner of the study area and near the head of Hurbers Canyon. The slope varies from nearly level (0 to 1 percent) across much of the study area with various areas being gently rolling with slopes up to 8 percent. Steeper slopes occur around the northwest, north, and east edges of the Site as the topography transitions into the adjacent canyons.

REVIEW OF PUBLISHED INFORMATION

The soil map units on the Site and in the immediate vicinity are shown on Map Sheets 6 and 11 of the Soil Survey of Upper Deschutes River Area, Oregon (USDA/NRCS) issued in 2002. A copy of the soils

map from the original soil survey (at the scale mapped and published) is shown on Figure 2. In addition, a copy of a custom web soil survey including the Site is attached as Appendix A. According to the soil survey map, the following soil map units occur on or near the property.

- Map unit 87A, Madras loam, 0 to 3 percent slopes. Madras soils are typically moderately deep, well drained, and formed in loess over volcaniclastic sediment of the Deschutes Formation on lava plains and hills. This soil map unit is expected to be composed of 85 percent Madras soils and similar inclusions and 15 percent contrasting inclusions.
- Map unit 87B, Madras loam, 3 to 8 percent slopes. Madras soils are typically moderately deep, well drained, and formed in loess over volcaniclastic sediment of the Deschutes Formation on lava plains and hills. This soil map unit is expected to be composed of 85 percent Madras soils and similar inclusions and 15 percent contrasting inclusions.
- Map unit 119D, Simas-Ruckles complex, 15 to 40 percent south slopes. This soil map unit predominantly consists of Simas soils on toe slopes and Ruckles soils on midslopes of canyon sides. Simas soils are typically very deep, well drained, and formed in colluvium. Ruckles soils are typically shallow, well drained, and formed in colluvium. This soil map unit is expected to be composed of 50 percent Simas soils and similar inclusions, 35 percent Ruckles soils and similar inclusions, and 15 percent contrasting inclusions.
- Map unit 120F, Simas-Ruckles-Rock outcrop complex, 40 to 80 percent north slopes. This soil map unit predominantly consists of Simas soils on toe slopes and Ruckles soils on midslopes, and Rock outcrop on upper slopes of canyon sides. Simas soils are typically very deep, well drained, and formed in colluvium. Ruckles soils are typically shallow, well drained, and formed in colluvium. This soil map unit is expected to be composed of 50 percent Simas soils and similar inclusions, 35 percent Ruckles soils and similar inclusions, 10 percent Rock outcrop, and 5 percent contrasting inclusions.
- Map unit 121F, Simas-Ruckles-Rock outcrop complex, 40 to 80 percent south slopes. This soil map unit predominantly consists of Simas soils on toe slopes and Ruckles soils on midslopes, and Rock outcrop on upper slopes of canyon sides. Simas soils are typically very deep, well drained, and formed in colluvium. Ruckles soils are typically shallow, well drained, and formed in colluvium. This soil map unit is expected to be composed of 50 percent Simas soils and similar inclusions, 35 percent Ruckles soils and similar inclusions, 10 percent Rock outcrop, and 5 percent contrasting inclusions.

A summary of the key characteristics, including land capability classification, for each of these soil map units, their components, and various potential inclusions is presented in Table 1.

FIELD OBSERVATIONS AND SUMMARY OF REFINEMENTS

Soils are a product of the five soil-forming factors. Soils form as a result of "the integrated effect of climate and living matter acting upon parent material, as conditioned by relief, over periods of time" (The Nature and Property of Soils, Ninth Edition, by Nyle C. Brady, 1984). Landscape position, slope, soil depth and texture, presence and relative volume of coarse fragments, among other observable characteristics, were important factors in determining soil capability classes and delineating their boundaries. Vegetation (type, density, and relative vigor) was also considered in the process.

Methods

Brian Rabe of CES, Certified Professional Soil Scientist (No. 15239), conducted this soils assessment. A review of the published information pertaining to the anticipated soil map units and associated soils provided a means of focusing the field efforts on those criteria that quickly and easily distinguished the soil map units, or components, from one another (Table 1).

Mr. Rabe conducted field work on this Site to gather site-specific information on June 8, 11, and 12, and July 13, 2018. Soil conditions were observed and/or described at 106 representative locations within the approximate 289-acre area of interest. Locations were marked on a copy of a recent aerial photograph (Google earth image from April 19, 2015) with an approximate scale of 1:7,200 (or about 1 inch = 600 feet) using various visible landmarks noted during the site visit. Several diagnostic criteria were documented at each location, including depth (using an auger), soil texture, and coarse fragment content, as well as soil color (using a Munsell color chart), slope (using a clinometer), aspect (using a compass), and existing vegetation. A summary of observed soil conditions, key criteria, and relevant interpretations is provided in Table 3. Photos of representative observation points are included in Appendix B.

Relationships between landscape position, slope, vegetation, and other relevant features were observed for further consideration, interpretation, and soil boundary delineation. This mapping effort is considered a first order survey. Despite an average intensity of about one test hole or observation point every three acres, there are still likely both similar and contrasting inclusions within each delineation. The approximate location of each observation point, revised soil map unit boundaries, and a legend of the applicable soil map units are shown on Figure 4.

Discussion of Observations and Results

This effort is somewhat different than typical resource versus non-resource soil survey efforts in that there is no consideration of productivity elements – simply land capability classification. Since Class V soils are relatively unique and uncommon in Oregon, this project focused on the criteria that separates Class IV from Class VI soils. Using the Guide for Placing Soils in Capability Classes in Oregon (revised June 1977), soils less than 20 inches deep that are not irrigated are considered Class /VI. The soils shown on the published soil survey within the area of interest consisted of soil map units comprised primarily of the Madras series. Madras soils are typically 23 inches deep over consolidated sediment and basalt, which is slightly deeper than the minimum for Class IV soils. A primary focus of the efforts at this Site, as it directly related to land capability classification, was depth. Soils less than 20 inches deep to refusal were considered Class VI and soils 20 inches or more deep were considered Class IV. One of the listed inclusions in the Madras map units are soils in the Cullius series. Cullius soils occur on lava plains, are Class VI soils that are less than 20 inches deep, and typically have a higher clay content at depth. Where shallower soils were observed adjacent to deeper soils, the boundary was estimated based partially on the interpolated distance where the depth would have been 20 inches. Madras and Cullius soils occur on the same landform (lava plains), have the same vegetation (western juniper, basin big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Idaho fescue), with depth being a key differentiating characteristic. A few of the locations identified as Madras had soil depths substantially deeper than is typical but were too loamy to be considered Era (Era soils are a listed inclusion that is deeper but typically has textures of sandy loam and are Class VI). The loamy nature of the soils and the low moisture content made using a push probe unworkable so all points were advanced with an auger which

resulted in fewer holes than might otherwise have been possible for boundary refinement. The remaining areas within the tax lots outside of the area of interest consist primarily of soils on steeper slopes that, although typically Class VI or Class VII, would not be well suited for the installation of solar panels.

ACREAGE DETERMINATIONS FOR HIGH RESOLUTION MAPPING

The area of each delineation mapped within the Site as part of this effort was determined using a computer aided drafting program (Autodesk Civil 3D). The results of these measurements are presented in Figure 4. Of the 288.91 acres evaluated, 160.17 acres, or 55.4 percent, are represented by Cullius (Class VI) soils in map units 30A and 30B. The remaining 128.74 acres, or 44.6 percent of the total, are represented by Madras soils (Class IV) in maps units 87A and 87B. Since the Site predominantly consists of nonarable (Class VI) soils, the site is considered nonarable land.

SUMMARY AND CONCLUSIONS

The purpose of this report is to present the results of an assessment to verify and, where necessary, refine the soils, map units, and boundaries mapped on the Site and to determine whether the soils on the Site meet the land capability classification criteria for siting a solar farm. The published soil survey information was reviewed and direct observations of soil conditions were made at representative locations across the Site. CES has determined that the information from the published soil survey required refinement. CES was able to determine the presence and extent of arable and nonarable soils. CES has determined that 160.17 acres of the Site consists of nonarable (Class VI) soils. Since the nonarable soils represents more than 50 percent of the total acreage, the Site is classified as nonarable land as defined in the applicable rules for siting a solar facility.

If you have any questions or comments, please do not hesitate to contact me directly at (541) 812-6639.

Sincerely,
CASCADE EARTH SCIENCES

Brian T. Rabe, CPSS, WWS
Managing Soil Scientist

BTR/mjb

Enc: Table 1. NRCS Map Units and Key Characteristics
Table 2. Map Unit Acreage and Interpretations (NRCS Mapping)
Table 3. Summary of Soil Test Hole Information
Figure 1. USGS Topographic Map
Figure 2. NRCS Soils Map
Figure 3. Tax Lot Map
Figure 4. Site Specific Soils Map
Appendix A. Web Soil Survey
Appendix B. Site Photographs
Doc: 2018240031 Ecoplexus (Madras) LU Soils Report.docx

CPSS
Certified Professional
Soil Scientist
BRIAN T. RABE
15239 Exp. 12/31/18
Registered Wastewater Specialist
No. EH W 448430 Exp. 9/30/18

TABLES

Table 1. NRCS Map Units and Key Characteristics

Map Unit	Unit Name	Slope (%)	Depth (inches)	Drainage Class	Surface Color (moist)	Texture	Parent Material	Landscape Position	Vegetation	Available Water Holding Capacity	Land Capability Classification (non-irrigated/irrigated)	Distinctive Feature(s)
30A	Cullius loam	0 to 3	18 (10 to 20)	Well drained	10YR 3/2	Loam	Loess over colluvium and semiconsolidated sediment	Lava plains	Western juniper, basin big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Idaho fescue	Low (about 2.5 inches)	6s / 4s	Depth to welded tuff of the Deschutes Formation less than 20"
30B	Cullius loam	3 to 8	18 (10 to 20)	Well drained	10YR 3/2	Loam	Loess over colluvium and semiconsolidated sediment	Lava plains	Western juniper, basin big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Idaho fescue	Low (about 2.5 inches)	6e / 4e	Depth to welded tuff of the Deschutes Formation less than 20"
44B	Era sandy loam	3 to 8	60 or more	Well drained	10YR 3/2	Sandy loam	Ash over old alluvium	Hills	Western juniper, basin big sagebrush, antelope bitterbrush, needleandthread, and Indian ricegrass	About 7 inches	6e / 3e	Depth to bedrock greater than 60"
87A	Madras loam	0 to 3	27 (20 to 40)	Well drained	10YR 3/3	Loam	Loess over semiconsolidated sediment	Lava plains	Western juniper, basin big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Idaho fescue	Low (about 4 inches)	4c / 3c	Depth to bedrock between 20" and 40"
87B	Madras loam	3 to 8	27 (20 to 40)	Well drained	10YR 3/3	Loam	Loess over semiconsolidated sediment	Lava plains	Western juniper, basin big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Idaho fescue	Low (about 4 inches)	4c / 3c	Depth to bedrock between 20" and 40"
119D	Simas-Ruckles complex, south slopes	15 to 40	--	--	--	--	--	--	--	--	--	--
	Simas part		> 60	Well drained	10YR 2/2	Cobbly loam	Colluvium	Hills and canyonsides	Western juniper, Wyoming big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Sandberg bluegrass	About 7 inches	6e / --	Depth to bedrock between 20" and 40"
	Ruckles part	--	19 (10 to 20)	Well drained	10YR 2/2	Extremely cobbly loam	Colluvium	Canyonsides	Western juniper, Wyoming big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Sandberg bluegrass	Very Low (about 1 inch)	7e / --	Depth to bedrock between 10" and 20"
120F	Simas-Ruckles-Rock outcrop complex, north slopes	40 to 80	--	--	--	--	--	--	--	--	--	--
	Simas part		> 60	Well drained	10YR 2/2	Cobbly loam	Colluvium	Hills and canyonsides	Western juniper, Wyoming big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Sandberg bluegrass	About 7 inches	6e / --	Depth to bedrock between 20" and 40"
	Ruckles part	--	19 (10 to 20)	Well drained	10YR 2/2	Extremely cobbly loam	Colluvium	Canyonsides	Western juniper, Wyoming big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Sandberg bluegrass	Very Low (about 1 inch)	7e / --	Depth to bedrock between 10" and 20"
	Rock Outcrop part	--	--	--	--	--	--	--	--	--	8s / --	--
121F	Simas-Ruckles-Rock outcrop complex, south slopes	40 to 80	--	--	--	--	--	--	--	--	--	--
	Simas part		> 60	Well drained	10YR 2/2	Cobbly loam	Colluvium	Hills and canyonsides	Western juniper, Wyoming big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Sandberg bluegrass	About 7 inches	6e / --	Depth to bedrock between 20" and 40"
	Ruckles part	--	19 (10 to 20)	Well drained	10YR 2/2	Extremely cobbly loam	Colluvium	Canyonsides	Western juniper, Wyoming big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Sandberg bluegrass	Very Low (about 1 inch)	7e / --	Depth to bedrock between 10" and 20"
	Rock Outcrop part	--	--	--	--	--	--	--	--	--	8s / --	--

NOTES:

Abbreviations: -- = no data, c = climate, e = erosion, s = shallow, NRCS = Natural Resources Conservation Service, " = inch.

Table 2. Map Unit Acreage and Interpretations (NRCS Mapping)

Map Symbol	Unit Name	Acreage [1]	Land Capability Class [2]	
			non-irrigated	irrigated
87A	Madras loam, 0 to 3 percent slopes	102.1	4c	3c
87B	Madras loam, 3 to 8 percent slopes	211.7	4e	3e
120F	Simas-Ruckles-Rock outcrop complex, 40 to 80 percent north slopes	77.7	--	--
	Simas part (normalized at 52.6 percent of map unit)	40.9	6e	--
	Ruckles part (normalized at 36.8 percent of map unit)	28.6	7e	--
	Rock outcrop part (normalized at 10.5 percent of map unit)	8.2	8	--
121F	Simas-Ruckles-Rock outcrop complex, 40 to 80 percent south slopes	83.5	--	--
	Simas part (normalized at 52.6 percent of map unit)	43.9	6e	--
	Ruckles part (normalized at 36.8 percent of map unit)	30.8	7e	--
	Rock outcrop part (normalized at 10.5 percent of map unit)	8.8	8	--
Total		**475.0**		

Notes:

Abbreviations: -- no data, c = climate, e = erosion, s = shallow, NRCS = Natural Resources Conservation Service.

1 Complexes contain unspecified inclusions (both similar and contrasting) so the named components do not add up to 100 percent. The values shown are normalized to adjusted the percentages and associated acreage values so they sum to 100 percent.

2 Land Capability Class as published in the Soil Survey of Upper Deschutes River Area, Oregon (NRCS, 2002).

Table 3. Summary of Soil Test Hole Information

Observation Point	Depth (inches)	Texture[1]	Color	Slope (percent) / Aspect	Notes	Series	Land Capability Classification
E1	0-4	L	10YR 3/2	1 / NNW		Madras	4
	4-12	L	10YR 3/3				
	12-24	L	10YR 4/3				
	24	Refusal					
E3	0-6	L	10YR 3/2	1 / SW		Madras	4
	6-20	L	10YR 3/3				
	20-44	L	10YR 4/3				
	44	Refusal					
E5	0-6	L	10YR 3/2	6 / NW		Madras	4
	6-20	L	10YR 3/3				
	20-40	L	10YR 3/3				
	40	Refusal					
E7	0-6	L	10YR 3/2	2 / SW	10% gravel	Cullius	6
	6-15	CL	10YR 3/2		10% gravel		
	15	Refusal					
E9	0-5	L	10YR 3/2	3 / S	10% gravel	Cullius	6
	5-11	CL	10YR 3/2		10% gravel		
	11	Refusal					
E11	0-10	L	10YR 3/2	1 / NW		Madras	4
	10-20	L	10YR 3/3				
	20-30	L	10YR 3/3		10% gravel		
	30	Refusal					
C11	0-4	L	10YR 3/2	1 / SE	10% gravel	Cullius	6
	4-8	CL	10YR 3/2		10% gravel		
	8	Refusal					
C9	0-6	L	10YR 3/2	2 / S	10% gravel	Cullius	6
	6-12	CL	10YR 3/3		10% gravel		
	12	Refusal					
G11	0-6	L	10YR 3/2	1 / SE		Cullius	6
	6-15	CL	10YR 3/3				
	15	Refusal					
G9	0-6	L	10YR 3/2	2 / S		Cullius	6
	6-11	CL	10YR 3/3				
	11	Refusal					
I9	0-6	L	10YR 3/2	2 / SSW		Cullius	6
	6-12	CL	10YR 3/3				
	12	Refusal					
K9	0-6	L	10YR 3/2	5 / NNE		Cullius	6
	6-14	CL	10YR 3/3				
	14	Refusal					
K7	0-10	L	10YR 3/2	3 / S		Madras	4
	10-20	L	10YR 3/2		10% gravel		
	20-28	L	10YR 4/3		with 10YR 7/3 diatomaceous earth (?)		
	28	Refusal					
K5	0-5	L	10YR 3/2	3 / E		Cullius	6
	5-9	CL	10YR 3/3				
	9	Refusal					
K3	0-6	L	10YR 3/2	1 / SE		Cullius	6
	6-14	CL	10YR 3/3				
	14	Refusal					
K1	0-8	L	10YR 3/2	1 / S		Madras	4
	8-20	L	10YR 3/2		10% gravel		
	20-29	Gr L	10YR 4/3		20% gravel		
	29	Refusal					
I1	0-8	L	10YR 3/2	1 / S		Cullius	6
	8-17	CL	10YR 3/2		10% gravel		
	17	Refusal					
G1	0-8	L	10YR 3/2	1 / SW		Cullius	6
	8-19	CL	10YR 3/2		10% gravel		
	19	Refusal					

Table 3. Summary of Soil Test Hole Information

Observation Point	Depth (inches)	Texture[1]	Color	Slope (percent) / Aspect	Notes	Series	Land Capability Classification
C1	0-8	L	10YR 3/2	1 / S		Cullius	6
	8-19	L - CL	10YR 3/3		10% gravel		
	19	Refusal					
A1	0-4	L	10YR 3/2	2 / S		Cullius	6
	4-8	L - CL	10YR 3/3				
	8	Refusal					
A3	0-8	L	10YR 3/2	3 / SSE		Madras	4
	8-20	L	10YR 3/3				
	20-28	L - CL	10YR 3/3		10% gravel		
	28	Refusal					
A5	0-6	L	10YR 3/2	4 / ENE		Cullius	6
	6-14	L - CL	10YR 3/3				
	14	Refusal					
C5	0-8	L	10YR 3/2	6 / NNW		Madras	4
	8-20	L	10YR 3/2-3				
	20-40	L	10YR 3/3				
	40-52	SL	10YR 3/2				
	52	Refusal					
C3	0-8	L	10YR 3/2	3 / SSE	10% gravel	Madras	4
	8-20	L	10YR 3/2-3				
	20-28	L	10YR 3/3		10% gravel		
	28-35	L	10YR 3/3				
	35	Refusal					
G3	0-8	L	10YR 3/2	2 / SE		Cullius	6
	8-18	L - CL	10YR 3/3				
	18	Refusal					
I3	0-8	L	10YR 3/2	1 / S		Cullius	6
	8-18	L - CL	10YR 3/2-3				
	18	Refusal					
I5	0-8	L	10YR 3/2	1 / S		Madras	4
	8-20	L	10YR 3/2-3				
	20-25	L - CL	10YR 3/3		10% gravel		
	25	Refusal					
G5	0-10	L	10YR 3/2	2 / NE		Madras	4
	10-20	L	10YR 3/3		10% gravel		
	20	Refusal					
G7	0-8	L	10YR 3/2	1 / NW		Madras	4
	8-18	L - CL	10YR 3/3				
	18-24	L - CL	10YR 3/2				
	24	Refusal					
I7	0-10	L	10YR 3/2	2 / SE		Madras	4
	10-20	L	10YR 3/2-3				
	20-24	L - CL	10YR 3/2		10% gravel		
	24	Refusal					
M7	0-8	L	10YR 3/2	3 / ESE		Cullius	6
	8-19	L - CL	10YR 3/2				
	19	Refusal					
M3	0-6	L	10YR 3/2	4 / NNE		Cullius	6
	6-13	CL	10YR 3/3				
	13	Refusal					
M1	0-6	L	10YR 3/2	2 / SE		Cullius	6
	6-17	CL	10YR 3/3				
	17	Refusal					
D1	0-8	L	10YR 3/2	1 / SW		Madras	4
	8-20	L - CL	10YR 3/2-3				
	20-28	L - CL	10YR 3/3				
	28	Refusal					
C2	0-6	L	10YR 3/2	2 / NNE		Cullius	6
	6-11	CL	10YR 3/3				
	11	Refusal					

Table 3. Summary of Soil Test Hole Information

Observation Point	Depth (inches)	Texture[1]	Color	Slope (percent) / Aspect	Notes	Series	Land Capability Classification
A2	0-6	L	10YR 3/2	1 / SE		Cullius	6
	6-16	L - CL	10YR 3/3				
	16	Refusal					
B2	0-10	L	10YR 3/2	2 / WSW		Madras	4
	10-20	L - CL	10YR 3/2-3				
	20	Refusal					
B3	0-6	L	10YR 3/2	1 / NW		Madras	4
	6-18	L - CL	10YR 3/2-3				
	18-25	L - CL	10YR 3/2		10% gravel		
	25	Refusal					
B4	0-4	L	10YR 3/2	1 / N		Cullius	6
	4-8	L - CL	10YR 3/2-3				
	8	Refusal					
A4	0-6	L	10YR 3/2	3 / E		Cullius	6
	6-12	Gr L - CL	10YR 3/3		15% gravel		
	12	Refusal					
B5	0-8	L	10YR 3/2	4 / NE		Madras	4
	8-20	CL	10YR 3/3				
	20-34	L - CL	10YR 3/2-3				
	34	Refusal					
B6	0-4	L	10YR 3/2	6 NNE		Cullius	6
	4-8	L - CL	10YR 3/2-3				
	8	Refusal					
A6	0-10	L	10YR 3/2	7 / NE		Madras	4
	10-20	L	10YR 3/2-3				
	20-39	L	10YR 3/2-3		10% gravel		
	39	Refusal					
C6	0-8	L	10YR 3/2	10 / N	10% gravel and stones	Cullius	6
	8	Refusal					
D6	0-8	L	10YR 3/2	6 / NW		Madras	4
	8-23	CL	10YR 3/3				
	23	Refusal					
E6	0-4	L	10YR 3/2	2 / WNW		Cullius	6
	4-9	CL	10YR 3/3				
	9	Refusal					
D8	0-8	L	10YR 3/2	5 / SSW		Cullius	6
	8-15	L - CL	10YR 3/2-3				
	15	Refusal					
E10	0-5	L	10YR 3/2	2 / SSW		Cullius	6
	5-9	CL	10YR 3/3				
	9	Refusal					
D10	0-6	L	10YR 3/2	1 / SE		Madras	4
	6-12	Gr CL	10YR 3/3		15% gravel		
	12-22	CL	10YR 4/3				
	22	Refusal					
C10	0-6	L	10YR 3/2	3 / SE		Cullius	6
	6-13	L - CL	10YR 3/3		10% gravel		
	13	Refusal					
D11	0-8	L	10YR 3/2	1 / ESE		Cullius	6
	8	Refusal					
F11	0-5	L	10YR 3/2	3 / S		Cullius	6
	5-11	CL	10YR 3/3				
	11	Refusal					
F10	0-8	L	10YR 3/2	1 / S		Madras	4
	8-15	L - CL	10YR 3/2-3				
	15-22	L - CL	10YR 3-3				
	22	Refusal					
G10	0-4	L	10YR 3/2	1 / S		Cullius	6
	4-8	CL	10YR 3/3		10% gravel		
	8	Refusal					

Table 3. Summary of Soil Test Hole Information

Observation Point	Depth (inches)	Texture[1]	Color	Slope (percent) / Aspect	Notes	Series	Land Capability Classification
D9	0-8	L	10YR 3/2	2 / SSE		Madras	4
	8-20	L - CL	10YR 3/2-3				
	20-33	L - CL	10YR 3/2-3		10% gravel		
	33	Refusal					
C8	0-6	L	10YR 3/2	4 / S		Cullius	6
	6-12	CL	10YR 3/3		10% gravel		
	12	Refusal					
D2	0-8	L	10YR 3/2	1 / E		Madras	4
	8-16	L - CL	10YR 3/2-3				
	16-25	L - CL	10YR 3/2-3		10% gravel		
	25	Refusal					
F1	0-8	L	10YR 3/2	1 / SE		Cullius	6
	8-18	CL	10YR 3/3		10% gravel		
	18	Refusal					
F2	0-8	L	10YR 3/2	1 / SE		Madras	4
	8-16	L - CL	10YR 3/2-3				
	16-21	CL	10YR 3/3		10% gravel		
	21	Refusal					
F3	0-8	L	10YR 3/2	1 / SE		Madras	4
	8-18	L - CL	10YR 3/2-3				
	18-26	CL	10YR 3/3		10% gravel		
	26	Refusal					
F4	0-10	L	10YR 3/2	5 / E		Madras	4
	10-28	L - CL	10YR 3/2-3				
	28-54+	L	10YR 3/2				
F5	0-10	Gr L	10YR 3/2	4 / NW	25% fine gravel (pumice)	Madras	4
	10-28	Gr L - CL	10YR 3/2-3		25% fine gravel (pumice)		
	28-44+	Gr L	10YR 3/2		25% fine gravel (pumice)		
F6	0-6	L	10YR 3/2	2 / W		Cullius	6
	6-12	CL	10YR 3/3				
	12	Refusal					
F7	0-8	L	10YR 3/2	3 / NW		Cullius	6
	8-17	CL	10YR 3/3		10% gravel		
	17	Refusal					
G8	0-6	L	10YR 3/2	2 / SW		Cullius	6
	6-14	CL	10YR 3/3		10% gravel		
	14	Refusal					
H8	0-8	L	10YR 3/2	2 / SW		Cullius	6
	8-16	L - CL	10YR 3/3				
	16	Refusal					
I8	0-8	L	10YR 3/2	2 / SW		Cullius	6
	8-17	CL	10YR 3/3				
	17	Refusal					
J8	0-8	L	10YR 3/2	3 / SW		Madras	4
	8-24	CL	10YR 3/3				
	24-26	L	10YR 5/3		with weathered bedrock (saprolite)		
	26	Refusal					
K8	0-8	L	10YR 3/2	2 / E		Madras	4
	8-20	L - CL	10YR 3/3				
	20	Refusal					
L8	0-6	L	10YR 3/2	6 / NE		Cullius	6
	6-14	L - CL	10YR 3/3				
	14	Refusal					
J9	0-8	L	10YR 3/2	3 / NNW		Madras	4
	8-16	L - CL	10YR 3/2-3				
	16-22	CL	10YR 3/3				
	22	Refusal					
J10	0-8	L	10YR 3/2	6 / ENE		Madras	4
	8-16	L - CL	10YR 3/2-3				
	16-24	L - CL	10YR 3/2				
	24	Refusal					

Table 3. Summary of Soil Test Hole Information

Observation Point	Depth (inches)	Texture[1]	Color	Slope (percent) / Aspect	Notes	Series	Land Capability Classification
I10	0-10	L	10YR 3/2	4 / NNE		Madras	4
	10-20	L - CL	10YR 3/2-3				
	20-30	L	10YR 3/2-3				
	30	Refusal					
H10	0-5	L	10YR 3/2	1 / SE		Cullius	6
	5-10	CL	10YR 3/3				
	10	Refusal					
H9	0-8	L	10YR 3/2	2 / SW		Madras	4
	8-16	CL	10YR 3/3				
	16-22	CL	10YR 3/2				
	22	Refusal					
J1	0-8	L	10YR 3/2	1 / ENE		Cullius	6
	8-16	CL	10YR 3/3				
	16	Refusal					
L1	0-8	L	10YR 3/2	2 / ESE		Madras	4
	8-16	L - CL	10YR 3/2-3				
	16-24	CL	10YR 3/3		10% gravel		
	24	Refusal					
K2	0-7	L	10YR 3/2	1 / SW		Cullius	6
	7-14	CL	10YR 3/3				
	14	Refusal					
J2	0-8	L	10YR 3/2	2 / SE		Madras	4
	8-16	L - CL	10YR 3/2-3				
	16-20	CL	10YR 3/3		10% gravel		
	20	Refusal					
L2	0-8	L	10YR 3/2	1 / SE		Madras	4
	8-16	L - CL	10YR 3/2-3				
	16-21	CL	10YR 3/3		10% gravel		
	21	Refusal					
I2	0-10	Gr L	10YR 3/2	2 / S	15% gravel	Madras	4
	10-20	Gr L - CL	10YR 3/2-3		25% gravel		
	20-36	Gr L	10YR 3/2-3		25% gravel		
	36	Refusal					
H2	0-8	L	10YR 3/2	1 / NW		Madras	4
	8-16	CL	10YR 3/2-3				
	16-21	L - CL	10YR 3/3				
	21	Refusal					
G2	0-8	L	10YR 3/2	3 / ESE		Cullius	6
	8-16	L - CL	10YR 3/3		10% gravel		
	16	Refusal					
G4	0-6	L	10YR 3/2	2 / S		Cullius	6
	6-12	CL	10YR 3/3				
	12	Refusal					
H4	0-8	L	10YR 3/2	2 / E		Madras	4
	8-16	L - CL	10YR 3/2-3				
	16-20	CL	10YR 3/3				
	20	Refusal					
H3	0-6	L	10YR 3/2	2 / W		Cullius	6
	6-12	CL	10YR 3/3		10% gravel		
	12	Refusal					
I4	0-7	L	10YR 3/2	1 / S		Cullius	6
	7-15	CL	10YR 3/3				
	15	Refusal					
J4	0-8	L	10YR 3/2	2 / E		Madras	4
	8-16	CL	10YR 3/3				
	16-22	CL	10YR 3/3		10% gravel		
	22	Refusal					
J3	0-8	L	10YR 3/2	3 / SE		Madras	4
	8-16	CL	10YR 3/3				
	16-22	CL	10YR 3/3		10% gravel		
	22	Refusal					

Table 3. Summary of Soil Test Hole Information

Observation Point	Depth (inches)	Texture[1]	Color	Slope (percent) / Aspect	Notes	Series	Land Capability Classification
J5	0-6	L	10YR 3/2	2 / E		Cullius	6
	6-13	CL	10YR 3/3		10% gravel		
	13	Refusal					
J6	0-8	L	10YR 3/2	2 / SE		Cullius	6
	8-18	CL	10YR 3/3				
	18	Refusal					
K6	0-8	L	10YR 3/2	3 / SE		Cullius	6
	8-16	CL	10YR 3/3				
	16-18	CL	10YR 4/3				
	18	Refusal					
L6	0-6	L	10YR 3/2	4 / SSE		Cullius	6
	6-13	CL	10YR 3/3		10% gravel		
	13	Refusal					
L7	0-8	L	10YR 3/2	2 / SE		Madras	4
	8-20	L - CL	10YR 3/2-3				
	20-22	CL			weathered bedrock (saprolite)		
	22	Refusal					
B1	0-10	L	10YR 3/2	2 / W		Madras	4
	10-21	L - CL	10YR 3/3				
	21	Refusal					
H1	0-8	L	10YR 3/2	2 / SW		Cullius	6
	8-10	L - CL	10YR 3/3				
	10	Refusal					
M2	0-8	L	10YR 3/2	1 / SSW		Cullius	6
	8-10	L - CL	10YR 3/3				
	10	Refusal					
L3	0-8	L	10YR 3/2	1 / NNE		Cullius	6
	8-15	L - CL	10YR 3/3				
	15	Refusal					
K4	0-8	L	10YR 3/2	2 / ESE		Cullius	6
	8-10	L - CL	10YR 3/3				
	10	Refusal					
E8	0-7	L	10YR 3/2	3 / SSW	5% gravel	Cullius	6
	7-12	CL	10YR 3/3		5% gravel		
	12	Refusal					
F8	0-7	L	10YR 3/2	3 / SW		Cullius	6
	7-10	L - CL	10YR 3/3				
	10	Refusal					
F9	0-7	L	10YR 3/2	1 / SW	5% gravel	Cullius	6
	7-11	L - CL	10YR 3/3		10% gravel		
	11	Refusal					
B9	0-6	L	10YR 3/2	1 / SSW		Cullius	6
	6-10	CL	10YR 3/3		10% gravel		
	10	Refusal					
B10	0-6	L	10YR 3/2	2 / SW		Cullius	6
	6-11	CL	10YR 3/3				
	11	Refusal					
B11	0-6	L	10YR 3/2	1 / S		Cullius	6
	6-9	CL	10YR 3/3		5% gravel		
	9	Refusal					
B1	0-10	L	10YR 3/2	1 / SW		Madras	4
	10-21	L - CL	10YR 3/3				
	21	Refusal					

Notes:
Observations made and noted by Brian T. Rabe, CPSS, on June 8, 11 and 12, and July 13, 2018.
Abbreviations: AWHC = available water holding capacity, "<" = less than.
1 Texture: LS = loamy sand, SL = sandy loam, L = loam, CL = clay loam, St = stony, Cob = cobbly, Ex = extremely, V = very

FIGURES

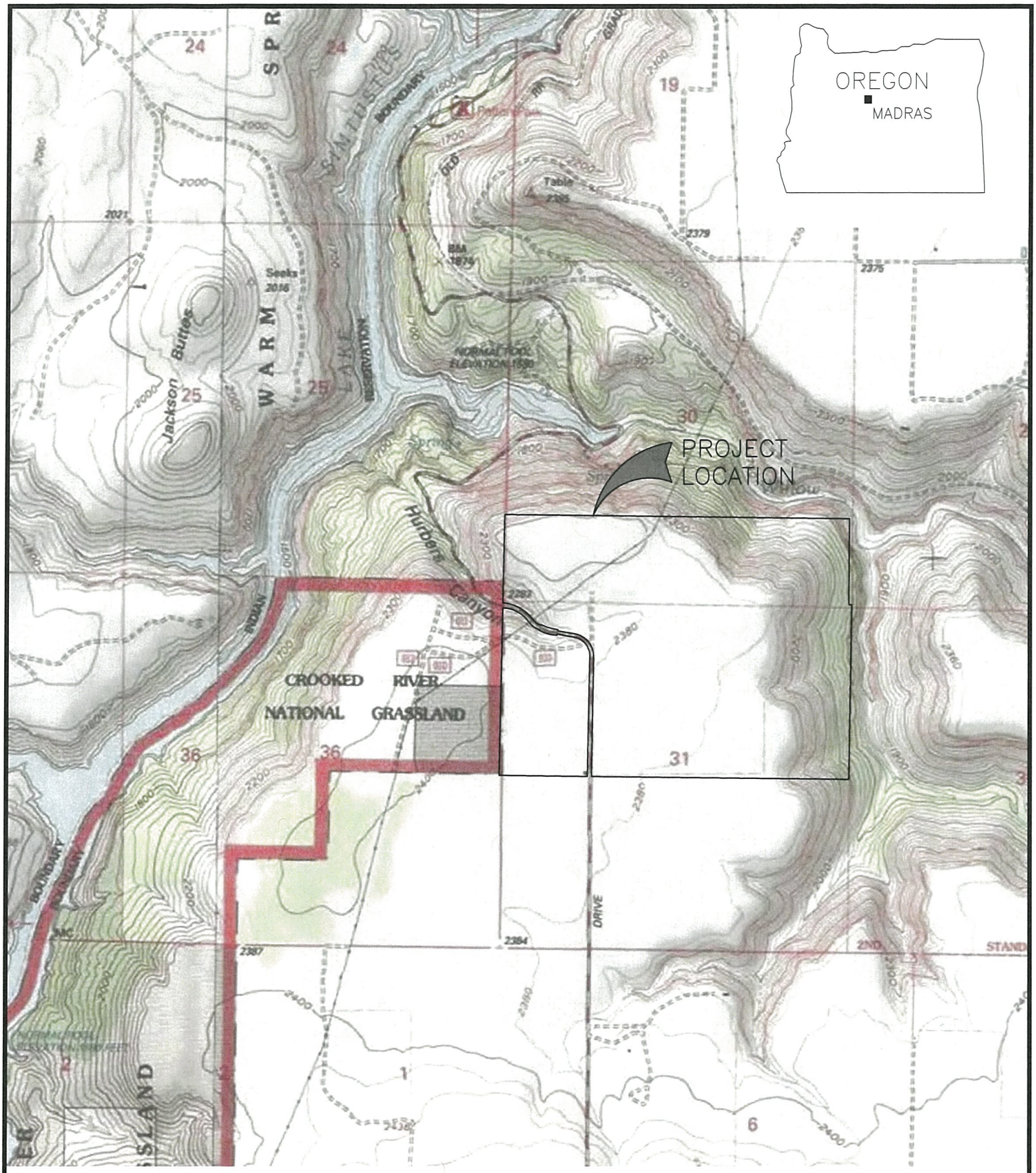


Figure 1. USGS Topographic Map

0 2000'

1"=2000'

(LOCATIONS AND SCALE ARE APPROXIMATE)

(SOURCE: ©2013 National Geographic Society, i-cubed)

PROJECT NUMBER: 2018240031	Land Use Soils Assessment
DATE: 07/02/2018	
DWG NO: 2018240031 F1-4.DWG	Ecoplexus Elk Drive Madras, OR 97741
DWG BY: 5SW / PROJECT MANAGER: 1BTR	
REVISED:	CES CASCADE EARTH SCIENCES

SYMBOL	NAME
87A	MADRAS LOAM, 0 TO 3 PERCENT SLOPES
87B	MADRAS LOAM, 3 TO 8 PERCENT SLOPES
120F	SIMAS–RUCKLES–ROCK OUTCROP COMPLEX, 40 TO 80 PERCENT NORTH SLOPES
121F	SIMAS–RUCKLES–ROCK OUTCROP COMPLEX, 40 TO 80 PERCENT SOUTH SLOPES.

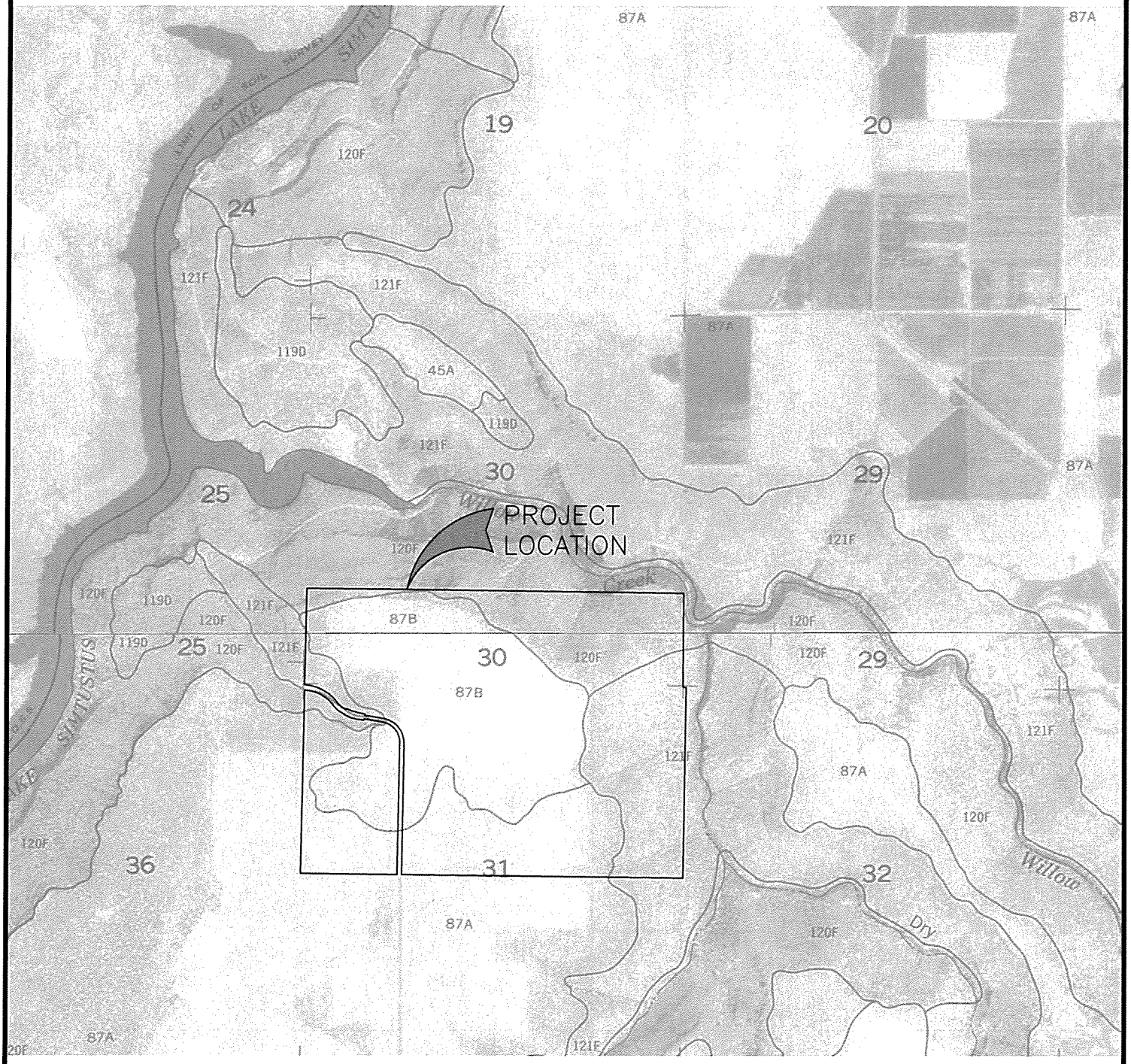


Figure 2. NRCS Soils Map

0 2000'

1"=2000'

(LOCATIONS AND SCALE ARE APPROXIMATE)

(SOURCE: NRCS Published Soils Map for Jefferson County, Oregon)

PROJECT NUMBER: 2018240031	Land Use Soils Assessment
DATE: 7/02/2018	
DWG NO: 2018240031 F1-4.DWG	Ecoplexus Elk Drive Madras, OR 97741
DWG BY: 5SW / PROJECT MANAGER: 1BTR	
REVISED:	CES CASCADE EARTH SCIENCES

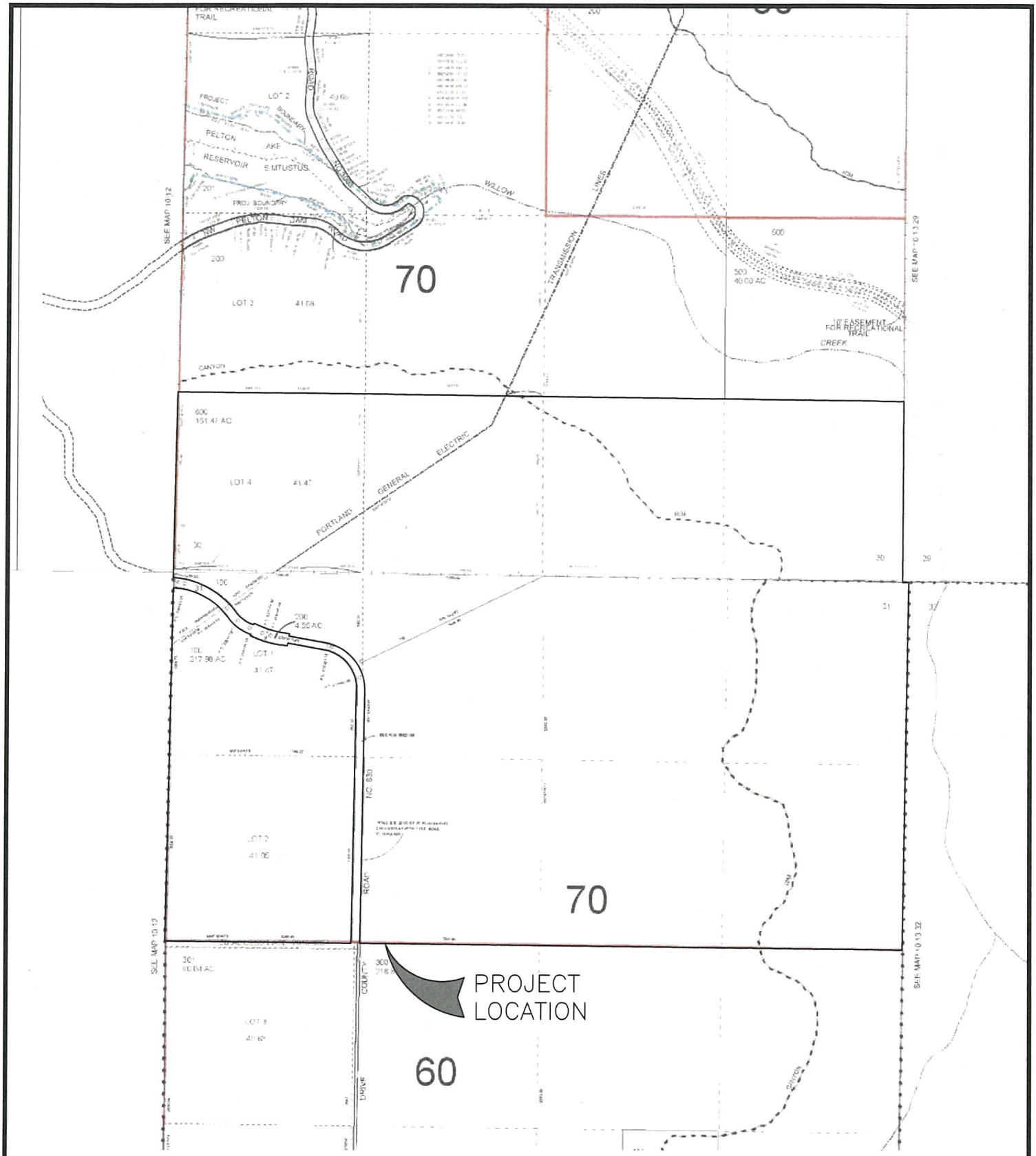


Figure 3. Tax Lot Map

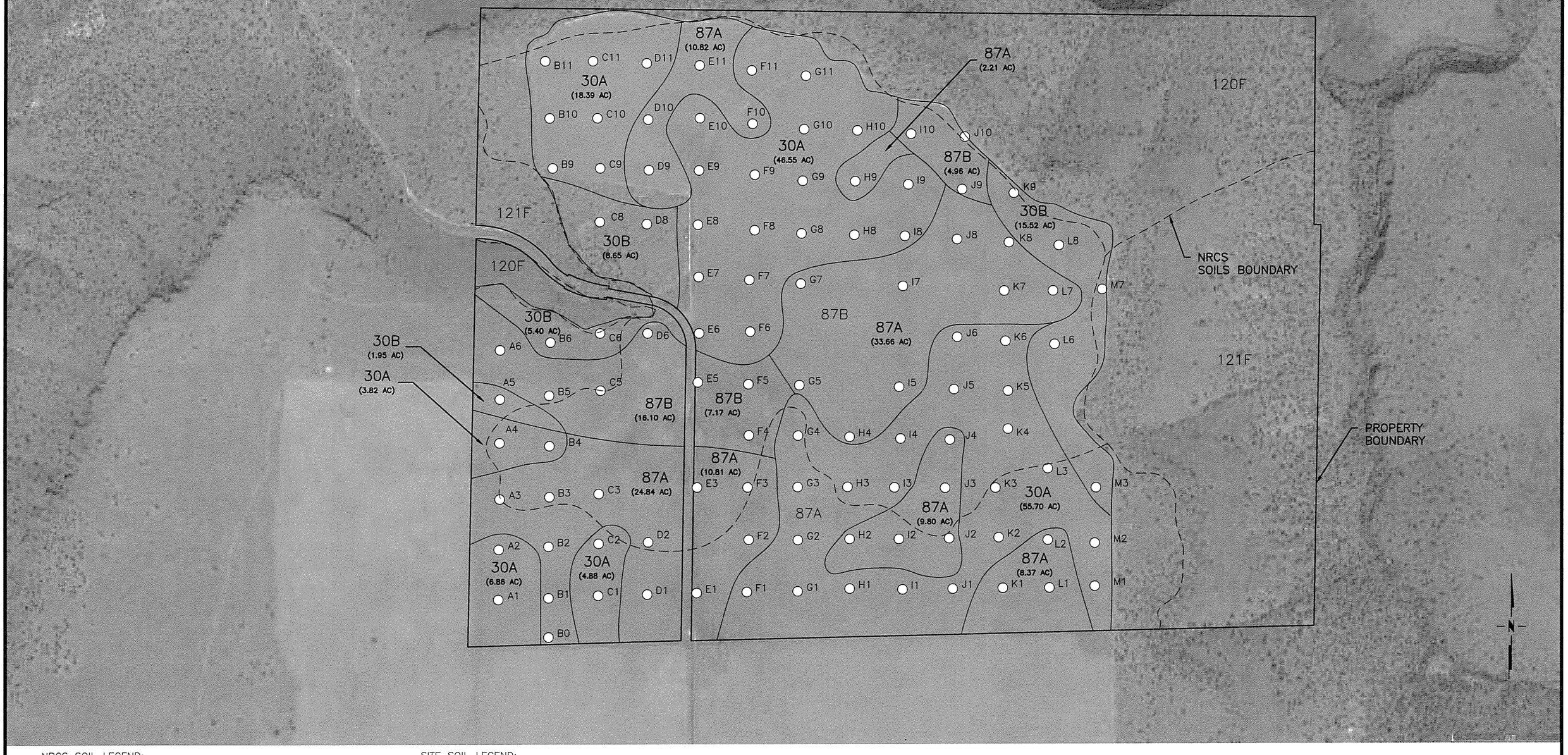
0 950'

1"=950'

(LOCATIONS AND SCALE ARE APPROXIMATE)

(SOURCE: Tax Lot Maps for Jefferson, Deschutes & Klamath County, Oregon)

PROJECT NUMBER: 2018240031	Land Use Soils Assessment
DATE: 7/02/2018	
DWG NO: 2018240031 F1-4.DWG	Ecoplexus Elk Drive Madras, OR 97741
DWG BY: 5SW / PROJECT MANAGER: 1BTR	
REVISED:	CES CASCADE EARTH SCIENCES



NRCS SOIL LEGEND:

SYMBOL	NAME
87A	MADRAS LOAM, 0 TO 3 PERCENT SLOPES
87B	MADRAS LOAM, 3 TO 8 PERCENT SLOPES
120F	SIMAS–RUCKLES–ROCK OUTCROP COMPLEX, 40 TO 80 PERCENT NORTH SLOPES
121F	SIMAS–RUCKLES–ROCK OUTCROP COMPLEX, 40 TO 80 PERCENT SOUTH SLOPES

SITE SOIL LEGEND:

SYMBOL	NAME
30A	CULLIUS LOAM, 0 TO 3 PERCENT SLOPES
30B	CULLIUS LOAM, 3 TO 8 PERCENT SLOPES
87A	MADRAS LOAM, 0 TO 3 PERCENT SLOPES
87B	MADRAS LOAM, 3 TO 8 PERCENT SLOPES
○ 12	TEST PITS/PHOTO POINTS

0 600'

1"=600'

(LOCATIONS AND SCALE ARE APPROXIMATE)

(SOURCE: Google Earth Pro Image, 4-19-2015)

Figure 4. Site Specific Soils Map

PROJECT NUMBER: 2018240031	Land Use Soils Assessment
DATE: 7/2/2018	
DWG NO: 2018240031 F1-4.DWG	Ecoplexus Elk Drive Madras, OR 97741
DWG BY: 5SLW / PROJECT MANAGER: 1BTR	
REVISED:	CES CASCADE EARTH SCIENCES

APPENDICES

Appendix A. **Web Soil Survey**
Appendix B. **Site Photographs**

Appendix A.

Web Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties

Ecoplexus - Madras

August 14, 2018

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

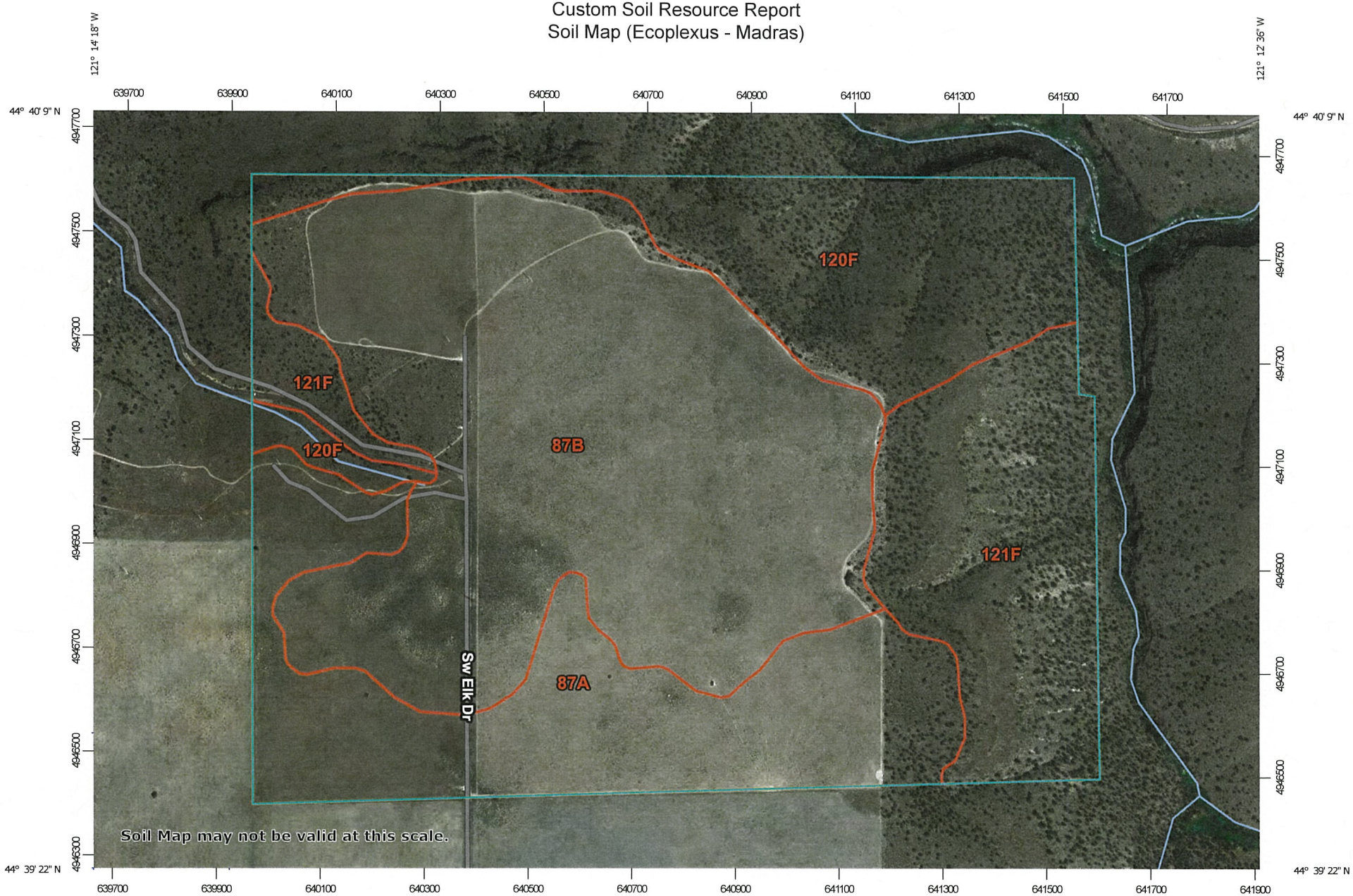
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Ecoplexus - Madras)



Map Scale: 1:10,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N 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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties
Survey Area Data: Version 12, Sep 19, 2017

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

Date(s) aerial images were photographed: Jun 21, 2013—Sep 21, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Ecoplexus - Madras)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
87A	Madras loam, 0 to 3 percent slopes	102.1	21.5%
87B	Madras loam, 3 to 8 percent slopes	211.7	44.6%
120F	Simas-Ruckles-Rock outcrop complex, 40 to 80 percent north slopes	77.7	16.4%
121F	Simas-Ruckles-Rock outcrop complex, 40 to 80 percent south slopes	83.5	17.6%
Totals for Area of Interest		**475.1**	**100.0%**

Map Unit Descriptions (Ecoplexus - Madras)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Upper Deschutes River Area, Oregon, Parts of Deschutes, Jefferson, and Klamath Counties

87A—Madras loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 24h1
Elevation: 2,000 to 3,000 feet
Mean annual precipitation: 8 to 10 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Madras and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Madras

Setting

Landform: Lava plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over residuum weathered from volcaniclastic sediments of the deschuteas formation

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 16 inches: loam
H3 - 16 to 23 inches: clay loam
H4 - 23 to 27 inches: weathered bedrock
H5 - 27 to 37 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 22 to 40 inches to paralithic bedrock; 26 to 44 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): 3c
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: C
Ecological site: LOAMY 8-10 PZ (R010XA001OR)
Hydric soil rating: No

87B—Madras loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 24h2
Elevation: 2,000 to 3,000 feet
Mean annual precipitation: 8 to 10 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Madras and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Madras

Setting

Landform: Lava plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over residuum weathered from volcaniclastic sediments of the deschuteas formation

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 16 inches: loam
H3 - 16 to 23 inches: clay loam
H4 - 23 to 27 inches: weathered bedrock
H5 - 27 to 37 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 22 to 40 inches to paralithic bedrock; 26 to 44 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: LOAMY 8-10 PZ (R010XA001OR)
Hydric soil rating: No

120F—Simas-Ruckles-Rock outcrop complex, 40 to 80 percent north slopes

Map Unit Setting

National map unit symbol: 23zx
Elevation: 1,400 to 2,600 feet
Mean annual precipitation: 9 to 11 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Simas, north, and similar soils: 50 percent
Ruckles, north, and similar soils: 35 percent
Rock outcrop: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Simas, North

Setting

Landform: Canyons
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium derived from tuff

Typical profile

H1 - 0 to 12 inches: cobbly loam
H2 - 12 to 19 inches: cobbly clay
H3 - 19 to 37 inches: clay
H4 - 37 to 60 inches: gravelly clay

Properties and qualities

Slope: 40 to 60 percent
Depth to restrictive feature: 10 to 20 inches to abrupt textural change
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C

Ecological site: JD SHRUBBY SHALLOW 12-16 PZ (R010XB083OR)
Hydric soil rating: No

Description of Ruckles, North

Setting

Landform: Canyons
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium over welded tuff

Typical profile

H1 - 0 to 9 inches: extremely cobbly loam
H2 - 9 to 14 inches: extremely cobbly clay loam
H3 - 14 to 18 inches: cobbly clay
H4 - 18 to 19 inches: weathered bedrock
H5 - 19 to 29 inches: unweathered bedrock

Properties and qualities

Slope: 40 to 80 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock; 11 to 21 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: JD SHRUBBY SHALLOW 12-16 PZ (R010XB083OR)
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

R - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 50 to 80 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

121F—Simas-Ruckles-Rock outcrop complex, 40 to 80 percent south slopes

Map Unit Setting

National map unit symbol: 23zy
Elevation: 1,400 to 2,600 feet
Mean annual precipitation: 9 to 11 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Simas, south, and similar soils: 50 percent
Ruckles, south, and similar soils: 35 percent
Rock outcrop: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Simas, South

Setting

Landform: Canyons
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium derived from tuff

Typical profile

H1 - 0 to 12 inches: cobbly loam
H2 - 12 to 19 inches: cobbly clay
H3 - 19 to 37 inches: clay
H4 - 37 to 60 inches: gravelly clay

Properties and qualities

Slope: 40 to 60 percent
Depth to restrictive feature: 10 to 20 inches to abrupt textural change
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: JD DROUGHTY SOUTH 9-12 PZ (R010XB044OR)
Hydric soil rating: No

Description of Ruckles, South

Setting

Landform: Canyons
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Colluvium over welded tuff

Typical profile

H1 - 0 to 9 inches: extremely cobbly loam
H2 - 9 to 14 inches: extremely cobbly clay loam
H3 - 14 to 18 inches: cobbly clay
H4 - 18 to 19 inches: weathered bedrock
H5 - 19 to 29 inches: unweathered bedrock

Properties and qualities

Slope: 40 to 80 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock; 11 to 21 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: JD DROUGHTY SOUTH 9-12 PZ (R010XB044OR)
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

R - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 50 to 80 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix B.

Site Photographs

Photograph 1.

Test Hole E5 (40 inches of loam to refusal – deeper example of Madras).

Photograph 2.

Test Hole E5 (30 inches of loam to refusal – deeper example of Madras).

Photograph 3.

Test Hole C1 (8 inches of loam over 11 inches of loam to clay loam, 19 to refusal – typical example of Cullius).

Photograph 4.

Test Hole A1 (4 inches of loam over 4 inches of loam to clay loam, 8 to refusal – shallow example of Cullius).

Photograph 5.

Test Hole A5 (6 inches of loam over 8 inches of loam to clay loam, 14 to refusal – typical example of Cullius).

Photograph 6.

Test Hole I7 (20 inches of loam over 4 inches of loam to clay loam, 24 inches to refusal – typical example of Madras).

Photograph 7.

Test Hole B3 (6 inches of loam over 19 inches of loam to clay loam, 25 inches to refusal – typical example of Madras).

Photograph 8.

Test Hole A4 (6 inches of loam over 6 inches of loam to clay loam, 12 to refusal – typical example of Cullius).

Photograph 9.

Test Hole C6 (8 inches of loam to refusal – shallow example of Cullius).

Photograph 10.

Test Hole L8 (6 inches of loam over 8 inches of loam to clay loam, 14 to refusal – typical example of Cullius).

Photograph 11.

Test Hole J10 (8 inches of loam over 16 inches of loam to clay loam, 24 inches to refusal – typical example of Madras).

Photograph 12.

Test Hole H9 (8 inches of loam over 8 inches of clay loam over 6 inches of clay loam and weathered bedrock, 22 inches to refusal – typical example of Madras).

Photograph 13.

Test Hole L1 (8 inches of loam over 8 inches of loam to clay loam, over 8 inches of clay loam, 24 inches to refusal – typical example of Madras).

Photograph 14.

Test Hole G2 (8 inches of loam over 8 inches of loam to clay loam, 16 to refusal – typical example of Cullius).

Photograph 15.

Test Hole J3 (8 inches of loam over 14 inches of clay loam, 22 inches to refusal – typical example of Madras).

Photograph 16.

Test Hole F8 (7 inches of loam over 3 inches of loam to clay loam, 10 to refusal – shallow example of Cullius).

Photograph 17.

Test Hole B11 (6 inches of loam over 5 inches of clay loam, 11 to refusal – shallow example of Cullius).

Photograph 18.

Test Hole C8 (6 inches of loam over 6 inches of clay loam, 12 to refusal – shallow example of Cullius).