Exhibit G

Materials Analysis

West End Solar Project
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Prepared for
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Acronyms and Abbreviations

Applicant	EE West End Solar LLC
OAR	Oregon Administrative Rules
Project	West End Solar Project

1.0 Introduction

EE West End Solar LLC (Applicant) proposes to construct and operate the West End Solar Project (Project), a solar generating facility and related or supporting facilities in Umatilla County, Oregon. This Exhibit G was prepared to meet the submittal requirements in Oregon Administrative Rules (OAR) 345-021-0010(1)(g).

2.0 Materials Inventory – OAR 345-021-0010(1)(g)(A)

OAR 345-021-0010(1)(g) A materials analysis including:

OAR 345-021-0010(1)(g)(A) An inventory of substantial quantities of industrial materials flowing into and out of the proposed facility during construction and operation.

2.1 Construction Materials

Construction will include land clearing; minimal grading; installation of concrete foundations for a collector substation; switchyard substation; construction of pads for transformers, inverters, and energy storage containers; construction of an operations and maintenance enclosure; and installation of electrical controls and associated components. Typical materials needed for construction of the Project include rock and gravel aggregate, water, cement, steel, aluminum, copper, and assorted electrical equipment and materials, as well as smaller quantities of other materials such as fuels and oils. Rock and aggregate materials will be needed for access road construction, substation, and for other permanent and temporary gravel-surfaced areas. Aggregate suppliers in the vicinity of the Project will be determined by the construction contractor.

In addition to the above listed construction materials, the Project will include photovoltaic solar modules that use mono- or poly-crystalline silicon cells that will be supported by galvanized steel and aluminum components. The crystalline silicon cells are insulated and protected from the elements on both sides by sheets of polymers and glass. The glass is tempered and covered with a protective plastic layer that gives the glass added strength and ensure that if the glass were to crack or break it would stay intact. Thus, damaged panels generally do not break into pieces but remain together in one piece. Therefore, the modules will be inert and will not introduce any hazardous materials to the Project. The photovoltaic modules will measure approximately 16 feet in height when tilted on a single-axis tracking system. The length of each tracker row may vary by topography. The tracker system, will be specifically designed to withstand wind, snow, and seismic loads anticipated at the site. The number of modules that the tracker can hold and the actual number of tracker systems will depend on the system selected. Each tracker system will be supported by multiple steel posts, which could be round hollow posts or pile-type posts (i.e., H-pile, C-pile, S-pile) or helical. Post depth may vary depending on soil conditions, but the posts are typically installed 4 to 8 feet below the surface and protrude 4 to 7 feet above grade. Posts at the

end of tracker rows are usually installed to greater depth to withstand wind uplift. In some soil conditions, concrete backfill is required for each post.

The Applicant is considering including a lithium-ion energy storage system. The use of this type of energy storge system may require additional materials onsite. The batteries will be manufactured offsite and will be shipped to the site as self-enclosed prefabricated modules, which will be installed and connected onsite. Lithium-ion battery systems are either air or liquid cooled. Liquid cooled lithium-ion batteries use coolant similar to automotive antifreeze. The coolant, if used, is recirculated through a closed system to cool the batteries. Each prefabricated module will contain a group of lithium-ion battery packs electrically connected inside the enclosure. Each enclosure measures roughly 8 x 10 x 10 feet (w, d, h). It is estimated that 200 battery enclosures will be required for the 70-megawatt storage system. However, the final energy storage design and system has not been selected, and therefore it is not possible to determine which materials and in what quantities, including any solutions associated with fire suppression systems, might be present onsite. The Applicant will provide materials estimates to the Oregon Department of Energy in coordination with the relevant authorities, including the Umatilla County Fire Department, once it is known what quantities of batteries and other materials will be needed to achieve the desired storage duration. The Applicant will provide an estimate of both hazardous and nonhazardous materials before construction as a condition of approval of the Site Certificate.

During construction, temporary trailers and storage facilities will be required and most materials that are not in use will be stored in temporary staging areas within the Site Boundary. Industrial materials flowing into the Project include fuels and lubricants associated with construction equipment. These materials will be stored in the temporary staging areas. Oils, lubricants, and solvents will be stored within covered containers such as work trailers and Conex boxes to prevent incidental spills or drips from reaching the environment. Fuels will be stored in mobile, double-walled tanks to be parked in the construction staging area. The primary location for fueling will occur offsite at local gas stations, and the mobile tanks will only be used to fuel equipment that cannot travel off-site (such as excavators). On-site refueling will occur only within the staging areas.

A majority of material that will be used at the Project site will be rock and gravel to be used for road and parking construction. Water will be used for site preparation including dust suppression. Volumes of water are discussed in Exhibit O. The solar photovoltaic modules and steel racking will also be a part of the material brought to the site.

Table G-1 provides a list of industrial materials that would be used during Project construction, based on current engineering estimates. This is a rough estimate, and actual quantities may vary. Solid wastes generated and flowing out of the Project during construction are outlined in Exhibit W.

Table G-1. Inventory of Construction Materials

Material	Purpose	Ultimate Disposition	Units	Quantity
Aggregate Base	Access road base; substation and operations and maintenance enclosure	Remains on-site as yard rock until useful life of Project has expired	tons	16,200
Concrete	Foundations for inverters, transformers, energy storage system, substation, operations and maintenance enclosure	Remains on-site as structure footings until decommissioning then will be removed within 3 feet of ground surface	cubic yards	3,414
Concrete	Concrete backfill for solar module posts	Remains on-site as structure footings until decommissioning then will be removed within 3 feet of ground surface	cubic yards	2,500
Steel	Steel posts supporting solar modules	Remains on-site until decommissioning then will be removed within 3 feet of ground surface	tons	2,500
Battery Storage Units	Battery storage containers and battery racks for lithium-ion battery technology	Remains on-site until decommissioning	Units	200
Solar photovoltaic modules, steel mounting racks, and steel trackers	Photovoltaic modules	Remains on-site until decommissioning	Modules	180,000
Electrical cabling (underground)	Underground collector line cabling	Remains on-site until decommissioning	miles	15
Inverters	Convert direct current output from photovoltaic modules to alternating current	Remains on-site until decommissioning	inverters	25
Transformers	Main power transformer	Remains on-site until decommissioning	transformers	1
Transformers	Distributed step-up pad mounted transformers	Remains on-site until decommissioning	transformers	25

Material	Purpose	Ultimate Disposition	Units	Quantity
Substation	Step-up voltage for interconnection	Remains on-site until decommissioning	Various pieces of equipment described in Section 3.0, Exhibit B	
Operations and maintenance enclosure	Storage of materials and equipment for routine maintenance	Remains on-site for operations	Various pieces of equipment described in Section 3.0, Exhibit B	
Chain link fencing	Security of Project. Perimeter fence and fence around substation	Remains on-site as permanent fencing	feet	15,400
Grease	Grease is used to lubricate areas of equipment that rotates	Unused grease to be properly recycled or disposed as hazardous waste per Oregon Administrative Rules Chapter 340 Division 111	gallons	5
Heavy, medium, and light lubricant oils	Equipment lubrication	Unused oil to be properly recycled or disposed as hazardous waste per Oregon Administrative Rules Chapter 340 Division 111	Gallons	5
Non-petroleum based solvents	Cleaning of equipment	Unused solvents to be recycled if possible or disposed at appropriate facility	gallons	5
US EPA registered herbicide (weed control)	For spot weed control during construction.	Stored in operations and maintenance enclosure. Applied to ground surface for weed control.	Gallons	5

2.2 Operational Materials Inventory

During operations, industrial materials such as grease, oil, solvents, and cleaners will be used and stored on site. Some electrical equipment such as transformers, breakers and switches contain grease for lubrication and dielectric mineral oils for cooling. These greases and oils are contained within the electrical equipment. During periods of maintenance and or repairs specialty contractors and equipment will be hired who will perform any necessary work while at the same time containing, changing and shipping the greases and oils out for recycling and or disposal.

All greases, oils, solvents, cleaners, herbicides and pesticides will be stored in an operations and maintenance enclosure. Quantities of each product will very throughout the year with none

exceeding 5 gallons. These greases, oils, solvents and cleaners needed for maintenances and repairs will be delivered by a licensed contractor on an as-needed basis.

As part of normal operations solar modules and electrical equipment will need to be repaired or replaced over the lifetime of the project. Minor maintenances, repairs and replacement events will generate less material to be recycled or disposed of than larger events. The project will establish service provers that will recycle and or dispose of all panels, equipment and spent consumable such as greasy/oily rags, empty solvent containers in accordance with all federal, state and municipal regulations and industry best practices.

Solar modules will require periodic washing to minimize the effects of solar module dust and dirt on energy production (referred to as soiling). Water quantities estimated for operations are discussed in Exhibit O.

If the Project decides to include a lithium-ion energy storage system, the lithium-ion batteries will require a regular change out of batteries as they degrade over time. Lithium-ion batteries will be replenished at a rate dependent on usage. For example, batteries cycle frequently will degrade faster than ones that are used less often. For this analysis, it is assumed that the battery will be fully discharged each day and that all batteries will need to be replaced every 10 years, or three times over the life of the Project (30 years). This assumption overestimates the number of batteries that will be replaced for the duration of the Project's life, since not all batteries will be replaced during each replenishment cycle (e.g., fewer batteries will need replacing early in the Project's life). Table G-2 provides a list of materials estimated for use during operation and maintenance of the Project. Actual quantities may vary.

Table G-2. Materials Inventory for Operations

Material	Purpose	Ultimate Disposition	Units	Quantity
Transformer Oil	Substation main power transformer	Within transformer boxes for cooling. (No extra oil stored outside of transformers. Additional oil only required due to failure, provided on an as-needed basis.)	Gallons	14,000
Transformer Oil	Pad-mounted step-up transformers in solar array areas (25 total)	Within transformer boxes for cooling. (No extra oil stored outside of transformers. Additional oil only required due to failure, provided on an as-needed basis.)	Gallons	13,750 (550 gallons per station)

Material	Purpose	Ultimate Disposition	Units	Quantity
Light lubrication oil	Small equipment lubrication	Unused oil to be recycled if possible or disposed of at appropriate facility	Gallons	5
Non-petroleum based solvents	Cleaning of equipment	Unused solvents to be recycled if possible or disposed at appropriate facility	Gallons	5
US EPA registered herbicide (weed control)	Vegetation growth during facility operations will be managed through subcontract with local provider.	NA	Gallons	NA

3.0 Hazardous Materials Handling and Management – OAR 345-021-0010(1)(g)(B)

OAR 345-021-0010(1)(g)(B) The applicant's plans to manage hazardous substances during construction and operation, including measures to prevent and contain spills.

As shown in Tables G-1 and G-2, hazardous materials used at the Project may include fuels, paint, spent oils, solvents, and pesticides. During construction, small quantities of a few hazardous materials may be utilized or stored in the construction yards. Such materials may include cleaners, insecticides or herbicides, paint, or solvents. None will be present in substantial, reportable quantities, the amounts present (if any) will be no greater than household quantities[1] of up to a few gallons each.

The hazardous materials used during the Project's construction and maintenance will be stored according to the U.S. Environmental Protection Agency and U.S. Occupational Safety and Health Administration regulation, as applicable. Safety data sheets of each hazardous material will be stored onsite. Project personnel will receive guidelines and will be trained on the handling, storage, transport, and disposal of hazardous materials.

The construction contractor will be required to develop a Spill Prevention, Control and Countermeasure Plan prior to the beginning of construction of the Project. This plan would apply during construction and outlines preventative measures and practices to reduce the likelihood of an accidental release of a hazardous or regulated liquid and, in the event such a release occurs, to expedite the response to and the remediation of the release. Disposal practices for hazardous waste

[1] "Household quantity" refers to container sizes designed for consumer use, which are sized such that each container would hold less than a reportable quantity of any constituent hazardous chemical.

materials will follow applicable regulations and will depend on the type of waste. Any oily waste, rags, or dirty or hazardous solid waste will be collected in sealable drums at the construction yards, to be removed for recycling or disposal by a licensed contractor.

In the unlikely event of an accidental hazardous materials release, any spill or release will be cleaned up and the contaminated soil or other materials disposed of and treated according to applicable regulations. See Exhibit CC for a listing of applicable regulations. Spill kits containing items such as absorbent pads will be located on equipment and in on site temporary storage facilities to respond to accidental spills, if any were to occur. Employees handling hazardous materials will be instructed in the proper handling and storage of these materials, as well as to the locations of spill kits.

Regarding battery storage, as stated in Section 2.1, the Applicant will provide materials estimates to the Oregon Department of Energy in coordination with the relevant authorities, including the Umatilla County Fire Department, once it is known what quantities of batteries will be needed to achieve the desired storage duration. The Applicant will provide an estimate of both hazardous and nonhazardous materials before construction as a condition of approval of the Site Certificate.

4.0 Non-Hazardous Waste Management – OAR 345-021-0010(1)(g)(C)

> *OAR 345-021-0010(1)(g)(C) The applicant's plans to manage non-hazardous waste materials during construction and operation.*

Solid waste generated during construction will include general construction debris such as scrap steel and packing materials from delivery components, plastics, glass, cardboard, paint, electrical debris, waste concrete, and excavated soil. Excavated soil will be used on-site as fill or will be transported off-site for disposal. The Applicant will aim to recycle as much solid waste as possible during construction and operation of the Project. Construction debris that is unable to be recycled will be transported by a local commercial hauler to the Finely Buttes Landfill.

Waste concrete will be disposed of as solid waste, recycled, or used onsite as fill. Concrete truck chutes will be washed out in a dedicated area or areas located onsite. The number and location of dedicated concrete washout areas will be determined based on the location of concrete truck activity. At a minimum, one concrete washout area will be sited near the substation or suitable areas under utility transmission line easement crossing site. Concrete washout facility design will be determined by the construction contractor and will follow EPA's best management practices to (a) collect and retain all the concrete washout water and solids in leak proof containers, so that caustic material does not reach the soil surface and then migrate to surface waters or into the ground water, and (b) recycle the collected concrete washout water and solids (EPA 2012). Concrete washout facilities will have appropriate gravel or rock approaches and will be signed as needed to direct concrete truck drivers. Concrete washout facilities will be inspected daily and after heavy rains to check for leaks, identify any plastic linings and sidewalls have been damaged by

construction activities, and determine whether they have been filled to over 75 percent capacity. When the washout container is filled to over 75 percent of its capacity, the washwater will be vacuumed off or allowed to evaporate to avoid overflows. Then when the remaining cementitious solids have hardened, they will be removed and recycled. Damages to the container will be repaired promptly. Before heavy rains, the washout container's liquid level will be lowered, or the container will be covered to avoid an overflow during the rain storm. .

Portable toilets will be provided for on-site sanitary waste management during construction and operation of the Project. The portable toilets will be maintained by a local contractor. Water for the Project will be trucked in. Sanitary wastewater will be treated offsite. Solar panel and equipment wash water that contains no added cleaning solutions will be discharged by evaporation and seepage into the ground. Nonhazardous solid waste generated during operation will be recycled or disposed of as municipal waste, as described in Exhibit W.

5.0 References

EPA (Environmental Protection Agency) 2012. Stormwater Best Management Practice, Concrete Washout. EPA Office of Water, EPA 833-F-11-006. February 2012. Available here: Stormwater Best Management Practices: Concrete Washout (epa.gov)