Bricker & Eckler LLP
100 South Third Street
Columbus, OH 43215
Office: 614.227.2300
Fax: 614.227.2390

Dylan F. Borchers
Direct Dial: 614.227.4914
dborchers@bricker.com
www.bricker.com
info@bricker.com

May 6, 2021

Via Electronic Filing

Ms. Tanowa Troupe
Administration/Docketing
Ohio Power Siting Board
180 East Broad Street, 11th Floor
Columbus, Ohio 43215-3793

Re: Union Ridge Solar, LLC, Case No. 20-1757-EL-BGN

Dear Ms. Troupe:

Attached for filing in the above referenced case is Union Ridge Solar, LLC's Response to OPSB Staff's First Data Request.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Dylan F. Borchers

Attachment

Cc: Mark Bellamy (w/Attachment)

OPSB DATA REQUEST
Union Ridge Solar

1. ***Does Union Ridge Solar, LLC intend to hold a preconstruction conference prior to commencement of construction activity?***

   Response: Yes, we will hold a preconstruction conference.

2. ***What does Union Ridge Solar, LLC estimate the contingency cost to be for this solar farm?***

   Response: The costs detailed in the initial decommissioning plan are preliminary estimates. A contingency cost will be included in updated decommissioning plan.

3. ***Referring to Table 1 from Exhibit L (Decommissioning Plan), there appears to be no line item for contingency costs, will this be included in in the final decommissioning plan?***

   Response: Yes

4. ***Please fully explain what financial assurance mechanism Union Ridge Solar, LLC will employ, and when the funds will be available to perform decommissioning activities. Staff would recommend that the decommissioning funds be posted in the form of a performance bond where the company is the Principal, the insurance company is the Surety, and the Ohio Power Siting Board is the Obligee.***

   Response: Union Ridge Solar, LLC will post decommissioning funds in the form of a performance bond where the Union Ridge Solar, LLC is the Principal, the insurance company is the Surety, and the Ohio Power Siting Board is the Obligee. The performance bond will be posted within 30 days of commercial operation.

5. ***The decommissioning plan was developed by a professional engineer and on page 33 the Application Union Ridge Solar indicates that the cost estimate will be periodically updated. Staff would recommend that the Applicant retain an independent, registered professional engineer, licensed to practice engineering in the state of Ohio to periodically estimate the total cost of decommissioning facility, salvage value, and appropriateness of any contingency percentage. Please indicate the Applicant's understanding and commitment to provide this to Staff and indicate when this would be provided.***

   Response: Union Ridge Solar LLC will update the Decommissioning Plan and financial assurance in year 10 of operations and every 5 years thereafter to assess the value of the financial assurance versus the Total Decommission Cost. This work will be conducted and approved by a licensed Ohio professional engineer.

6. ***Will the Union Ridge Solar, LLC submit an updated decommissioning plan and cost estimate based upon the final design at least 30 days prior to the preconstruction conference?***

   Response: Union Ridge Solar LLC will update the Decommissioning Plan before the preconstruction meeting.

7. ***Please provide the following information for the gen-tie line referenced on page 2 of the Application:***
   a. ***Tower designs, pole structures, conductor size and number per phase, and insulator arrangement.***
   b. ***Base and foundation design.***
   c. ***Cable type and size, where underground.***
   d. ***Other major equipment or special structures.***

   Response: The gen-tie line has not been designed yet, but we have provided some typical drawings for reference as Appendix A. Final engineering will have to be coordinated with AEP. We will provide detailed design information to staff after final engineering, at least 30 days prior to the pre-construction meeting.

8. ***Page 12/115 of the Application states that two collection substations, gen-tie lines, and O&M facilities are represented in the design, and the final location will be determined during the Application review. Please be more specific on the timing of the decision on the alternatives considered for the location of the collection substation and related ancillaries.***

   Response: Our design team had the facility study kick-off call with PJM/AEP on 4/26/21, which is the triggering event for AEP to explore the details of our requested interconnection to their Kirk substation. Union Ridge Solar has selected the "Alternate West" gen-tie route for the Facility. The "Alternate East" route should no longer be considered as part of the Application. A letter regarding route selection will be filed in the docket for this case.

9. ***Page 17/115 of the Application mentions an Irradiance of 3.9 kW/m2/day; should that be expressed as 3.9 kWhr/m2/day or 3.9 kWh/m2/day?***

   Response: kWh/sq.m/day.

10. ***Please explain how Union Ridge Solar, LLC will, during the detailed engineering phase, minimize any potential damage from high wind velocities by proper structural design of the project support equipment at sufficient depths based on the site-specific soil conditions to preclude any adverse influence from high wind velocities.***

    Response: An Ohio licensed structural professional engineer will design the foundations per ASCE 7-16 Risk Category I: 100 mph wind loading, as well as considering other loadings as required by code. The engineer will use recommendations from the geotechnical report and geotechnical engineer of record.

11. ***Please indicate any wind loading precautions or wind equipment specific ratings that will be included in the final project design.***

    Response: All equipment will be rated to withstand the design wind speed per ASCE 7-16 Category I: 100 mph as required by this code. As a precaution the modules that are mounted to the trackers can be rotated to a wind stow position to reduce wind forces via tracker control system. This system typically activates at 60 mph, 3 second gusts.

12. ***What specific structural design codes and building codes, referenced on page 55 of the Application, will the final project design adhere to?***

    Response: American Society of Civil Engineers (ASCE) 7-16, 'Minimum Design Loads and Associated Criteria for Buildings and Other Structures', per local authority having jurisdiction (AHJ).

13. ***Will the emergency response plan for the project referenced on page 469 of the Application be provided to OPSB Staff prior to the preconstruction conference?***

    Response: Yes. Please see response to question 14.

14. ***Please provide the current draft emergency response plan or an example emergency response plan.***

    Response: Please refer to the attached emergency action plan provided as Appendix B.

15. ***Referring to page 41 of the Application, what is the approximate limited volume of water that would be required to clean the solar farm?***

    Response: Roughly 50,000 gallons per wash, but we do not anticipate washing as normal rainfall amounts will naturally clean the modules.

16. ***Referring to Figure 7 in the Geology and Hydrogeology Report (Exhibit O), how many water wells are within the project area?***

    Response: Page 51 of the application notes that there are 6 abandoned water wells within the project area. Based on Hull's well survey questionnaire response, there are currently no working wells located on Project Area property. Any abandoned wells that are encountered will either be avoided or verified as properly decommissioned.

17. ***What is the distance between the solar farm equipment and nearest water well within the project area?***

Response: Based on data provided by ODNR, there are three abandoned wells within the project panel area. These wells are all located on parcels owned by the same property owner, a project participant, who responded to the well survey conducted by Hull and Associates. The survey results concluded that all six wells within the project area are abandoned wells.

18. ***Please explain what avoidance, minimization, and/or mitigation measures Union Ridge Solar, LLC will employ during construction for water well locations in the project area.***

    Response: Because the wells located with the project area are abandoned and are located on a project participant's property, impacts to active water wells would not be an issue.

19. ***The application at page 30 states, "Information has also been shared through direct landowner mailings, and through a web based public information meeting and a teleconference call, both held on June 25, 2021." Please clarify for the record when the public informational meeting and teleconference call were held.***

    Response: The public informational meeting and teleconference call were held on February 25, 2021.

20. ***HULL anticipates permanent or unavoidable impacts to approximately 0.006 acres of emergent wetlands and approximately 32 linear feet (0.003 acres) of perennial stream channel. How many stream and wetland crossings are anticipated in total? Will these crossings for gen-tie lines and collection lines all be done via HDD or through some other method?***

    Response: Impacts are proposed to two wetlands (Wetlands B and D, both Category 1 emergent wetlands) for the permanent placement of access roads and support piles for the solar arrays, and one perennial stream (Stream 2) for the permanent placement of an access road. Impacts from collection line crossing of one wetland and one stream will be avoided by using horizontal directional drilling (HDD) to install the underground collection line. The gen-tie line will be installed overhead. There are no stream or wetland crossings for the western gen-tie line. Union Ridge Solar has selected the "Alternate West" gen-tie route for the Facility. The "Alternate East" route should no longer be considered as part of the Application. Surface water delineations and impacts are detailed in Attachments C and D of the Ecological Assessment (Exhibit P of the OPSB Application).

21. ***The ODNR DOW states the project lies within the range of the Upland Sandpiper. This species utilizes grasslands and pastureland for nesting and/or hunting. In the application, HULL lists pastureland/grassland as accounting for 9.61 acres within the project area. Will you be avoiding these types of habitats altogether? Or will efforts be made to committing to avoid these types of habitats during the species' nesting periods of April 15-July 31?***

    Response: Construction activities will likely be avoided in upland sandpiper habitat from April 15 through July 31, during the upland sandpiper nesting period. If construction can not be avoided

in those areas during that time period, the areas will be mowed and maintained to lower than 4 inches prior to April 15, to discourage the use of the area for nesting.

22. ***Page 6/24 of Exhibit C (Geotechnical Report by Kleinfelder) indicates "It is possible that abandoned underground structures, such as foundations, may still exist in the area." Please provide Staff with any plans to mitigate and/or remediate any such areas should they be encountered during construction of the proposed solar facility.***

    Response:
    In general, abandoned structures are not anticipated to be a concern for the solar facility. Kleinfelder's desktop review identified an area where a structure had been previously demolished. If abandoned structures are encountered during foundation installation, they will be completely removed within the influence of the new foundation element. The void left by the removed foundation will be backfilled with structural fill in accordance with the recommendations on the Geotechnical Report.

23. ***Page 8/24, Table 3-2 of Exhibit C provides risk levels assigned to a variety of potential geologic hazards. In discussing the Earthquake hazard risk assessment, a risk level of "Low" is provided in part due to "There are no known faults shown in the project area on the USGS Quaternary Faults and Folds Database." Please revise this risk assessment to consider all faulting (not limited to Quaternary Period), and previous seismic events within or near the project area.***

    Response:
    The data sources cited in the Geotechnical Report are the primary data sources used in assessing initial seismic risk. The data cited in the Geotechnical Report indicates the relative risk of occurrence of an earthquake with a magnitude great enough to cause minor damage is low. There is recent documented seismic activity in the state of Ohio, but generally greater than 5 miles from the project site and generally of low intensity. To clarify, geotechnical report does not state that risk of seismic activity is low. The assessment of seismic risk is that the risk of damage to structures caused by seismic activity is low.

24. ***Page 16/24 of Exhibit C discusses recommendations for PV array foundations which were based on field investigation, lab testing, and experience in the area. The geotechnical report indicates it assumes driven steel piles are preferred. Can the Applicant please provide an explanation as to how this assumption was made and clarify if driven steel piles are in fact the recommendation of the report?***

    Response:
    The report lists various types of foundations that can be used. The majority of these will be driven steel piles for solar field foundations, combiner boxes, and inverter skids. Leeward conducted pile load testing to verify the required depths of the piles for the solar field.

25. ***Did the Applicant conduct a pile load testing investigation within the project area? If not, are there any intentions to conduct pile load testing prior submittal of the final engineering design?***

Response:
Yes, we conducted a pile load testing investigation within the project area. A copy of the report documenting the pile load testing investigation is attached as Appendix C.

26. ***Can the Applicant please expand upon its experience in the area relative to pile foundation engineering design? Exhibit C also provides a recommendation of 7.5 feet below ground surface for pile embedment depth, but also states "Greater depths may be required to achieve structural requirements." Could the Applicant please specify or provide reference to the structural requirements it's speaking to?***

Response:
Leeward has worked with Kleinfelder to conduct preliminary pile design. Kleinfelder is an industry expert on solar field foundation design. There are various tracker structures on the market and they can have different number of support posts and loads. A 7.5' embedment will work with most trackers under the design load conditions but other trackers with fewer larger supports may require deeper embedment. This will be finalized after final selection of the tracker system. The foundations must support the loads and meet the deflection requirements of the manufacturer as well as resist frost loads and long-term differential settlement for example. Also, outer rows of trackers will have a higher wind load and require different foundation designs than interior rows.

27. ***Page 55 of the application indicates additional geotechnical testing (borings) may be conducted for very site-specific engineering considerations, but there are no intentions to provide that data to OPSB Staff as the results are not expected to alter the placement of Facility components. Given the limited geotechnical investigation to date (6 borings, and 2 test pits) and apparent lack of site-specific pile load testing, additional test borings would appear appropriate. Plans for those test borings should be provided in accordance with Ohio A.C. Rule 4906-4-08 (A)(5)(b). The resulting data and interpretation should supplement the final engineering design to be presented to OPSB Staff at least 30 days prior to the preconstruction conference.***

Response:
Please refer to question 25 above – we have conducted pile load testing and are providing a copy of the report. Leeward considers the geotechnical test borings and pile load testing that have been done to date to be preliminary, and anticipates that the engineer of record for structural design will require additional borings and/or pile load testing before final design and stamping the plans.

28. ***Page 32 of the application discusses developing a Road Use and Maintenance Agreement (RUMA) with the Licking County Engineer's Office. Given a portion of the proposed travel route will fall under Etna Township jurisdiction, will Etna Township also be involved in the development of the RUMA?***

Response:
Yes. Our experience has been that only one RUMA would be prepared for both County and Township roads for a project. We would presume that the County Engineer would coordinate with Etna Township.

29. ***Page 4 of Exhibit K (Route Evaluation Study by Hull & Associates) of the application provides an assessment of the current conditions of the roadways expected to be impacted. Are there plans to re-assess these conditions immediately prior to commencement of construction?***

Response:
Typically, if a pre-construction assessment of the roads would be required, it would be part of the RUMA.

Because it is not known specifically when construction on a project would begin after a Certificate is approved, the Route Evaluation Study should not be used as the baseline of the condition of the roads because further deterioration may occur after the time the Study is performed. Usually, the RUMA will specify any required pre-construction roadway assessment that should be performed and that is something to negotiate with the County Engineer. Union Ridge Solar, LLC intends to perform this assessment before the preconstruction conference to establish an accurate baseline condition that the roads will be evaluated from after construction.

30. ***Will the RUMA provide for any arrangements for the County Engineer and Etna Township to corroborate the Applicant's road condition assessment, or otherwise provide their own assessments prior to initiation of construction?***

Response:
If the County Engineer and Etna Township request to corroborate the Applicant's road condition assessment or provide their own assessment prior to construction, those conditions would be negotiated as part of the RUMA for the project.

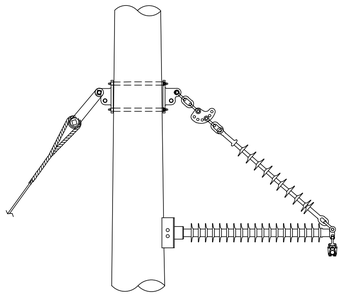
31. ***Will the laydown yards be surrounded by a fence? If so, what will the height of the fence be?***

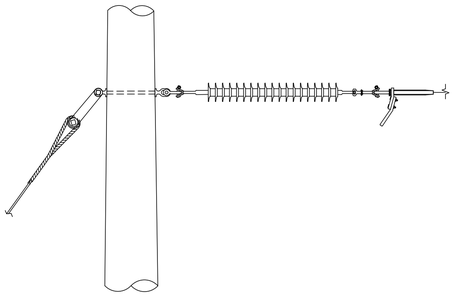
Response:
The project fence will surround the whole project and the laydown yards will be temporary areas inside the project fence. We are proposing a 7' high agricultural security fence for the project except for the high voltage substation which will have a chain link fence.

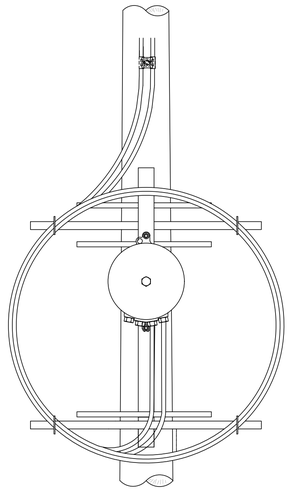
32. ***What is status of the cultural resource studies?***

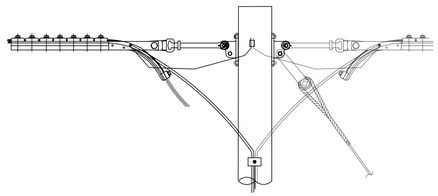
Response:
We have received full concurrence from SHPO for the Phase 1 Archaeological Survey. We have received partial concurrence from SHPO for the Phase 1 Historic Architecture Survey. To provide more project flexibility, the panel area was expanded in the southwest portion of the project area consistent with the layout filed in our application with the OPSB. This expansion is currently under

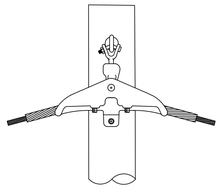
Appendix A

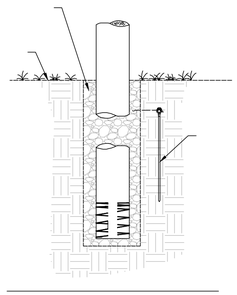


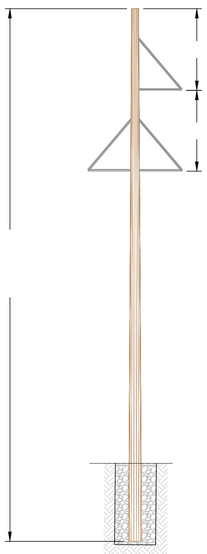




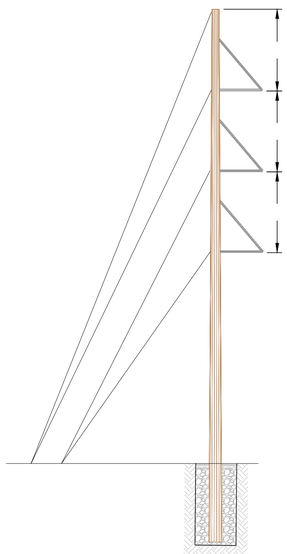




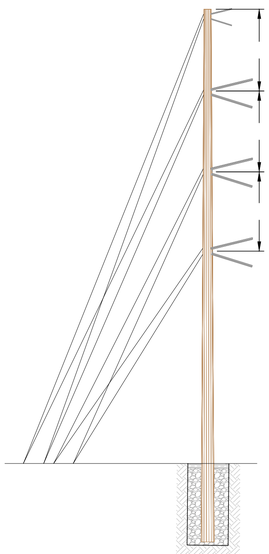




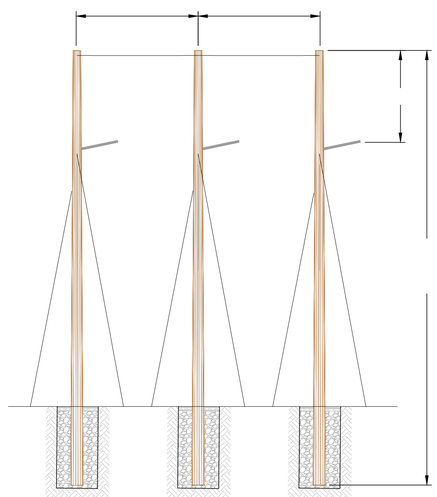
138 kV TANGENT, BRACED POSTS,
WOOD POLE
DIRECT EMBEDMENT



138 kV RUNNING ANGLE TANGENT,
GUYED, BRACED POSTS,
WOOD POLE
DIRECT EMBEDMENT



138 kV DOUBLE DEAD END
STRAIN INSULATION,
GUYED, WOOD POLE
DIRECT EMBEDMENT



138 kV DOUBLE DEAD END
STRAIN INSULATION
WITH POST JUMPERS
GUYED 3-WOOD POLES
DIRECT EMBEDMENT

RRC POWER & ENERGY, LLC
7591 SW MOHAWK ST,
TUALATIN, OR 97062
PHONE: (503) 342-4064
www.RRCcompanies.com

PRELIMINARY
NOT FOR CONSTRUCTION

REV	DATE	ISSUE DESCRIPTION
	04/28/2021	

APPROVED BY:

BAR MUST SCALE 2" FOR FULL SIZE
OR 1" FOR HALF SIZE DRAWING

PROJECT NUMBER:

UNION RIDGE SOLAR
138 kV OVERHEAD LINE

PRELIMINARY
PROJECT DETAILS
AND GENERAL NOTES

UNRS-T-000-00

Appendix B

Union Ridge Solar, LLC
Emergency Action Plan

LEEWARD
union ridge solar

Table of Contents

Appendices

1 Introduction

This Emergency Action Plan (EAP) has been prepared for **Union Ridge Solar, LLC** (hereafter, referred to as 'Union Ridge Solar' or the 'Site').

The Site is approximately 0.5 mile southeast of the City of Pataskala in Harrison Township, Licking County, Ohio (Appendix A). Emergency evacuation routes including a route to the nearest hospital and Site muster points is provided in Appendix B. Associated with this EAP, Union Ridge Solar is to ensure its personnel, contractors, and visitors (of any tier) are provided guidance and awareness relating to the overall health and safety management at the Site.

This EAP shall be updated as necessary to address any additional activities or changes in Site conditions, which may occur during construction and full-scale operations. In addition, this is a living document which may be altered at any time throughout the duration of the project.

1.1 Purpose

The purpose of this EAP is to establish procedures for safely and effectively managing an emergency event for the Site. All Site personnel, including visitors, are expected to follow the procedures outlined in this plan to ensure that they are protected from any further harm during an emergency.

1.2 Authority

- OAC 4906-4-08 (A)(1) Equipment safety
- OSHA 29 CFR 1910.38, Emergency action plans.
- OSHA 29 CFR 1926.35, Employee emergency action plan

1.3 Scope

This EAP covers the designated actions managers and employees must take to ensure employees, contractors, and visitors' safety from fire and other emergencies. This plan includes: emergency escape procedures and emergency escape route assignments; procedures for employees who have to stay to operate critical plant operations before they evacuate (if applicable); procedures to account for employees after emergency evacuation has been completed; rescue and medical duties for those employees who are to perform them; the preferred means of reporting fires and other emergencies; and individuals who can be contacted for further information about the plan.

2 Responsibilities

Key Associates (and designees) have responsibility and accountability in ensuring the safe response and evacuation of Site personnel and any visitors in an emergency. Those key job titles, with appropriate responsibilities, are listed in the following section and hereafter will be referred to as Emergency Response Team (ERT) members. The ERT consists of management and supervisory personnel who have the

delegated authority to act and make decisions, as required, during emergencies in accordance with their defined roles and responsibilities.

The Associates responsible for emergency planning and information are: [TO BE UPDATED WHEN CONTRACTOR IS SELECTED]

Name of Associate	Title	ERT Role	Contact Information
TBD	Project Manager	ERT Team Member	
TBD	Construction Manager	ERT Leader	
TBD	Site Safety Manager	ERT	
TBD	Site Manager	ERT Team Member	
TBD	Structural Supervisor	ERT Team Member	
TBD	Electrical Supervisor	ERT Team Member	

2.1 Emergency Response Team (ERT) Responsibilities

The goal of the ERT is to assist with the orderly evacuation of the Site, from a building or area during an emergency, or assist with shelter in place procedures, if warranted. The duties of the ERT are as follows:

- Be familiar with the content of this Plan;
- Alert personnel and visitors of emergency situations;
- Ensure that personnel and visitors appropriately evacuate a Site building or area using the escape route assignments (see diagrams in **Appendix B**);
- Assist in the evacuation of anyone with disabilities during emergency situations, or alerting security, fire, and police personnel of the last known location of the individuals;
- Perform medical duties, as necessary, during emergency situations;
- Extinguish small fires with the use of a fire extinguisher; and
- Account for all personnel and visitors at the designated meeting location(s), if necessary.

2.2 Site Manager (O&M Plant Manager)

The Site Manager (or designee) has the following responsibilities:

- Approving the EAP;
- Reviewing and updating the EAP periodically to cover prevalent conditions or dangers or those likely to occur at the Site;
- Assessing Site conditions and directing emergency response activities in accordance with the EAP;
- Ensuring information regarding Site evacuations, emergency assembly areas, communication, and other emergency procedures are accurate and up-to-date; and
- Ensuring Site contact information is accurate and up-to-date (see **Appendix C**).

2.3 Site Manager Responsibilities (O&M Plant Manager)

Site Managers have the following responsibilities:

- Conducting routine EAP drills and evaluating compliance with the EAP;
- Acting as the sole liaison to senior emergency services personnel;
- Directing Associates in the event of an emergency evacuation, as follows:
    - Relaying the final accountability results to senior Emergency Services responders;
    - Having sole responsibility to allow personnel and/or visitors to return to the Site or to dismiss them from the Site; and
    - Organizing a meeting of all key Associates after each evacuation to investigate, discuss, and review the occurrence.
- Ensuring all Associates have received the proper fire and evacuation training and documenting that training;
- Monitoring work areas for potential fire risks and obstructed fire exits, alarm stations, and fire extinguishers;
- Verifying that emergency evacuation routes and emergency assembly areas are accessible;
- Managing emergency equipment or supplies, including first aid kits, fire-fighting equipment, and personal protective equipment (PPE); and

- Preparing detailed written reports of each incident, which include recommendations for preventing future incidents and suggestions for improved handling of similar emergencies.

In the event of an emergency, Site Managers are also responsible for the following:

- Assisting or coordinating the evacuation of handicapped individuals;
- Assisting with mobilization of supplies and equipment required during and after an emergency;
- Bringing their group to the emergency assembly area and obtaining a head count as soon as possible to determine if anyone is missing;
- Reporting accountability results; and
- Maintaining control of the Associates within their areas to prevent wandering, premature return to the work area, or unauthorized exit from the work area.

2.4 Associates' Responsibilities

All Associates have the following responsibilities.

- Complying with the Site EAP;
- Advising Site Management of problems or discrepancies with this EAP at the Site;
- In the event of an emergency, assuring that most Associates are evacuated and do not participate in emergency response activities.

3 Emergency Methods/Procedures

This section of the EAP details the appropriate measures to be employed during the development of the Plan and during an actual emergency or incident. It should be noted that all procedures should only be undertaken if it is safe to do so and there is no risk of harm to any other personnel. Should further risks to other personnel exist, it is imperative that external professional assistance is requested to ensure all Associates and visitors are safe and no further incidents occur.

3.1 Risk Analysis and Plan Development

During initial site preparation for start of operation, the Site Manager (or designee) shall perform the following steps in developing the Site EAP:

Step	Action
1	Perform a risk analysis of the entire Site to identify potential accidents and incidents that may occur and determine mitigating measures designed to reduce exposure.
2	Develop a list with the Site address, primary Union Ridge Solar contact, and local emergency response (e.g. fire, police and ambulance) and update the information in **Appendix C.**
3	Identify Site muster points (i.e. emergency assembly areas) and develop an emergency evacuation map for Site personnel. Post emergency evacuation map in conspicuous areas for Site Associates and visitors.
4	Identify Associates responsible for emergency response and evacuation and update in **Appendix C.**
5	Provide EAP training component for Site safety orientation for all new Union Ridge Solar Associates, visitors, West Licking Joint Fire District, and EMS.

3.2 Reporting Emergencies

In the event of a Site emergency, the following steps shall be taken:

Step	Action
1	If appropriate, call 911, then notify the operations center**.** 911 shall **ALWAYS** be contacted for all life-threatening injuries and significant environmental events (e.g. uncontrolled fires, floods, earthquakes, etc.).
2	Provide as much information, as possible, including the following (if applicable): • Type of emergency • Address and geographical location • Location of emergency (e.g. block/equipment, trailer, parking lot, etc.) • Number of injured or trapped persons

Step	Action
3	Site Manager (or designee) shall notify the entire Site of emergency through two-way radio communication and/or telephone.

3.3 General Emergency Response

Once an emergency has been issued by the Site, all Associates and visitors shall take the following actions:

Step	Action
1	Turn off all mobile equipment and power tools.
2	Attempt to rescue or assist others, only if it can be done safely.
3	Report to the designated muster point (i.e. emergency assembly area), unless the egress route to the muster area is not safe for travel. In such a case, proceed to an alternate muster area. **Important:** Walk briskly, but do not run.
4	Remain calm, alert, and wait for further instructions from your supervisor or other representative designated as the 'Person-in-Charge'.
5	Listen carefully for your name to be called for accountability. If your name is not called, report this to your supervisor, or Person-in-Charge, immediately.
6	Listen for the names of unaccounted Associates. If possible, provide information to their supervisor regarding their location such as an Associate's absence, break, off-Site meeting, etc.
7	Remain in the assembly area until dismissed by Site management. Do not get in a car, leave the Site, or wander out of your assembly area unless given the 'ALL CLEAR' or return to work authorization has been given by Site management.
8	Do not return to the work area until authorized by Site management.

3.4 Injury Response

In the event of an injury, Associates and visitors shall take the following actions:

Step	Action
1	Check the scene and the victim to determine the danger potential and the extent of the injury. Do not move a seriously injured victim unless there is an immediate danger.
2	If appropriate, call **911,** then notify the operations center.
3	If the injury is minor, treat with first aid.
4	If the injury is determined to need medical attention, the supervisor (or designee) will make notifications to West Licking Fire Association and/or Pataskala Police Department.
5	If an ambulance is required, the Site manager (or designee) will assist in escorting ambulance to the area of the injured person.

3.5 Hazardous Materials Response

A hazardous material is a substance that presents a physical or health hazard. A health hazard refers to a substance for which there is significant evidence that health effects may occur for exposed employees.

A Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS) is required for all hazardous substances in use at the Site. Associates will be trained on the safe use of all chemicals they will be exposed to.

The list of chemicals regularly used at this Site is located at the Operations &Maintenance (O&M) office.

In the event of a hazardous materials release, all Associates and visitors shall take the following actions:

Step	Action
1	Evacuate the area and secure access to the area, when possible.
2	Immediately inform your supervisor of the situation. Provide as much information as possible.
3	If safe, remain in the immediate area and prevent others from being exposed to the hazardous materials until appropriate emergency response can arrive.

Step	Action
4	If it is determined that emergency services are needed, the Site manager (or designee) will notify emergency services and assist with the arrival of emergency vehicles.

3.6 Earthquake Response

In the event of an earthquake, all Associates and visitors shall take the following actions:

Step	Action
1	If indoors during an earthquake: • Take cover by moving under a sturdy table or other piece of furniture. • Hold on until shaking stops. • If you cannot take cover under a piece of furniture, tuck your head into your knees and cover your head with your arms. • Proceed to muster point only after shaking has stopped and it is safe to do so.
2	If outdoors during an earthquake: • Get out of trenches and excavations by using the safest means necessary. • Remain outdoors. DO NOT enter a building. • Stop all work, exit arrays and hot areas, and proceed to nearest muster point. • Drop to your knees into a fetal position, close your eyes, and cross your arms over the back of your neck for protection. Remain in this position until shaking stops. • Do not walk the Site alone.
3	If in a vehicle during an earthquake: • Stop as quickly as safety permits and stay in the vehicle. • Avoid stopping near or under buildings, trees, overpasses and utility wires. • Proceed to muster point cautiously once shaking has stopped. • Avoid roads, bridges, or ramps that might have been damaged by the earthquake.

3.7 Fire or Explosion Response

In the event of a fire or explosion, all Associates and visitors shall take the following actions:

Step	Action
1	Notify the operations center and, if appropriate, call **911** for the West Licking Joint Fire District.
2	Provide your location – use landmarks or block/array information if working outside.
3	Provide status of victims, if any, and the affected areas of the fire or explosion.
4	If you are a victim that is on fire – STOP, DROP, and ROLL.
5	Try to extinguish the fire ONLY if safe to do so and trained to use a fire extinguisher or other firefighting medium.
6	Alert others nearby to clear affected area.
7	All Site personnel shall stop work and maintain radio silence if not directly involved in the emergency.
8	Try to move any victims to a safe area, if possible.
9	Upon radio and/or phone instruction from Site management, proceed to the nearest assembly area and wait for further instruction.
10	Stay together and do not leave until 'ALL CLEAR' is given or further instruction is provided by Site management.
11	In the event of an electrical fire within the PV fields, all personnel must evacuate the premises and, the West Licking Joint Fire District and/or Pataskala Police Department must be notified. No fire extinguishing equipment at the Site is capable of safely extinguishing a fire within the PV fields. No personnel shall return to the Site until the fire is extinguished and the Site Manager has given authorization.

3.8 Severe Weather Response

In the event of severe weather, all Associates and visitors shall take the following actions:

Step	Action
1	Monitor media resources for warnings associated with severe weather conditions. Severe weather can be any of, or a combination of, the following: • Wind Storm • Heavy Rain Storm or Flash Flood • Lightning Storm • Dust Storm • Other weather conditions that may be rare events that could disrupt operations or present hazardous conditions such as snow, sleet, hail, or tornados
2	Obtain as much information as possible from information sources, such as: • Internet access to weather websites • Local forecasting and warnings via AM/FM radio. • Weather apps on smart phones • Personal observations of existing conditions
3	Personnel should be advised to seek shelter in one of the following locations (preferably in the O&M building): • O&M Building • Vehicles
4	In the case of the following conditions further sheltering or protection should be sought as follows: • Wind Storm ○ If driving, assess conditions and try to pull off the road in a sheltered location. Avoid trees, power lines and other objects that may be displaced by the wind. ○ If on Site, seek shelter in the above-mentioned locations. • Heavy Rain Storm or Flash Flood ○ If traveling, assess conditions and adjust traveling speed accordingly. ○ If traveling and water is rising, seek high ground and shelter in your vehicle. ○ DO NOT try to cross portions of roadways covered by water. Wait until water flows subside to ensure that the roadway is intact and that no current can sweep away your vehicle. Ten inches of water will sweep away a passenger vehicle or light truck. ○ If on Site, shelter in the above-mentioned shelter locations.

Step	Action
	○ Seek high ground if sheltering in a vehicle. ○ Stay clear of electrical devices, poles, breakers, and overhead lines. ○ DO NOT drive through low lying areas that are covered with water. ○ DO NOT return to the Site until conditions allow safe access. • Lightning Storm ○ If lightning is detected 30 miles from the location: ▪ Prepare to shut down all activities. ▪ Identify shelter and prepare to move to it. ○ If Lightning is detected at 15 miles from the location: ▪ Cease outdoor activity ▪ Secure equipment ○ If Lightning is detected at 8 miles or visibly observed: ▪ Immediately seek shelter and cease any outdoor activities. Abandon any efforts to secure equipment. ○ Outdoor activity should not resume until lightning has been verified to have moved at least 15 miles away from the Site. • Dust Storm ○ If driving, pull off the side of the road and park clear of traffic. Stay with your vehicle. Turn lights off and keep foot off the brake pedal (brake lights). ○ If on the Site and able, seek shelter in one of the above-mentioned sheltering locations. ○ If on Site and unable to avoid the storm, shelter in your vehicle. • Tornado: ○ Seek shelter in the most interior sections of buildings. ○ Seek shelter in low areas on the ground. Abandon your vehicle and look for a depression in the ground.
5	Other Conditions and Response: • In the event of snow, hail, sleet or freezing rain: ○ If driving, slow vehicle to match conditions or safely exit at the next exit location and wait for conditions to improve. ○ Shelter in buildings, if possible. ○ If sheltered in vehicle, run vehicle motor sparingly and be aware of carbon monoxide poisoning potential.

Step	Action
	○ Be aware of traveling conditions on Site and avoid locations where vehicles may get stuck or are otherwise inhibited from travel.

3.9 Bomb Threat

In the event of a bomb threat, all Associates and visitors shall take the following actions:

Step	Action
1	If you receive a bomb threat or discover a possible bomb or suspicious object(s), immediately notify your supervisor.
2	Get someone's attention and convey the nature of the call. Have them notify a supervisor.
3	Get as much information as possible from the caller. Ask the following questions: • Where is the bomb? • When is it going to explode? • What does it look like? • What kind of bomb is it? • What is the person's name or organization?
4	Record the following information: • Date and time of call • Exact words of caller • Age, sex, adult, or child
6	For bomb threats by mail or for suspicious objects discovered: • Do not handle the letter, envelope, or package any further. • Notify your Supervisor, Safety and the operations center. • Site management will make call to emergency services.

3.10 Emergency Recovery

Emergency recovery planning and activities shall commence while the actual emergency is still occurring. Where statutory investigations may need to be undertaken prior to the commencement of clean-up activities, a designated ERT representative shall only permit entry into the emergency site by authorized personnel.

Site access boundaries will be determined, enforced and continuously reassessed. Consideration will be given to allowing entry by personnel into those areas of the Site not impacted by the emergency and found to be free of contamination.

The following shall also be considered during emergency recovery:

- Mobile equipment and machinery will be inspected and assessed to determine if it is safe for return to service.
- The Site will be cleaned, including removing and disposing damaged materials.
- Essential services (power, water, sewage etc.) will be restored.
- Reconstruction of infrastructure will be undertaken, as required.
- Hazardous materials must be contained, cleaned, and disposed in accordance with legislative requirements for hazardous materials. Temporary storage areas may need to be identified until hazardous materials are removed from Site.
- Environmental monitoring must be undertaken to determine the extent of any environmental harm until it can be confirmed that all contamination has been cleaned.

A stand-down of the ERT shall not occur until recovery arrangements are in place. Progress reports of recovery activities shall be communicated to all Associates and other relevant stakeholders.

4 Training

Training will be provided to all Associates and to the West Licking Joint Fire District to ensure they understand their roles and responsibilities in emergency action response. Typically, this training shall be provided in the mandatory Site safety orientation.

The following emergency procedures and topics shall be covered in the Site safety orientation:

- Locations of muster points (i.e. emergency assembly areas);

- Pre-determined routes used to reach emergency assembly areas;
- Procedures to follow in the event of specific emergency situations;
- Locations of fire extinguishers and first aid kits;
- Site emergency contact information; and
- Details of equipment to be used during emergency situations – Alarm stations, air horns, two-way radios and firefighting equipment.

All individuals designated as members of an ERT shall be indoctrinated through a more formal training exercise provided by a Site Safety representative. This training shall be provided to key ERT staff during initial Site move-on. They shall be made aware of their responsibilities under this Plan:

- Initially when the plan is developed;
- Whenever the Associate's responsibility under the Plan changes; and
- Whenever the Plan is changed.

While Union Ridge Solar is in operation, fire and emergency responders will be provided with training necessary for responding to emergency situations at the site. Training should be coordinated through the Fire Marshal with the West Licking Joint Fire District. Additionally, equipment that is reasonably required to enable emergency responders to respond to emergency situations at the site will be provided by Union Ridge Solar.

5 Reporting/Notification

All Site emergencies shall be adequately reported to Union Ridge Solar management, Site Owner(s), regulatory agencies (if applicable) and other appropriate organizations in a timely fashion. Drills shall also be conducted regularly to ensure the EAP works as designed.

5.1 Emergency Notification

There is a requirement to ensure that consistent information is presented to all stakeholders appropriate to the nature of all emergencies at the Site.

Client (Owner) Notification – Client or Owner representatives shall be provided the details of all Site emergencies within 24 hours or as prescribed in the O&M contract.

Community/Authority Notification – The process for notification of stakeholders relates directly to the nature of the hazard. In the event that there is an unacceptable risk to the community from the emergency or incident, the impacted community stakeholders will be notified. OSHA shall also be notified in the event of serious injury or death within 8 hours.

5.2 Emergency Investigation and Close Out

All emergency events shall be reported, investigated, and managed as prescribed in the O&M Health and Safety Manual, including Union Ridge Solar procedures in Incident Reporting & Investigation.

On close out of an emergency, the ERT shall assess if further controls or resources are required to prevent or mitigate the impact of a future recurrence.

5.3 Emergency Drill Schedule

Office fire and emergency drills shall be conducted at least *annually*. Where offices accommodate persons with special requirements, emergency arrangements shall be tested at least every six (6) months.

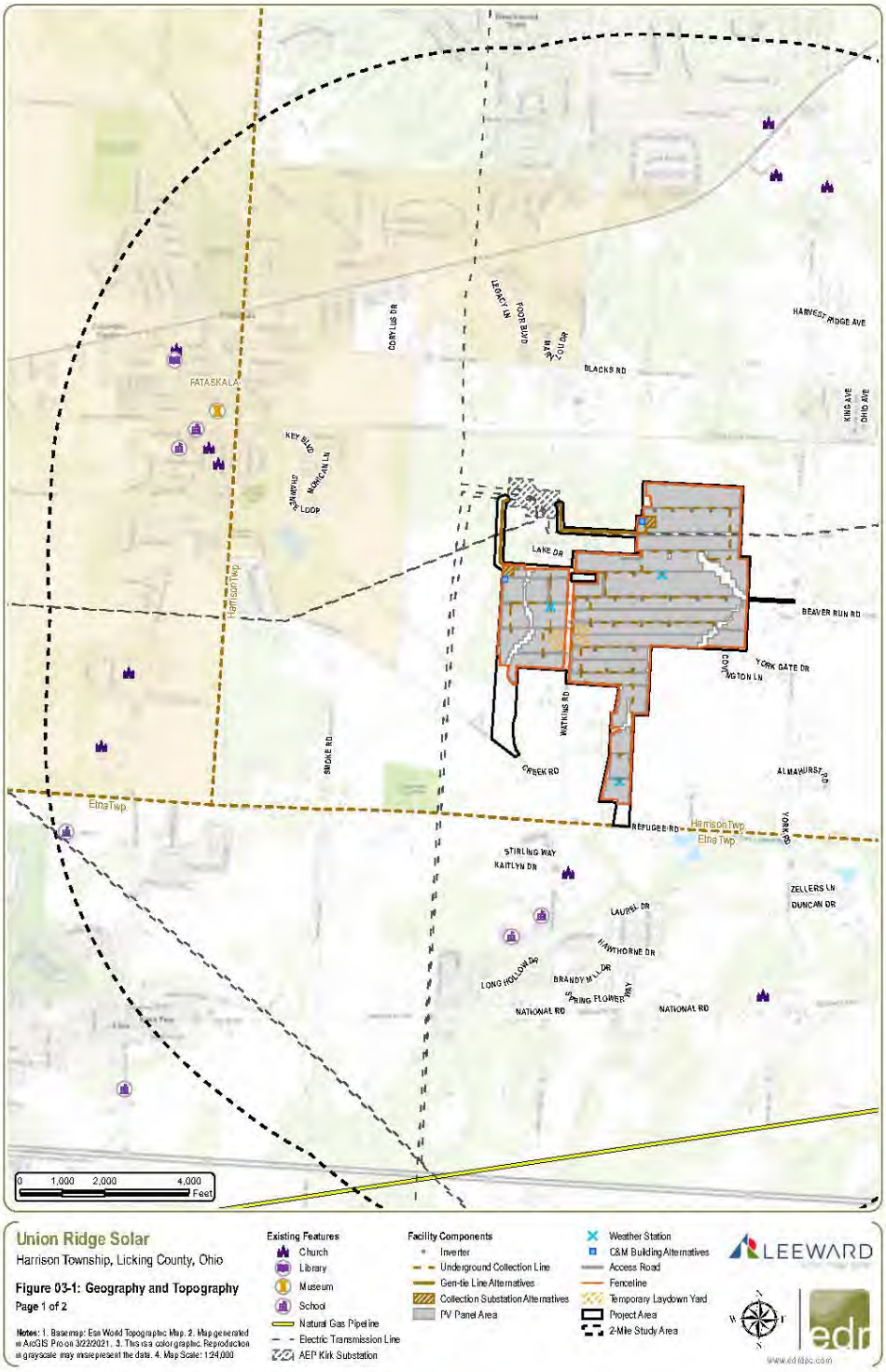
The ERT team leader shall nominate observers who understand the deliverables and required actions in the Plan to observe the drill, take notes and provide feedback at a debrief which will be recorded and evaluated.

Formal documented debriefs shall also be conducted with involved personnel following each actual emergency to identify the strengths, deficiencies, and opportunities for improvement.

Revisions or lessons learned shall be communicated to all stakeholders at construction team meetings, toolbox talks, and via email.

Appendices

Appendix A – Site Location Map

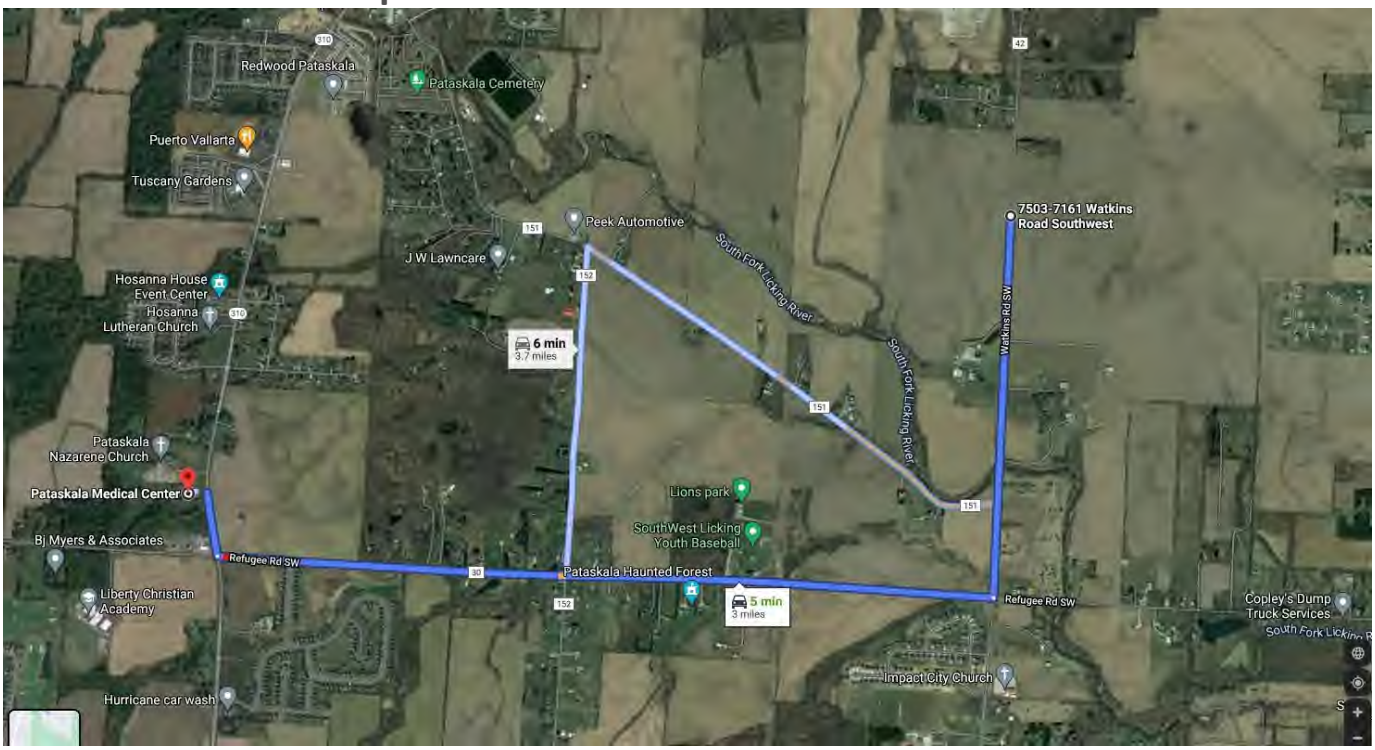


Appendix B – Emergency Evacuation Maps, Muster Points, and Hospital Directions

[SITE MAP AND MUSTER POINT LOCATIONS TO BE ADDED UPON FINAL ENGINEERING OF PROJECT]

LEEWARD
union ridge solar

Route to Nearest Hospital



From the Watkins Road:

Head south on Watkins Rd SW
Turn right onto Refugee Rd SW
Turn right onto Hazelton-Etna Rd SW

Pataskala Medical Center, 8200 Hazelton-Etna Rd SW, Pataskala, OH 43062

LEEWARD
union ridge solar

Appendix C – Emergency Contact List

[TO BE UPDATED UPON SELECTION OF CONTRACTOR]

Site Name:	**Union Ridge Solar**	
ADDRESS:	**Watkins Road SW, Pataskala, OH 43062**	
Description	**Contact Name** Address	**Contact Details,** e.g. phone number, instructions
Construction Manager		
Site Supervisor		
Safety Manager		
Structural Supervisor		
Electrical Supervisor		
Emergency Numbers	Emergency	911
	West Licking Joint Fire District and EMS	911
	Licking County Sheriff's Office	911
Nearest Hospital/Medical Center	Pataskala Medical Center	740-927-7665
Security	24 Hour Phone	
Local Ohio OSHA Office	Columbus	614-469-5582
Ohio EPA	Central District	1-800-282-9378
Poison Control	24 Hour Phone	1-800-222-1222

Appendix D – Health and Safety Plan

Union Ridge Solar

Health and Safety Plan

LEEWARD
union ridge solar

Table of Contents

1 LEEWARD SOLAR HEALTH AND SAFETY POLICY STATEMENT

1.1 LEEWARD RENEWABLE ENERGY O&M HEALTH AND SAFETY POLICY STATEMENT

Leeward Renewable Energy (hereafter referred to as Leeward or the Company) has no higher priority than to provide a save work environment for our associates, community and a safe product for our customers. Safety first means exactly that; we are committed to eliminating safety risk, or when it is not possible to eliminate a risk to then minimize the risk. If there's ever a choice to be made between our financial self-interests and the safety of our associates and customers, we'll always address the safety issues first above all other obligations.

- We value personal safety over financial results.
- We strive for an accident and injury free workplace.
- We are pro-active in providing a safe product and work environment.
- We shall empower associates to identify and report risks to safety.
- We shall strive to continually improve our Safety Program.

Leeward is committed to protection against illness, injuries, and accidental loss to its workers and property.

In fulfilling this commitment, we will provide and maintain a safe and healthy work environment that meets or exceeds established industry practices and safety regulatory requirements. We shall strive to identify any foreseeable hazards which may result in personal injuries/illnesses, fires, and losses to property.

This organizational culture of safety can be controlled through strong management support in combination with active team and individual involvement. O&M associates shall comply with this Leeward policy of safety in the planning and conduct of operation and maintenance activities. All Leeward O&M Associates are personally responsible to perform their job in accordance with Company safety procedures and this overriding policy of safety.

The O&M team is committed to safety as a way of life.

2 LEEWARD SOLAR SAFETY COMMITMENT

Leeward Renewable Energy is committed to complying with all applicable federal, state, and local safety standards and regulations at all times. Safety is a joint responsibility and cooperative undertaking that requires ever-present safety awareness on the part of every Associate.

This Health and Safety Plan (hereafter referred to as the Plan) can apply to all job locations where Leeward Associates work. However, this Plan was prepared based on the best available information regarding the health, physical, chemical, environmental and biological hazards known or suspected to be present at a utility-scale photovoltaic plant (hereafter referred to as the Facility). While it is not possible to discover, evaluate, and protect in advance against all possible hazards, which may be encountered at Facility, adherence to the safety requirements of this Plan will significantly reduce the potential for occupational injury.

These general safety rules are to protect you and your co-worker(s) from harm and apply to all Leeward Associates:

- No one shall be assigned or permitted to work while their ability or alertness is impaired by fatigue, illness, intoxicating liquor, illegal drugs, prescription drugs, etc. such that impairment of motor skills or other faculties might expose the individual or his or her co-associates to injury.
- Report immediately all injuries, near misses, unsafe conditions or work practices to your supervisor.
- Maintain good housekeeping at all times in the work area.
- Wear suitable clothing and footwear at all times.
- Properly wear Personal Protective Equipment (PPE) whenever needed and where posted.
- Participate in the safety awareness training sessions conducted by the Leeward Site Manager/Designee.
- No horseplay.
- Plan work carefully to avoid injuries.
- Visually inspect machinery and equipment to ensure that all guards and other protective devices are properly placed and adjusted.
- Report deficiencies promptly to your supervisor.
- Do not use defective tools and equipment.

- Do not throw or toss objects. Dispose of all waste properly and carefully.
- Use proper body mechanics when lifting heavy objects. Ask for assistance or use mechanical devices to move heavy objects.
- Stop work whenever you feel the job is unsafe and immediately contact your supervisor.

The Leeward Site Manager is responsible for enforcing the requirements within this Plan; YOU are responsible for adherence to these requirements.

3 SCOPE, APPLICABILITY, AND PURPOSE

3.1 SCOPE

This Health and Safety Plan (HASP) provides an overview of the application of Leeward Health and Safety Program procedures that are applicable to the operation and maintenance of a Facility. Read this Plan and make available for reference. It was prepared to enhance Associate and contract employee (hereafter referred to singularly as Associates) awareness of the Company focus on the importance of employee health, workplace safety and regulatory compliance. It does not address every situation that will arise and, therefore, is not intended to serve as an exhaustive set of rules.

This Plan and its referenced procedures, as well as future updates, are not intended as a contractual commitment or obligation of the Company to its Clients and Associates. From time to time, the Company may change or discontinue procedures based on contractual service agreements, policies and practices. As in all matters, the Company will use its discretion to take action that it believes is appropriate in the particular circumstances based on legal provisions, interpretations of law and personnel relations principles.

At the start of work at a new facility, obtain the latest revision number of this Plan from the Company's Plant Manager/Supervisor/Designee. You are responsible for having the most current revision. It is an expectation that Associates will give their best effort, however failure to abide by this Company Plan and referenced procedures may subject Associates to disciplinary actions up to and including termination.

We expect that you are committed to upholding the safety requirements within this HASP and procedures of the Company. All of us shall view safety as our primary concern. Not only is safety a concern in the workplace but also in our daily lives away from work. This Plan has been designed to provide you the fundamentals to help maintain good safety awareness at work and in everyday life. Please use the safety guidance in this Plan and share the ideas and safety tips with your families, friends and co-workers.

The Company has coupled general personnel policies and guidelines with this Plan and referenced procedures. It obviously cannot answer every question and is not intended to do so. Contractual specific requirements with the Client, site specific policies and procedures, and, if applicable, local labor agreements, may also need to be referenced when questions arise.

Our goal is to make Associates aware of Company health and safety policies and to make health and safety not just a set of rules, but a way of life. We are proud of the way in which we run our Company with our focus on safety first, and expect you to share that sense of pride.

3.2 APPLICABILITY

- Safety is the responsibility of everyone in the Company from senior management to front-line Associates.
- Each individual has the duty to work safely.
- Individuals have the duty to promote safety throughout their area of responsibility.
- As a condition of employment, every Associate is required to observe all rules and practices and to follow the instruction of their supervisor. They shall be alert to unsafe conditions and promptly report them to their supervisor.

3.3 RESPONSIBILITIES

3.3.1 Senior Management

- Impressing upon employees the importance of safe work behaviors and conditions;
- Providing opportunity and resources for safety training;
- Taking an active role in safety meetings and discussions;
- Consistently enforcing the safety policies, procedures, practices and rules;
- Actively participating in investigating mishaps resulting in serious occupational injury and illness or property damages and appointing special accident investigation committees as needed.
- Providing timely answers to safety and health suggestions and taking the appropriate action to correct any identified unsafe condition; and
- Ensuring investigation teams are properly staffed and incidents are investigated.

3.3.2 Mid-Management Responsibilities

- Impressing upon employees the importance of safe work habits;
- Making frequent safety appraisals of front-line leaders and others that report to them;

- Soliciting information from their employees regarding accidents, near misses or hazards and taking the necessary action to prevent a reoccurrence;
- Scheduling appropriate, regular, and meaningful safety meetings and providing an adequate meeting place;
- Ensuring annual training requirements are scheduled and completed;
- Ensuring new Associates are trained on proper work procedures and policies;
- Informing senior management of field conditions that will affect Associates;
- Informing front-line leaders of all future plans that will affect them or their personnel; and
- Ensuring that safety meetings are performed and documented.

3.3.3 Front-Line Leaders' Responsibilities (e.g. Leeward Plant Manager)

- Maintaining a high degree of morale and teamwork among their personnel;
- Conducting an assessment of the daily work plan and work area for hazardous conditions and the acquisition of appropriate PPE, when needed;
- Implementing all applicable rules and safe work practices on every job or task;
- Detecting and correcting unsafe working conditions and practices;
- Familiarizing Associates with proper work policies and procedures with special attention given to new Associates;
- Conducting and documenting new Associate safety orientation;
- Establishing when and how safety meetings are conducted;
- Making certain all Associates know, understand and follow the safety rules pertaining to their job;
- Encouraging safety suggestions and frequently discussing safety matters with Associates;
- Providing Associate recognition for outstanding safety performance as the opportunity presents itself;
- Intervening when unsafe conditions or behaviors are observed and stopping work until the unsafe conditions or behaviors are corrected;
- Completing appropriate reports and notifications of injury, illness and/or property damages upon receiving knowledge of said event and initiating the necessary corrective action(s) to prevent reoccurrence;
- Ensuring accident investigations are conducted in accordance with corporate procedures and that corrective actions are implemented;
- Providing information in a timely fashion to Associates, Client representatives, peers and management that will keep all parties informed on safety and health issues;
- Being familiar with and practicing the concepts associated with pre-job briefings whether working alone or on a crew;

- Ensuring that proper authorizations have been obtained for all work under their supervision;
- Performing monthly safety inspections of work area and documenting deficiencies that are not immediately corrected during the inspection; and
- Notifying Owner of all accidents by submitting preliminary and final investigation reports; and submitting material communications and notices with governmental authorities and insurance companies with respect to accidents.

D. Front-Line Employees' Responsibilities

- Abiding by all safety policies, procedures, practices, and rules; and following the instructions of their supervisor;
- Doing everything possible to ensure their safety, the safety of fellow Associates, and the safety of the public including taking special precautions they feel may be necessary under the circumstances;
- Using good judgment and asking for a sufficient number of people to do the work safely;
- Knowing and understanding the safety rules that apply to the work being performed;
- Avoid startling others while they are working;
- Endeavoring to promote harmony and good working relations between yourself and fellow workers;
- Identifying and correcting hazards and at-risk behaviors observed in the workplace;
- Reporting the unsafe condition or seeking help to correct the unsafe condition or practice if unable to correct immediately;
- Avoid engaging in horseplay, scuffling and practical jokes;
- Reporting work situations to the supervisor's attention if it is believed that Associates are not sufficiently protected, are called upon to do work they consider hazardous, or are asked to do work which they have not performed in the previous twelve (12) months;
- Reporting to work "fit-for-duty"; and
- Wear appropriate PPE at all times.

3.3.4 Safety Manager Responsibilities

- Conducting safety assessments of work conditions and behaviors and advising management on enhancements for the work force;
- Managing of safety and occupational health program elements;
- Developing and recommending safety and occupational health policy and practices;

- Applying safety and occupational health laws, regulations, principles, theories, practices and procedures to advise on or resolve technical matters dealing with occupational safety and health requirements;
- Developing safety and occupational health practices and procedures to eliminate or control potential hazards;
- Developing or implementing programs to reduce the frequency, severity, and cost of accidents and occupational illnesses.
- Analyzing or evaluating new and existing jobs, processes, products, or other systems for the possible existence of hazards;
- Inspecting or surveying workplaces, processes, products, or other systems for compliance with established safety and occupational health policies or standards and to identify potential new hazards; and
- Train Associates, leaders, managers, or other safety and occupational health personnel in safety and occupational health subjects.
- Review and approve contactors specialized work procedures to be used at Leeward sites (e.g., confined spaces and safety at heights

4 GENERAL SAFETY

This chapter contains specific requirements, instructions, and guidelines for Associates that establish safety expectations that help reduce the kinds of accidents and close call events that may result in injury.

4.1 SAFETY ORIENTATION

4.2 SAFETY INSPECTIONS AND WORKER OBSERVATIONS

- Field inspections shall be conducted, at least, monthly and performed by designated personnel, using a site-specific form or checklist. Results shall be documented and retained for, a minimum, of two (2) years
- Management, at all levels, is encouraged to observe other Associates during the performance of their work and visit with them about the activities that are being performed. Observations should include identification of unsafe actions that may be occurring while also taking note of the safe work that is being performed. In a positive manner, the observations should be communicated, recorded and changes initiated to work procedures when needed

4.3 GENERAL SAFETY INSTRUCTIONS

- Know and understand the safety rules that apply to the work being performed.
- Abide by all safety policies, procedures, practices and rules.
- Follow the leader's instructions.
- Do everything possible to ensure individual safety, the safety of fellow workers, and the safety of the public; including taking special precautions felt to be necessary under the circumstances.
- Endeavor to promote harmony and good working relations with fellow workers.
- Ask for a sufficient number of people to do the work safely.
- Identify and correct at-risk behaviors observed in the workplace.
- Identify and correct hazards encountered or created in the workplace.
- Seek help to correct the unsafe condition or practice if unable to correct.
- Avoid startling others while they are working.
- Do not engage in horseplay.
- Assess all walking surfaces prior to walking on them. Areas with uneven terrain, loose surface material, obstructed pathways, or any other hazardous condition which increases the risk of a slip, trip, or fall incident shall be avoided or made safe prior to walking on them.

- Do not wear jewelry, rings, bracelets, watches, etc., during jobs involving manual labor, the operation of moving equipment or near electrically energized parts

4.4 EMERGENCY RESPONSE INSTRUCTIONS

4.4.1 Emergency Response Plan

- Each Facility shall maintain a list of local site emergency contacts including:
    - Site Telephone number
    - Site Address
    - Primary Leeward Contact
    - Fire Department
    - Police
    - Medical Emergency
- Each Facility is responsible in completing an Emergency Action Plan and posting it in a common area at the Facility. The Emergency Action Plan shall be made readily available to all Associates, contractors and visitors.
- The Plan should also include either a map or written directions to the closest medical facility.

4.4.2 Communication preparedness Instructions

- Use two-way communications for rapid emergency response when working in remote areas.
- Know the location when working at a fixed location for more than a few minutes.
- Be able to accurately communicate the location information.
- A suggested safety practice is to write down the location (e.g. PCS building ID, GPS coordinates) and leave the information near the two-way communications device so that, should an emergency occur, the resulting excitement does not result in miscommunications and lost time attempting to direct rescuers to the scene.
- Possess a reference indicating the name, address and phone number of the nearest emergency medical facility when working in remote areas.

4.4.3 Emergency Response Instructions

- Request assistance.
- Provide for urgently necessary first aid (to control severe bleeding or no breathing).
- Report emergencies affecting worker safety to immediate supervisor or site-specific emergency number immediately.
- Follow the procedures that have been established for checking in and out with operations center or Facility offices.

4.4.4 Training Requirements

- Associates, who work in the field in a crew environment and are considered electrical workers, are required to successfully complete first aid and CPR training as frequently as specified by the certifying agency.

4.5 SAFETY MEETING GUIDELINES

- Conduct a well-planned and meaningful safety meeting at each Facility at least once each month to provide opportunities for open discussion.
- Record the following for the safety meeting records:
    - Date and time of the meeting;
    - Topics covered during the meeting; and
    - Attendee names.
- Keep records of safety meetings for a minimum of two (2) years

4.6 LIFTING SAFETY INSTRUCTIONS

- Keep the load's center of gravity as close to the body as possible.
- Lift with the legs.
- Keep the lower back flexed during the lift.
- Make turns with the feet, not by twisting at the waist.
- Do not obstruct forward vision.
- Do not attempt to lift or push objects that are too heavy.
- Split awkward or heavy loads into several smaller ones when possible.
- Use mechanical assistance, where appropriate.
- Use gloves or other hand protection, as required, when handling materials.

4.7 ERGONOMICS GUIDELINES

- Stretch the areas of the body required to perform an action prior to performing (and during) significant manual or repetitive tasks.
- Maintain good posture when working and take appropriate breaks to avoid overexertion.
- Report pain related to repetitive motion and overexertion to your leader immediately.
- Adhere to instructions received as a result of an ergonomic consultation performed by a health and safety professional

4.8 MANUFACTURER'S SAFETY INSTRUCTIONS

- Read and follow the manufacturer's safety instructions prior to first use of new equipment (e.g. installation of new inverter).

- Review the manufacturer's safety instructions as necessary for continued safe operation of the equipment

4.9 HOUSEKEEPING GUIDELINES

- Keep offices, yards, vehicles, and Facility neat and orderly at all times.
- Keep tools, equipment and materials orderly.
- Do not place tools and materials where they are likely to fall.
-
- Remove tools, equipment and materials from the work area if not to be used immediately.
- Promptly dispose of oily waste or rags brought in from the job site or found in the work area.
- Do not leave combustible or flammable material on vehicles

4.10 PACKING AND UNPACKING MATERIAL

- Dispose of nail points, ends of wires or bands exposed when packing or unpacking boxes, crates, barrels or other containers.
- Remove nails, bend the points down, or dispose of the lumber immediately to prevent loose lumber from becoming a hazard.
- Cut the bands on packing crates using shears or a device designed for the purpose.
- Take precautions to keep everyone clear of flying ends when cutting bands on packing crates

4.11 STAIRWAY USE GUIDELINES

- Walk carefully; do not run up or down stairs.
- Take one step at a time using the handrails provided.
- Do not carry items that obscure vision.
- Do not carry liquids in open containers.
- Immediately report defective stairways to appropriate supervision.
- Install a warning device for other users indicating the presence of identified hazards until repaired.

4.12 OFFICE SAFETY GUIDELINES

- Learn and follow all safety-related procedures, particularly those for special hazards involving unique equipment used in the area.
- Keep stairways, hallways, aisles and walkways between desks clear of spilled liquids, telephone and office machine cords, trash cans, or other objects that could create slipping or tripping hazards.

- Keep to the right at corners.
- Go around corners slowly to avoid collisions.
- Do not run or slide across floors or through doorways.
- Stand or walk clear of doors that may swing open unexpectedly.
- Open doors slowly to avoid striking someone on the other side.
- Sit squarely and well back on the seat of any chair keeping all chair legs and casters on the floor.
- No smoking is ever allowed in offices, enclosed hallways or storage areas.
- Keep desks, file drawers, door slides and locker doors closed when not in immediate use.
- Do not leave sharp or pointed edges exposed when not in immediate use.
- Know the location of area fire extinguishers and first aid kits.
- Store the heaviest materials near the bottom of shelving units and lockers to keep the unit's center of gravity low.
- Use proper ladders or portable steps to gain access to elevated materials and equipment.
- Do not use a chair or desk as a substitute for a ladder or portable step.
- Equip all office-related power cords and extension cords with a grounded three prong plug (unless it is double-insulated per the manufacturer's design).
- Ensure all power cords and extension cords are properly insulated.
- Replace or repair, using a qualified person, power cords with damaged insulation.

4.13 BLOODBORNE PATHOGENS INSTRUCTIONS

- Notify your direct supervisor if biological materials (excrement, urine, blood or drug paraphernalia) are encountered, which interfere with the planned work, before proceeding with the job.
- The front-line supervisor will arrange for qualified contractors to remove and sanitize the work area

4.14 FIRE SAFETY INSTRUCTIONS

4.14.1 Fire Prevention Instructions

- Take all reasonable precautions to prevent accidental fires.
- Be familiar with fire prevention and suppression equipment in assigned areas.
- Properly maintain and inspect all fire tank storage areas and firefighting equipment on a monthly basis.
- Be able to locate and to use all firefighting equipment in assigned areas.
- Maintain all firefighting apparatus in serviceable condition and retain in accessible locations.

- Report uncontrolled fires to the appropriate emergency response agency immediately by calling 9-1-1.
- Keep work areas, exits, stairways, areas under stairways, or areas used for safe passage free of rubbish, flammable and combustible materials.
- Maintain a clear aisle width of at least 30 inches inside all buildings and inside storage areas.

4.14.2 Fire Prevention Prohibitions

- Smoking indoors and in outside areas that constitute a fire hazards is prohibited. These areas include, but are not limited to, the following:
    - Paint areas
    - Areas containing fuel pumps
    - Chemical storage areas
    - Areas within 50 feet of posted "No Smoking" signs
- Smoking shall only be done in designated smoking areas located at the Facility.

4.14.3 Flammable and Combustible Liquid Instructions

- Store all flammable and combustible liquid containers in fire-proof cabinets designed to safely store such materials. NOTE: This requirement does not apply to incidental containers (i.e. containers that have been opened for use, but not necessarily being used) or warehoused storage if insurance carrier safety requirements are met.
- Cap incidental containers containing flammable and combustible liquid securely when not in use.
- Use only approved containers for handling and dispensing flammable and combustible liquids (i.e. gasoline, oil and diesel fuel).
- Label cans of flammable and combustible liquids in accordance with the Hazard Communication (GHS) program.

4.14.4 Equipment Refueling Instructions

- Shut off the engine when refueling equipment.
- Do not store gasoline and diesel fuel in the same portable container.
- Verify that there is at least one fire extinguisher with a rating of not less than 12BC within 50 feet of the fueling area.
- Exercise caution to avoid static discharge when fueling a vehicle.

4.14.5 Emergency Exit Sign Instructions

- Properly post and maintain emergency exit signs in work areas.

- Letter emergency exit signs with letters no smaller than 6 inches high with the principal strokes of letters not less than ¾ of an inch wide spelling the word "EXIT."
- Ensure emergency exit signs are illuminated in areas used after dark or in areas potentially absent of natural lighting.

4.14.6 Fire Extinguisher Safety Instructions

- Post "FIRE EXTINGUISHER" signs for fire extinguishers that are not readily noticeable due to their location to highlight their location.
- Equip company motor vehicles with fire extinguishers as part of the required list of emergency equipment.

4.14.7 Fire Extinguisher Inspection Instructions

- Perform visual inspections on fire extinguishers mounted inside motor vehicles as part of the daily inspection.
- Perform and document visual inspections monthly on other fire extinguishers to verify the following:
    - No visible damage or obstructions
    - Proper charge/pressure
    - Securely attached
    - Properly sealed
    - Annual, 6 year and 12 year tests/inspections are current
- Use a qualified vendor to perform annual inspections within 12 months from the date of manufacture as stamped on the extinguisher or from the previous inspection.
- Use a qualified vendor to perform 6 year maintenance within 6 years from the date of manufacture as stamped on the extinguisher or from the previous inspection.
- Use a qualified vendor to perform 12 year hydrostatic tests on all stored pressure fire extinguishers within 12 years from the date of manufacture as stamped on the extinguisher or from the previous inspection.

4.14.8 Fire Extinguisher Documentation Instructions

- Document fire extinguisher inspections on a tag/label affixed to the fire extinguisher.
- Do not use a tag affixed to the neck of the fire extinguisher method for fire extinguishers located in harsh environments (e.g. on vehicles).
- Use labels affixed to the shell of the fire extinguisher for annual, 6-year and 12-year tests/inspections

4.14.9 Fire Extinguisher Replacement Instructions

- Replace fire extinguishers when used.
- Replace fire extinguishers when found to be defective.
- Replace fire extinguishers when found to exceed the annual, 6-year or 12-year tests/inspections.
- Replace used or defective fire extinguishers with similarly rated fire extinguishers.
- Ensure used or defective fire extinguishers are changed out by the vendor in a timely manner

4.15 ACCIDENTS, EMERGENCY MEDICAL TREATMENET, ACCIDENT AND NEAR MISS REPORTING INSTRUCTIONS

4.15.1 Emergency Medical Treatment Instructions

- Initiate prompt, appropriate care of the injured person is always the first priority.
- Send the injured person to an occupational clinic if the injury needs care beyond first aid.
- The front-line supervisor shall investigate any accident where an Associate, contracted personnel, or visitor is injured or exposed to an occupational illness.

4.15.2 Accident and Near Miss Classifications

- Near Miss – A near miss is any event that has taken place which had a potential for personal injury or property damage and which presents a learning experience to support a ZERO accident culture. A good rule of thumb to use is: IF IT CAUSED THE HEART RATE TO QUICKEN, REPORT IT.
- Minor Injury
    - A minor injury is one treated with Band-Aids, gauze pads, elastic wraps or other first aid material. Additionally, the use of non-prescription medication (at non-prescription strength) is considered first aid treatment and would be deemed a minor injury.
    - While not considered generally to be serious, these small injuries must be reported to the person in charge of the work so that a record can be made of it. This is YOUR personal responsibility.
    - A record of all such injuries will be forwarded to the appropriate Safety Department for recording.
- Recordable Injury
    - A recordable injury is one which results in a death, days away from work, restricted work or transfer to another job, medical treatment beyond first aid, or loss of consciousness.

- An injury may also be considered recordable if it involves a significant injury or illness diagnosed by a physician or other licensed health care professional, even if it does not result in death, days away from work, restricted work or job transfer, medical treatment beyond first aid or loss of consciousness.

4.15.3 Accident and Near Miss Reporting Instructions

- Report all of the following to the front-line supervisor, or designee, as soon as possible and, at a minimum, prior to the end of the shift during which it occurs:
  - Accidents that result in personal injury;
  - Accidents that result in property damage;
  - Near misses; and
  - Environmental compliance concerns.
- The responsible supervisor or Associate should capture all reported information on an approved Incident Notification and Investigation Report form as soon as practical.
- Report all accidents to the Owner representative(s) within 24 hours or as prescribed in the contract. Final investigation reports of all incidents at the Facility shall also be forwarded to the Owner representative(s) in a timely fashion.

4.15.4 Accident and Near Miss Investigation Instructions

- Investigate significant accidents and near misses.
- Determine the root cause of significant accidents and near misses using a team of trained investigators designated by senior management.
- Control the accident scene to preserve evidence. Red barrier tape can be used to isolate the area.
- Take photographs, interview witnesses and take notes and focus on the facts regarding the accident or close call.
- Submit final investigation reports to the Safety Department for distribution and tracking of assigned corrective actions.
- Base potential corrective actions on causal factors identified during the investigation.
- Submit potential corrective actions to the appropriate reviewer for consideration.
- Forward corrective action assignments to the specific individual(s) best suited to address the issues.
- Distribute completed investigation reports to management, peers, Client representatives and other interested parties in order to heighten awareness around the event, its cause(s), and its corrective actions

4.16 FITNESS FOR DUTY INSTRUCTIONS

4.16.1 Qualification for Duty

Any supervisor having reasonable grounds to suspect that an Associate or contractor under their jurisdiction is either emotionally, or physically unfit for the work assigned, shall prohibit such employee from working until satisfactory medical or other evidence indicating fitness is secured.

4.16.2 Intoxicants and/or Drugs

- Use of intoxicating liquor or drugs by any Associate during working hours is forbidden, and any violation will be sufficient cause for dismissal.
- Any supervisor having reasonable grounds to suspect any Associate, contracted personnel, or visitor reporting to the Facility is under the influence of intoxicating liquor or drugs shall prohibit such Associate, contracted personnel or visitor from working until satisfactory medical or other evidence indicating fitness is secured.
- Abide by any restrictions placed on work activities.
- Report questionable situations to management or Human Resources.

4.17 FIRST AID KIT INSTRUCTIONS

- Know the location(s) of first aid kits in assigned work areas.
- Maintain first aid kit contents with at least all of the supplies specified for the type of kit.
- Contact Safety Department for information on specific first aid kit contents.
- Inspect first aid kits at least monthly to ensure that the contents are adequate and perishable items have not expired.
- Document the first aid kit inspections on a log maintained in Facility files or a label affixed to the first aid kit.
- Replenish first aid kit contents as necessary.

5 JOB HAZARD ANALYSIS, PRE-JOB BRIEFINGS AND WORK AUTHORIZATIONS

5.1 JOB HAZARD ANALYSIS

Careful planning of work assures that the work is performed efficiently and safely. Hazard analysis is a critical part of work planning. Work planning ensures the scope of work is understood, appropriate materials are available, all hazards have been identified, effective measures to mitigate hazards are established, and all affected employees understand what is expected of them.

- Major work activities (or activities as identified by the Plant Manager or Safety Manager) shall be subjected to work planning and Job Hazard Analysis (JHA). Depending on the complexity of the task and the hazards involved, the JHA process may be a mental exercise and verbal discussion, or it may be more formal with a written hazard analysis and pre-job briefing.
- A library of formal JHAs, including the procedure on the JHA/pre-job briefing process, is available for all O&M Associates.
- Table 1 below provides guidelines to assist in making that determination when a formal JHA is required

Table 1. Job Hazard Analysis Requirements

Category	Hazard (JHA Required)
Electrical work	- Work activities near or on exposed electrical conductors, circuits, or equipment that is or may be energized and where there is a significant and unmitigated exposure to electrical shock or a significant potential for arcing, flash burns, electrical burns, or arc blast.
Confined space work	- Permit required confined space entry where and when hazards cannot be adequately addressed in the permit.
Crane & hoist usage	- Load requires exceptional care in handling because of size, shape, weight, close-tolerance installation, high susceptibility to damage, or other unusual factors.
Excavation and digging	- Digging or excavating in area where the potential exists for encountering buried utilities. - Employees entering excavation/trench that is > 4 feet in depth.

Category	Hazard (JHA Required)
Hazardous substances & regulated pollutants	- Potential for release of HAZMAT on-site in quantities > 50% of "Reportable Quantities" (40 CFR 302 and 40 CFR 355). - Potential for release of 42 gallons or more of petroleum, fuel oil, oil refuse, and oil mixed with wastes (40 CFR Part 112.4(a)).
Chemical usage	- Use of materials that are flammable, combustible, corrosive, reactive, toxic, caustic, poisonous, where the quantity or manner of use is hazardous to the health of the workers, the environment, or presents a potential for fire/explosion
Respiratory and hearing protection	- Work requiring hearing or respiratory protection due to potential to exceed Permissible Exposure Limits (PELs)
Hazardous substance abatement activities	- Work involving abatement of asbestos, lead, PCBs, or mercury
Lasers	- Use of Class IIIB or IV lasers (FESHM 5062.1)
Working at heights	- Fall potential is > 4 feet when performing maintenance work, and > 6 feet when performing construction work and additional fall protection is required
Stored energy	- Potential for inadvertent startup of equipment - Potential for unexpected release of energy (electrical, hydraulic, pneumatic, thermal, potential, etc.) where LOTO is required
Tools and fixtures	- In house designed or modified tools or tooling required for work activities where a tool or tooling failure could pose a risk of injury to workers - In house designed or modified fixtures used for work activities where a fixture failure could pose a risk of injury to workers
Sharp instruments	- Non-routine work requiring the use of sharp instruments or cutting tools where the worker is exposed to the unguarded cutting surface.
Other	- Working with systems or equipment which are pressurized > 15 psig - Work requiring welding, brazing, or open flames - Work requiring construction, altering, and/or repair

Category	Hazard (JHA Required)
	- Materials being used in a state that is altered from its original form, that as a result may be is hazardous to the health of the workers, the environment, or presents a potential for fire/explosion - Activity involving a lower level hazard, but involving multiple organizations participating - Potential for job-induced alertness reduction (e.g., long hours, short deadlines) - Activities presenting lower hazards, but are performed infrequently - Activities presenting hazards unfamiliar to employees - Excessive hot or cold working conditions or inclement weather

5.2 PRE-JOB BRIEFINGS AND WORK AUTHORIZATIONS

This section provides guidelines and requirements associated with the performance of pre-job briefings.

A complete assessment and thorough understanding of any work assignment is vital to its safe and successful completion.

The pre-job briefing has been proven over time to be an effective tool in identifying and communicating critical elements of a job to the workers involved so that safety is provided for employees as well as the public.

Human error-related accidents typically occur when one or more individuals involved in the performance of a work assignment fail to fully understand or recognize certain elements of that work.

5.2.1 Pre-Job Briefing Requirements

- The designated supervisor is responsible to ensure that the pre-job briefing requirements defined in this chapter are met.
- The designated supervisor is responsible to ensure that proper authorizations have been obtained for all work orders under their supervision.

- Each Associate, including contract personnel, involved in a work activity shall attend the pre-job briefing associated with that work, participating as necessary to ensure an understanding of the job and its hazards.
- Each worker has the right and responsibility to stop and seek clarification to questions or uncertainties regarding the safe performance of a work assignment at any time

5.2.2 Pre-Job Briefing Instructions

- Conduct a pre-job briefing with the workers directly involved in a job prior to the start of EVERY job. NOTE: Workers working alone need not conduct nor document a pre-job
- briefing. However, the worker shall consider the critical elements of the job as defined on the approved Pre-Job Briefing and Work Authorization form.
- Discuss each of the following critical elements of the job, at a minimum, in the pre-job briefing:'
    - Task identification
    - Roles and responsibilities
    - Communications
    - Hazard identification
    - Opportunity for questions and input
    - Special precautions
    - Work criteria
    - Energy source controls
    - PPE requirements
- Use the Pre-Job Briefing and Work Authorization form when conducting a pre-job briefing.
- Practice human performance techniques prior to performing critical steps:
    - S.T.A.R. – Stop. Think. Act. Review.
    - Peer Checking – Observation or check between two people to prevent an error by the performer.
    - "Two Minute" Drill – brief awareness exercise to become aware of the immediate work environment prior to work.
    - Three-way communication – 1: Sender speaks message to intended receiver; 2: Receiver repeats message back to confirm understanding; 3: Sender acknowledges receiver heard and understood message
- Provide a more extensive review if:
    - The work assignment is complicated or particularly hazardous;
    - The worker cannot be expected to recognize and avoid the hazards involved in the work; or
    - Any worker feels the need for further information or clarification.

- Conduct at least one (1) pre-job briefing before the start of the day or shift if the work activity being performed is repetitive and similar in nature.
- Additional pre-job briefing shall be held if significant changes, which might affect the safety of the workers, occur during the course of the work.

5.2.3 Pre-Job Briefing Checklist

- Retain Pre-Job Briefing and Work Authorization forms for a minimum of thirty (30) days.
- Make forms available for inspection upon request.
- Provide the following minimum information on the form that is being retained:
    - Facility
    - Date
    - Work Location/Task Description
    - O&M Representative Approval Signature(s)
    - Names of Individuals attending Pre-Job Briefing

6 PERSONAL PROTECTIVE EQUIPMENT (PPE)

This chapter contains specific requirements, instructions, and guidelines for Associates that establish safety expectations in regards to protective equipment, devices, and clothing.

Leeward has conducted hazard assessments of all job categories to evaluate the potential for injury to various body parts and to determine the necessary protective equipment and clothing to protect against those injuries.

6.1 GENERAL PPE SAFETY INSTRUCTIONS

- Use suitable PPE whenever required by instructions or when it would provide additional protection. NOTE: The only exception shall be when the supervisor determines that the PPE could create a greater hazard than that from which it is intended to protection, due to the location or nature of the job.
- Inspect the PPE prior to use to ensure it is safe, properly assembled and not visibly defective.

6.2 HARD HAT SAFETY INSTRUCTIONS

- Employees working in areas where there is possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall wear hard hats or appropriate safety headgear.
- All hard hats used at Leeward O&M shall meet applicable standards and be designed to protect against electrical hazards.
- Wear a hard hat in areas that are posted requiring hard hat use and in all EPC-controlled areas.
- Replace the hard hat when necessary or per manufacturer specification.
- Attach no objects to the hat shell other than those decals or headlamps approved by Leeward.
- Do not drill holes in the hard hat.
- Do not deface the exterior of the hard hat by stamping, cutting, scratching, painting or using a permanent marker.
- Maintain a clearance between the shell of the hard hat and the head for the protective system to work properly.
- The shell and suspension function together as a system and are equally important

6.3 HARD HAT INSPECTION AND MAINTENANCE INSTRUCTIONS

- Inspect the hard hat components before use each shift.
    - Both the shell and suspension components of the hard hat require inspection and maintenance.
    - The shell and suspension shall both be in good condition at all times.
- Inspect the shell for dents, cracks, nicks and gouges.
- Inspect the shell for any damage due to impact, rough treatment, abrasions and penetration wear.
- Inspect the hard hat to determine if it is becoming stiff, becoming faded, becoming brittle, or exhibiting a chalky appearance.
- Inspect the suspension for cracks, torn headband, frayed or cut straps, or other signs of wear.
- Replace the hard hat if a shell or suspension shows any of these signs of being worn or damaged.

6.4 HARD HAT CLEANING INSTRUCTIONS

- Use only mild soap and warm water.
- Do not use solvents, chemicals, adhesives, gasoline, or like substances since they may damage the plastic components.

6.5 EYE PROECTION INSTRUCTIONS

- Wear appropriate eye protection in working areas where there is a potential for injury to the eyes as well as in areas where eye protection is posted for use.
- Use Leeward approved safety glasses that meet applicable standards.
- Do not use regular prescription glasses as a substitute for approved safety glasses.
- Wear appropriate eye protection whenever there is a potential for injury from:
    - Broken glass (PV modules)
    - Flying particles
    - Acids or caustic liquids
    - Potentially harmful light radiation
    - Liquid chemicals
    - Chemical gases or vapors
- Contact your supervisor if you need additional information on obtaining prescription safety eyeglasses

6.6 SAFETY GLASSES REQUIREMENT

- Safety glasses must have:

- Side shields (or uni-lens design that offers protection from the side)
- Impact-resistant lenses
- Frames that help prevent the lenses from being pushed into the eyes.

6.7 EYE PROTECTION INSPECTION AND MAINTENANCE

- Inspect the equipment before each use.
- Replace safety glasses immediately if the lenses are scratched or pitted.

6.8 HEARING PROTECTION SAFETY INSTRUCTIONS

- Wear approved hearing protection devices when areas or equipment have been posted or labeled indicating hearing protection is required.
- Wear approved hearing protection when working in areas where the sound level reaches or exceeds 85 decibels. NOTE: The PCS buildings measure greater than 85 decibels when inverter is running. Therefore, hearing protection shall be worn at all times.
- A good rule of thumb to use in determining this level is, when talking with someone else at a distance of three (3) feet, if either person needs to raise their voice to be heard, then the ambient noise level is likely at or above 85 decibels.
- Make hearing protection available to Associates, visitors and contractors upon request.

6.9 HEARING PROECTION MAINTENANCE INSTRUCTIONS

- Wash hearing protectors with warm water and soap between uses.
- Allow hearing protectors to dry before reuse in order to prevent problems with infections.

6.10 FALL PROTECTION SAFETY INSTRUCTIONS

- An acceptable form of fall protection is required anytime the unprotected working height is equal to or greater than four (4) feet above the surrounding areas.
- Acceptable forms of fall protection include:
  - Guardrails
  - Fall arrest system (anchorage, full-body harness, shock-absorbing lanyard, connection)
  - Fall restraint devices
- Any Associate working at unprotected heights greater than four (4) feet shall be trained in fall protection and the limitations of each accept able form.
- Inspect fall protection equipment thoroughly for defects prior to use.
- Do not use defective fall protection equipment.
- Destroy or tag for repair defective fall protection equipment to prevent accidental use by someone else.

6.11 HAND PROTECTION REQUIREMENTS

- Appropriate hand protection is required whenever hands have the potential of being exposed to severe cuts or lacerations, severe abrasions, punctures, chemical burns, skin absorption of harmful substances, harmful temperature extremes (hot or cold), or electrical contact.
- Rubber insulating gloves are required for the protection of workers against electrical shock and shall be worn whenever there is a possibility of contacting electric power above 50 VAC.
    - Class 00 - Maximum use voltage of 500 volts AC/proof tested to 2500 volts AC
    - Class 0 - Maximum use voltage of 1,000 volts AC/proof tested to 5,000 volts AC
    - Class 1 - Maximum use voltage of 7,500 volts AC/proof tested to 10,000 volts AC
    - Class 2 - Maximum use voltage of 17,000 volts AC/proof tested to 20,000 volts AC
    - Class 3 - Maximum use voltage of 26,500 volts AC/proof tested to 30,000 volts AC
    - Class 4 - Maximum use voltage of 36,000 volts AC/proof tested to 40,000 volts AC
- Rubber insulating gloves, that have been tested, are good for one (1) year while still maintained in sealed packaging.
- Once removed from packaging, rubber insulating gloves are required to be electrically tested every six (6) months thereafter.
- Leather gloves shall be worn over rubber insulating gloves to protect the overall integrity of the glove.
- Chemical-resistant gloves are required to be worn when handling chemicals as recommended by the product SDS.
- Cut-resistant gloves are required when handling modules whether the module is intact or damaged to prevent the potential for cuts.

6.12 HAND PROTECTION CARE AND MAINTENANCE INSTRUCTIONS

- Do not wear rubber insulating gloves inside out or without leather protectors. NOTE: Leather protectors are not required to be worn when wearing Class 00 gloves.
- Exchange rubber gloves any time they become damaged.
- Inspect rubber gloves for corona cracks and bruises.
- Give rubber gloves a “Roll and Air” test prior to first use each day.

6.13 RUBBER GLOVE ROLL AND AIR TEST INSTRUCTIONS

- Hold the glove at each side to air test the glove.
- Slightly stretch the gauntlet to provide a slight air seal.
- Revolve the glove around the edge of the glove as an axis, rolling it toward the palm and trapping the air in the palm.

- Hold the glove with one hand.
- Squeeze the glove with the other, while listening for leaks.
- Do not use the glove if it does not pass this test

6.14 FOOT PROTECTION SAFETY REQUIREMENTS

- Associates, contractors, and visitors are required to wear substantial, enclosed shoes that are in good condition and have non-slip soles.
    - Prohibited from wearing open mesh shoes, open toe shoes or high heel type shoes.
- PV plant Associates, subject to plant hazards, are required to wear safety footwear meeting applicable standards. NOTE: Dielectric footwear is recommended for those Associates who may be exposed to step-and-touch potentials.
- Safety footwear is required to be worn whenever there is a danger of foot injuries due to:
    - Falling or rolling objects
    - Objects piercing the sole
    - Any other physical hazards

6.15 WORK APPAREL REQUIREMENTS

- Associates assigned or flagged to work having a potential exposure to energized equipment, where a significant arc flash can occur, shall wear the appropriate level of FR-rated clothing.
- The appropriate level of arc flash protection shall be determined by following the instructions on the arc flash label at the equipment.
- FR clothing shall be worn in a manner that will provide the maximum protection.
- Whenever a worker is working on or is in close proximity to energized equipment (50 VAC or above), shirts shall be tucked in, with the front of the shirt buttoned up and the sleeves rolled down and buttoned at all times.
- All workers are responsible for wearing clothing that does not contribute to an unsafe, offensive or disruptive work environment.
- Loose clothing or jewelry is not permitted in work areas with machines, equipment with moving parts or near energized components

6.16 REFLECTIVE VESTS REQUIREMENTS

- Associates working within any construction-owned area or within any right-of-way where traffic hazards exist or within fifteen (15) feet of any street, road, highway, etc. shall wear a high visibility reflective traffic garment (shirt or vest).
- A Class II reflective garment is required for day work while a Class III shall be worn in low visibility/night conditions.

- Reflective vests shall be constructed of FR material when there is a potential for the worker to be working in close proximity to energized equipment.
- Reflective traffic vests shall be fluorescent lime green or orange in color, with "reflectorized" material for visibility in low light conditions.

7 HAZARDOUS MATERIALS

This chapter contains specific requirements, instructions, and guidelines for Associates purchasing and using hazardous chemicals. It's important to know the properties of the products we use and to understand the necessary measures needed to ensure that you are protected from inherent hazards. This information is made available to Associates through training, access to Safety Data Sheets (SDSs) and container labeling.

7.1 CHEMICAL USE REQUIREMENTS

- Only chemicals that are approved by Leeward shall be purchased or otherwise brought into the Facility.
- Chemicals that are not approved by Leeward shall not be purchased or otherwise brought onto the Facility.
- Associates shall be familiar with the hazards of all chemical materials in the workplace.
- Hazardous chemical materials in the workplace may pose potential health hazards to Associates who are exposed. Associates have a right to know the properties and potential hazards of materials to which they may be exposed.
- Safety Data Sheets (SDS) shall accompany all approved chemicals brought on-site

7.2 LABELING REQUIREMENTS

- Those responsible in purchasing new chemicals or other hazardous materials are responsible for notifying the supplier and acquiring containers that have an acceptable label.
- Each Associate who performs a transfer of hazardous substances from original containers into a secondary container shall completely and accurately label it. NOTE: Transfer containers that will be immediately used by the worker who performed the transfer do not need to be labeled provided the contents are used up or returned to the original container before the end of the shift in which it was transferred.

7.3 LABELING INSTRUCTIONS

- Do not remove or deface the labels placed on original containers.
- Notify the buyer who ordered the substance if material is received without a label.
- Do not release material for use at the Facility until it is properly labeled.
- Use the Globally Harmonizing Classification (GHS) coding system to label containers that are transferred from their original containers.

- Complete secondary labels with the specific product information using the information obtained from the product SDS.
- Label stationary containers (e.g. tanks) with either a sign depicting the necessary hazard information or a secondary container label that is correctly filled out.

7.4 SAFETY DATA SHEETS (SDS) REQUIREMENTS

- SDSs shall be readily available at each Facility.
- SDS information shall be readily available for field workers who won't have immediate access to product SDSs in the field.
- Each supervisor shall be sure that Associates know how to access and understand product SDSs.

7.5 HAZARDOUS MATERIALS HANDLING AND STORAGE REQUIREMENTS

- All chemicals shall be handled in accordance with the associated SDS. All required PPE, storage practices, incompatibilities, etc. as listed on the product's SDS shall be determined and, if appropriate, used.
- Hazardous materials shall only be used for their intended purpose(s).
- All Associates working with chemicals, hazardous materials, combustible or flammable materials shall be familiar with the product and the requirements for safe handling, storage and disposal.
- Smoking is prohibited in the immediate vicinity of bulk handling facilities, storage battery areas or chemical cleaning areas.
- Electric switches used in areas where explosive gases are potentially present shall be explosion- proof.

7.6 HAZARDOUS MATERIALS HANDLING AND STORAGE INSTRUCTIONS

- Store, handle and transport flammable and combustible liquids only in approved containers.
- Do not use gasoline for parts cleaning.
- Maintain contact between the pouring and receiving containers when pouring or pumping gasoline from one container into another.
- Do not use ignition sources in the immediate vicinity of bulk handling facilities, storage battery areas or chemical cleaning areas until the area is adequately ventilated.
- Store chemical products in separate storage containers to prevent reactive chemicals and vapors from mixing in the event of spillage or breakage.
- Periodically inspect chemical storage containers for deterioration of the containers and inappropriate storage of incompatible chemicals.

7.7 ACIDS, CAUSTICS AND OTHER DANGEROUS CHEMICALS – CARE AND HANDLING REQUIREMENTS

- Workers shall be instructed with regard to hazardous properties, proper protective clothing and safe handling procedures when handling acids, caustics or harmful chemicals.
- Face shields or goggles and rubber gloves shall be considered as minimum protective equipment when working with acids, caustics or harmful chemicals.
- Workers working with acidic or caustic chemicals that have the potential to splash in the eyes or on the body shall have a fixed or portable eyewash/show available within fifty (50) feet of the chemical exposure.

7.8 ACIDS, CAUSTICS AND OTHER DANGEROUS CHEMICALS – ACCIDENTAL CONTACT INSTRUCTIONS

- Immediately apply large quantities of running water, 15 minutes minimum, on any exposed area.
- Do not attempt to neutralize or apply oils or ointments to burned areas without specific recommendations from a doctor.
- Obtain medical attention/treatment as soon as possible.

7.9 COMPRESSED GAS USE INSTRUCTIONS

- Handle cylinders with caution to avoid injury; the cylinders are extremely heavy.
- Transport cylinders with safety caps in place.
- Do not use a direct flame to heat cylinder.
- Use only approved heating methods.
- Support and secure cylinders when in use.
- Store and ship cylinders in approved racks.
- Use only proper regulators.
- Use adequate ventilation when working in an area that contains SF6 gas. SF6 gas is heavier than air and will not support life. Harmful byproducts are also created during arcing.
- Keep regulators clean and dry.
- Remove regulators and install safety caps when compressed gas bottles are in storage or not in use.

7.10 COMPRESSED AIR USE INSTRUCTIONS

- Do not use compressed air to clean clothes or any part of the body.
- Do not use natural, LP, or other combustible gases for cleaning, painting, or to substitute for compressed air to operate portable equipment.
- Regulate compressed air used for cleaning equipment to no more than 30 psi.

- Check any hose and all connections attached to compressed air equipment for defects, loose connections and proper installation of safety pins or wires before using.
- Ensure the nozzle on the air hose is under control before turning on air pressure.
- Shut off the air at the compressor and release the pressure at the equipment when any air equipment is not in use or is to be disconnected.

7.11 GAS CYLINDER USE INSTRUCTIONS

- Remove the compressed gas cylinder's gauges when the cylinder is not in use.
- Be sure all connections are tight. Use soapy water or lead detector to locate leaks.
- Secure gas cylinders so that they cannot be knocked over.
- Ensure gas cylinders have their protective caps (if so designed) in place unless actually connected for use.
- Do not crack valves on hydrogen bottles to blow out valves and connections as the expanding hydrogen may ignite.
- Ensure that gas cylinders not having fixed handwheels have keys, handles, or non-adjustable wrenches on valve stems while these cylinders are in service.
- Do not face the regulator on a gas cylinder at the time the valve is opened.
- Do not open an acetylene cylinder valve more than 1¼ turns.
- Avoid direct contact with the gas when releasing compressed carbon dioxide from cylinders as its expansion produces a refrigerating effect that may freeze any exposed body portion.
- Relieve the pressure before dismantling valves, gauges and similar apparatus associated with compressed gas cylinders.

7.12 GAS CYLINDER STORAGE INSTRUCTIONS

- Store gas cylinders containing acetylene, oxygen, hydrogen, nitrogen, carbon dioxide, etc. upright with their caps in place in approved safe places away from highly combustible material and well separated from sources of heat.
- Store oxygen cylinders separately from cylinders containing acetylene or other combustible gases per one of the following:
    - Separated by a distance of at least 20 feet
    - Physically separated using an approved barrier with one-half hour fire-resistance rating that reaches a height of 5 feet
- Store full gas cylinders separate from empty ones.
- Do not store gas cylinders on welding carts unless the cart is equipped with an approved noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour. Plate steel is not considered an approved barrier.

- Store any cylinder not anticipated to be used within 24 hours as outlined in this section.

7.13 GAS CYLINDER TRANSPORT INSTRUCTIONS

- Ensure gas cylinder caps are in place and precautions taken to prevent their being knocked over or dropped when moving cylinders, except when the cylinder is properly secured on an approved cylinder transport vehicle.
- Do not lift a compressed gas cylinder by its protective cap.
- Do not drop or roughly handle gas cylinders.
- Secure compressed gas cylinders in the appropriate positions (e.g. upright for acetylene cylinders) with protective caps in place during transportation.
- Do not free gas cylinders that are frozen to the ground by prying on them using their protective caps.
- Use warm water to free gas cylinders that are frozen to the ground

8 TOOLS

This chapter contains specific requirements, instructions, and guidelines for Associates purchasing and using hand and power tools.

8.1 HAND AND POWER TOOL REQUIREMENTS

- Any safety device, tool or equipment that, upon inspection, is found unsafe shall not be used.
- Tools or equipment purchased for specialized types of work shall be reviewed and approved by the Safety Department.

8.2 LIVE-LINE EQUIPMENT INSTRUCTIONS

- Visually inspect all live-line tools before use each day.
- Wipe all live-line tools clean, and if any hazardous defects are indicated, tag and remove them from service.
- Remove all live-line tools from service every two (2) years for examination, cleaning, testing, repair and service.
- Do not use live-line tools that have not been tested by the due date indicated on the inspection sticker.
- Store all live-line tools in a dry, warm location away from direct sunlight.
- Keep live-line tools away from dirt and moisture.
- Do not lay live-line tools directly on the ground.
- Do not place hands closer to the energized components or the energized metal parts of the tool being used than is absolutely necessary when using live-line tools and in no case closer than specified by the applicable electrical standards minimum approach distances for qualified electrical workers.

8.3 HAND TOOL INSTRUCTIONS

- Do not use any safety device, tool or equipment found unsafe upon inspection.
- Cover sharp-edged and pointed tools with the scabbards or guards when not in use.
- Keep tools in good condition.
- Take care in handling and storing tools.
- Use tools only for the jobs for which they are designed.
- Use caution when selecting tools for use near energized equipment.
- Do not use screwdrivers with the metal shanks that extend through the handle near energized equipment.
- Personal pocket knives and multi-purpose pocket tools shall not be used at the Facility.

- Always direct a knife away from your body when using it.
- Knives shall not be used to cut tie wraps.
- Repair or replace impact tools such as chisels and punches as they become mushroomed or cracked.
- Do not use a pipe or "cheater bar" to extend the handle of a tool for leverage unless the tool was designed for such use.
- Replace wooden handles that are cracked, splintered, or loose.
- Do not use cloth or linen tape measures having metallic reinforcement fibers woven into the cloth at any Leeward Facility.
- Do not use metallic tape measures in areas where they may contact exposed energized equipment.

8.4 POWER TOOL INSTRUCTIONS

- Power tools shall only be used by qualified persons.
- All power tools shall not be operated without manufacturer instructions available for reference.
- Ground non-current carrying metal parts of portable electric tools such as drills, saws, and grinders by use of a three-wire cord when connected to a power source unless the tool is an approved double-insulated type, or is powered by a low-voltage isolation transformer. This applies to any cord-connected and plug-connected equipment.
- Associates and contractors shall utilize GFCI's on all 110 volt AC circuits not part of the permanent wiring.
- Visually inspect the tool and cord before use, looking for external and possible internal defects such as damaged insulation, missing or damaged ground pin and/or blade, loose parts, etc.
- Do not carry or lift a tool by its cord.
- Operate all power tools within their design limitations.
- Stop and disconnect power drive equipment before adjusting, cleaning, oiling or repairing.
- Do not use electrical tools where there is a hazard of flammable dusts, gases or vapors.
- Shut-off gasoline engines or motor-driven equipment before refueling.
- Be alert to the hazards of the exhaust fumes from gasoline engines. Always place them so that the exhaust fumes are downwind from the work area.
- Do not remove safety guards on machinery and power equipment.
- Any power tool found defective shall be tagged, "Defective – Do Not Use" and shall be immediately removed from service until repaired.

8.5 HYDRAULIC AND PNEUMATIC TOOL INSTRUCTIONS

- Use only tools that are in good condition.
- Ensure that hoses are appropriate for the pressure created by the tool.
- Do not exceed manufacturer safe operating pressure for hoses, pipes, valves, filters and other fittings.
- Check hoses for cuts, bulges, and abrasions, and replace any hose found defective.
- Any hydraulic or pneumatic tool found defective shall be tagged, "Defective – Do Not Use" and shall be immediately removed from service until repaired.
- Securely install and maintain safety clips or retainers on pneumatic tools and hose connections to prevent accidental disconnection of attachments.
- Use a non-conductive hose on tools where contact to exposed live electrical parts may occur.
- Do not use any part of the body to locate or attempt to stop leaks.
- Wear proper eye protection while operating hydraulic or pneumatic tools.
- Do not allow hoses to be kinked.
- Do not carry or lift a tool by its hose.
- Ensure check valves are installed when hydraulic lines longer than 35 feet may contact exposed parts at primary voltages or otherwise provided for loss of insulating value due to partial vacuum.
- Shut off pressure at the supply valve ahead of the valve when adjusting or changing hydraulic and pneumatic tools.
- Bleed off the pressure before breaking the connection when making adjustments or changing tools unless the tool is equipped with quick-change connectors.

8.6 LADDER INSTRUCTIONS

- Do not load ladders beyond their intended loads.
- All ladders much have readable manufacturer's load rating charts applied to the ladder.
- Use only Leeward approved ladders that are non-conductive near energized conductors or equipment.
- Use only Type 1A or Type 1AA stepladders on Leeward plant sites.
- Store fiberglass ladders out of direct sunlight.
- Use ladders of the correct length.
- Do not use defective ladders.
- Always tag defective ladders with a danger tag until either repaired or destroyed.

- Do not erect a ladder in front of a closed door that opens toward the ladder's position unless the door is first locked or guarded against movement.
- Do not use ladders that do not have safety feet as specified by the manufacturer.
- Place, hold, tie or otherwise secure a portable ladder to prevent slipping or falling.
- Face the ladder and use both hands when ascending or descending a ladder.
- Use stepladders in the fully spread position only.
- Do not substitute a stepladder for a straight ladder.
- Stand no higher than the second rung from the top of a stepladder.
- Extend all straight ladders a minimum of three (3) feet above its upper support.
- Stand no higher than the third rung from the top of a straight ladder.
- Place the bottom of the ladder one-fourth of the vertical height of the ladder away from its upper support, where possible.
- Fixed ladders greater than twenty (20) feet above the surrounding elevation must provide a safety cage beginning at a height not higher than seven (7) feet or the worker must use a ladder- climbing device.
- Check fixed ladders for looseness, rust, and corrosion before each use.
- Always assemble extension ladders so that the sliding section (upper) is placed on top of the base (lower).
- Do not lean to one side or work from the extension ladder without properly securing yourself to the ladder.
- Maintain the extension ladder rope and pulley in good condition.
- Use the extension ladder rope and pulley to extend the ladder whenever the ladder is to be extended.

9 CONFINED SPACES

This chapter contains specific requirements, instructions, and guidelines for Associates or contractors conducting activities within confined spaces.

9.1 Confined Space Requirements

- A confined space is a space that:
  - Is large enough for a person to enter the space and perform work;
  - Has limited or restricted means for entry or exit; and
  - Is not designed for continuous occupancy.
- At Leeward, this definition includes the following spaces:
  - PCS vaults
  - PVCS vaults
  - Transformer vaults
  - Water storage tanks
  - Miscellaneous tanks
- Leeward O&M Associates are not generally expected to enter a confined space as part of their normal duties. If they are, they shall be trained on the hazards of confined spaces and how to safely evaluate, monitor, work inside the space and handle emergency situations. IMPORTANT: Current confined space self-study presentation and quiz, provided by O&M, is considered 'awareness only' training. Additional training is required for confined space entry.
- The entryways into all of these spaces/areas shall be labeled with markings stating, "Confined Space."
- A rescue effort in a confined space shall not be attempted until personnel are properly trained and prepared to perform a rescue.

10 HAZARDOUS ENERGY CONTROL (LOTO)

This chapter contains specific requirements, instructions, and guidelines for Associates responsible in controlling or working on or around hazardous energy sources. Lockout/Tagout (LOTO) are two different methods used to protect Associates and contractors from potential hazardous energy sources at the Facility. This is accomplished by establishing a safe work boundary. This isolated boundary allows the performance of work safely while controlling hazards that can be in the form of electricity, compressed gases, steam, harmful chemicals, gravity, etc. It is also protection from the inadvertent start-up of rotating and mechanical force equipment.

10.1 LOCKOUT/TAGOUT PROCEDURE

- Associates responsible for isolating energy sources and applying LOTO measures shall be trained in accordance with the Leeward Lockout/Tagout Procedure. The procedure provides instructions for:
    - Identification and documentation of site personnel authorized as "Higher Authority", "Tagging Authority" and "Authorized Employee";
    - Requesting a LOTO;
    - Identifying energy isolations and developing a LOTO permit;
    - Executing a LOTO permit (energy isolation/release and locking/tagging energy isolations);
    - Releasing a LOTO;
    - Auditing of the LOTO program; and
    - LOTO training requirements.
- B. The Leeward Lockout/Tagout Procedure shall be followed to prevent personal injury and equipment damage by ensuring all known sources of energy are secured, released or contained in a safe manner during work activities.

11 ELECTRICAL

11.1 GENERAL ELECTRICAL INSTRUCTIONS

- Only qualified workers shall work on exposed energized lines or equipment in accordance with all applicable O&M procedures.
- Consider all electrical systems as live until verified as de-energized and grounded.
- Do not work on or in close proximity to electrical circuits unless the circuit is de-energized, grounded, or guarded.
- Always conduct a "Live-Dead-Live" check to verify a circuit is de-energized before performing work.
- Extension cords are for temporary use only and shall not be used as a substitute for permanent wiring.
- Each tool, extension cord set, attached cap, plug and receptacle of cord sets, and any equipment connected by cord and plug, shall be visually inspected before each day's use for external defects, such as deformed or missing pins or insulation damage, and or indication of possible internal damage. Equipment found damaged and/or defective will be immediately taken out of service, and may not be used until repaired.
- Electrical cords found damaged shall be immediately tagged "Out of Service" and removed until repaired or destroyed.
- Never overload an extension cord.
- Do not splice electrical cords.
- Avoid "ganging" or stringing multiple cords together to make a longer cord.
- Do not alter plugs or receptacles.
- Never remove the grounding prong from an electrical cord.
- Any maintenance, installation, cabling, wiring or switching work performed by Associates and contractors on electrical equipment is done so in accordance with state and local regulatory agencies & National Electrical Code requirements. This work shall only be completed by a qualified, competent electrical worker.
- Conductive items of jewelry or clothing must not be worn.
- Insulated tools shall be used when working near energized components.
- Associates and contractors must follow established LOTO procedures when performing work on electrical equipment or machinery unless power must be applied for the purpose of adjustment or electrical troubleshooting.
- Weatherproof outlets and fittings should be used in areas exposed to wind and rain.
- Avoid using electrical equipment outdoors in wet conditions.
- Ensure extension cords are positioned in work areas so they do not create a slip or trip hazard and are not exposed to physical damage.

- Associates and contractors shall utilize GFCI's on all 110 volt AC circuits not part of the permanent wiring.

11.2 INTERCONNECT AND SWITCHING ORDERS

- Associates responsible for clearance and switching operations at the Facility shall be trained in accordance with the Leeward Interconnect and Switching Procedure.
- The Leeward Interconnect and Switching Procedure shall be followed anytime a portion of a Facility will be taken out of service for inspection, maintenance, or repair work.

11.3 Shock and Arc Flash Protection Requirements

- Any task performed on electrical equipment where an exposure of an electrical shock or arc flash can occur shall be done so in accordance with Leeward policy and any applicable electrical safety requirements (e.g., NFPA 70E).
- Energized work shall only be completed by a qualified, competent electrical worker.
- All Leeward plant Facilities will perform an assessment to determine potential exposure to an electric arc for employees who work on or near energized parts or equipment. The arc hazard analysis shall include a calculation of the estimated arc energy based on the available fault current, the duration of the arc (cycles), and the distance from the arc to the employee.
- Safety signs and/or labels shall be used to warn employees of arc flash hazards. Such signs/labels shall include at least the following information:
    - flash protection boundary
    - limited approach boundary
    - restricted approach boundary
    - arc flash PPE category
    - shock hazard
- Barricades and/or safety attendant(s) shall be used to restrict access into the Flash Protection Boundary during arc-based related tasks.
- All personnel working within the Flash Protection Boundary during arc-based related tasks shall wear the level of PPE as designated on the arc flash sign/label.
- The arc-rated clothing, listed in the applicable electrical arc flash standard (e.g., NFPA 70E), will meet the minimum FR clothing requirements at Leeward. The clothing systems listed in the applicable standard(s) should be used with the other PPE appropriate for the task.
- Protective clothing shall not be used as a primary means of protection for equipment with an arc potential above 40 cal/cm2. Remote racking and/or administrative controls shall be used for these situations.

- Arc-based related tasks include any activity that could produce an electric arc. These tasks assume that the equipment is energized, exposed and the work is done within the flash protection boundary. Examples of arc-based tasks are:
  - Work on energized parts
  - Circuit breaker operation
  - Fused switch operation
  - Starter operation
  - Remove/install circuit breakers or fused switches
  - Insertion or removal of individual starter buckets
  - Insertion or removal (racking) of circuit breakers from cubicles
  - Removal of bolted covers
  - Opening hinged covers
  - Reading a panel meter while operating a panel switch
  - Opening PT drawers
  - Voltage testing
  - Live-dead-live checks
  - Application of safety grounds
- Any task that requires working on/near (within the limited approach boundary of) an exposed energized source greater than 600V, will be assigned two qualified electrical workers (with the exceptions listed below). Exceptions are as follows:
  - Routine switching of circuits
  - Work performed with live-line tools if the Associate is positioned so that they are neither within reach of nor otherwise exposed to contact with energized parts.
- Each worker is to watch the movement of the other to warn of near contact with an exposed energized source. Both workers can be involved in the associated work.

Appendix C

January 27, 2021
Project No. 20212714.001A

Mr. Bill Branca, PE
Senior Director - Development
Leeward Renewable Energy, LLC
6688 N. Central Expressway, Suite 500
Dallas, TX 75206

Subject: Geotechnical Report
Union Ridge Solar Project
Licking County, Ohio

Dear Mr. Branca,

Kleinfelder is pleased to present this revised report summarizing the geotechnical investigation and pile load testing for the Union Ridge Solar project. The purpose of the geotechnical investigation is to characterize the subsurface conditions and provide geotechnical recommendations for the design and construction of the Union Ridge Solar project. The recommendations presented in this report are subject to the limitations presented herein. In addition, the brief by the Geotechnical Business Association (GBA, Appendix F) provides additional information regarding data interpretation and industry-standard limitations of a geotechnical investigation.

We appreciate the opportunity to provide geotechnical engineering services on this project. Should you have any questions, please contact Bradley Baum at 303.297.5733.

Respectfully submitted,

KLEINFELDER, INC.

Bradley M. Baum, MS, PMP
Project Manager III

James M. Beideman, PE (OH)
Program Manager

KLEINFELDER 707 17th Street, Suite 3000, Denver, CO 80202 p | 303.237.6601

GEOTECHNICAL REPORT
UNION RIDGE SOLAR PROJECT
LICKING COUNTY, OHIO
KLEINFELDER PROJECT NO. 20212714.001A

January 27, 2021

A Report Prepared for:

Mr. Bill Branca, PE
Senior Director - Development
Leeward Renewable Energy, LLC
6688 N. Central Expressway, Suite 500
Dallas, TX 75206

GEOTECHNICAL REPORT
UNION RIDGE SOLAR PROJECT
LICKING COUNTY, OHIO

Prepared by:

Jennifer Carey, PE*
Project Professional
*Not Licensed in Ohio

James M. Beideman, PE (OH)
Program Manager

KLEINFELDER
707 17th Street, Suite 3000
Denver, Colorado 80202
P:303.237.6601

Kleinfelder Project No. 20212714.001A
January 27, 2021

TABLE OF CONTENTS

FIGURES

APPENDICES

1 INTRODUCTION

This report presents the results of Kleinfelder's geotechnical investigation of the proposed Union Ridge photovoltaic (PV) 108-MWac solar electric generation facility approximately 1.5 miles southeast of the City of Pataskala in Licking County, Ohio (the Project or Site). The location of the Project is shown on Figure 1. Kleinfelder's services were performed in general accordance with our proposal dated September 22, 2020 (DEN20P116657). Please note that the project name was changed from Elm Solar Project to Union Ridge Solar project after submission of our proposal.

The scope of Kleinfelder's geotechnical investigation consists of subsurface exploration, laboratory testing, engineering analysis, pile load testing, and preparation of this report. The purpose of Kleinfelder's geotechnical engineering investigation is to provide design and construction recommendations for the PV array foundations, equipment pads, access roads, site preparation, and general earthwork.

In summary, the Site appears to be suitable for the intended development provided the recommendations outlined in this report are properly incorporated in the design and construction phases of the project.

The conclusions and recommendations presented in this report are based on subsurface information encountered in our explorations, our site observations, and our experience with similar developments. The recommendations contained in this report are subject to the provisions and requirements outlined in the Limitations section of this report.

1.1 PROJECT DESCRIPTION

We understand the Project will include the installation of ground-mounted solar PV arrays consisting of PV panels attached to a single-axis tracker (SAT) system. The arrays will be supported on driven steel piles, typically fabricated from wide-flange beams. Maximum axial and lateral loads are expected to be on the order of two to three kips.

Other components installed at the Site will include overhead and underground electrical conductors, inverters, transformers, and other electrical components, to be supported on piles,

slabs-on-grade, or combinations of slabs and piles. Additional site development will likely include access roadways for construction and maintenance purposes.

The finished site grades had not been provided at the time this report was prepared. Kleinfelder anticipates grading within the solar array field will be limited. Earthwork cuts and fills of no more than approximately two feet are expected for equipment pads. Utility trenches are not anticipated to exceed four feet in depth.

2 FIELD EXPLORATION & LABORATORY TESTING

2.1 FIELD EXPLORATION

Subsurface conditions at the Site were explored with six soil test borings, two test pits, and three in-situ soil electrical resistivity tests between December 7, 2020, and January 13, 2021. The approximate test and field resistivity locations are presented on Figure 1.

Prior to Kleinfelder's field exploration, the exploration locations were cleared for underground utilities through the Ohio 811 system. Kleinfelder staked the boring and test pit locations in the field using a handheld GPS unit with an accuracy of approximately 16 feet. Kleinfelder geotechnical staff observed drilling and test pit operations, collected soil samples, and reviewed the subsurface conditions logged in each boring and test pit. Kleinfelder visually classified the observed soils in general accordance with ASTM D2488 and the Unified Soil Classification System. Keys to the soil descriptions and symbols used to describe the subsurface conditions encountered are presented in Appendix A. Kleinfelder geotechnical staff also visually evaluated the Site for the presence of obvious geohazards, such as karst features, that could impact the construction of the PV arrays.

2.1.1 Soil Test Borings

Six soil test borings were advanced with a Geoprobe 7822DT track-mounted drill rig using hollow stem auger drilling techniques to depths ranging from 15 to 50 feet below the ground surface (bgs). Soil samples were collected with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated six inches, then driven an additional 18 inches with blows of a 140-pound auto-hammer falling 30 inches. Standard Penetration Tests (SPTs) were performed at 2.5-foot intervals for the first 10 feet and at five-foot intervals thereafter, in general accordance with ASTM D1586. Standard Penetration Test data (SPT N-values) were used to estimate the in-situ soil strength and density. Soil samples were collected at each test interval. Groundwater observations were recorded during drilling, upon completion of drilling, and prior to backfilling the borings. All soil test borings were excavated to their target depths. The borings were backfilled with cuttings from the drill operations. Logs of the borings are presented in Appendix A.

2.1.2 Test Pits

Two test pits were excavated to depths of approximately eight feet bgs. Kleinfelder field personnel observed, classified, and logged the soil encountered in each test pit. Kleinfelder also collected bulk samples from each test pit for laboratory testing. Groundwater observations in each test pit during excavation were recorded on the logs. The test pits were excavated to their target depths. The test pits were subsequently backfilled with the site soils. Logs of test pits are presented in Appendix A.

2.1.3 Field Resistivity Testing

Kleinfelder personnel measured soil resistivity with an L&R Instruments Ultra MiniRes Soil Resistivity Meter using the Wenner four-electrode method in accordance with ASTM G57 and IEEE Standard 81 at 3 locations as shown in Figure 1. Resistance measurements were conducted within the array areas and the proposed substation location using electrode spacings of 2, 5, 10, 20, 30, and 50 feet. The results of the field resistivity testing are presented in Appendix B.

2.1.4 Pile Load Testing

Kleinfelder completed load testing of 15 piles installed by J&B Solar. The piles were installed using a Vermeer PD10 pile driver in groups of 3 at 5 separate locations (15 piles total) shown in Figure 1. Each pile testing location consisted of a W6x9 wide flange beam that was driven to a depth of 5 feet, a W6x9 driven to a depth of 7 feet, and a W6x15 wide flange beam that was driven to a depth of 6 feet. A summary of pile load testing results is provided in Section 4.5, while a summary of the pile installation, axial pullout loads, and pile drive times is presented in Appendix E.

The piles were tested under lateral and axial tension (pullout) loading. Each pile was first tested laterally by incrementally loading the pile up to approximately 3,500 and 5,500 pounds for the W6x9 and W6x15 piles respectively, at 48 inches above grade and measuring the deflections at 4 and 48 inches above grade. After completion of lateral testing, piles were subject to axial tension testing to maximum movement of 1 inch or approximately 12,500 pounds, whichever condition was observed first. Results of testing are presented in Appendix E.

2.1.5 Laboratory Testing

Laboratory testing was performed on selected samples to evaluate physical and engineering properties of the soils. The laboratory testing included the following tests performed in general accordance with the referenced standards:

- Moisture Content (ASTM D2216);
- Grain Size Distribution (ASTM D422);
- Atterberg Limits (ASTM D4318);
- Standard Proctor (ASTM D698);
- Thermal Resistivity (IEEE Standard 442-1981); and
- Soil Chemistry Testing:
    - pH of Soils (ASTM D4972),
    - Electrical Resistivity (ASTM G187),
    - Sulfate Content (ASTM D4327),
    - Chloride Content (ASTM D4327),
    - Sulfide Content (SM 4500-S2-D),
    - Oxidation-Reduction Potential (ASTM G200),
    - Nitrate, Fluoride, and Phosphate (ASTM D4327), and
    - Ammonium, Lithium, Sodium, Potassium, Magnesium, and Calcium (ASTM D6919).

Laboratory testing results are shown on the boring logs and test pits presented in Appendix A. A summary table and laboratory test results are included in Appendix C. Thermal Resistivity Test Results and Corrosion Test Results are included in Appendix D.

3 SITE DESCRIPTION AND GEOLOGICAL SETTING

3.1 SITE DESCRIPTION

The project site consists of approximately 480 acres of predominantly undeveloped farmland. The topography of the Site is relatively flat and with several drainages and streams crossing it. The South Fork Licking River bisects the southwest corner of the Site. Topographic relief is approximately 100 feet across the Site. Ground cover at the time of our investigation primarily consisted of predominantly harvested crops. Drain tiles are located throughout the Site to aid in drainage of the field. It appears that some drain tiles have been damaged as evident by standing water at the Site. Review of aerial and satellite photography from 1994 through 2020 indicates the Site has remained mostly undeveloped agricultural land. A Quonset hut, owned by Mr. Jerry Lamp, is located near the center of the site and was used as a muster point/equipment storage area during our investigation. A small structure to the south of PLT-5 is shown on a satellite image in 1994 but has been demolished and removed from the Site. It is possible that abandoned underground structures, such as foundations, may still exist in the area. Overhead power lines traverse the northern portion of the Site between PLT-1 and PLT-2 and along the east side of Watkins Road SW.

3.2 GEOLOGIC SETTING AND SURFACE SOILS

3.2.1 Physical Setting

Based on the “Physiographic Regions of Ohio” map published by Ohio Department of Natural Resources (OH DNR), the Site is mapped within the Galion Glaciated Low Plateau Section of the Central Lowland Physiographic Province. This geology of this region consists of medium- to low-lime Wisconsinan-age till over Mississippian-age shales and sandstones. The ground surface ranges in elevation from 950 to 1,050 feet above mean sea level.

3.2.2 Surficial Geology

A review of the Quaternary Geology Map published by the Ohio DNR’s Division of Geologic Survey indicates the presence of several surficial geologic units across the Site. These geologic units are known to have originated from the Late Wisconsinan-aged Woodfordian ice deposits and are comprised predominantly of loam till on the northeastern and silty loam till to the southwestern portions of the Site. Figure 2 shows the project site overlain on the OH DNR

Quaternary Geologic map. More detailed descriptions of these units have been presented in Table 3-1 below:

Table 3-1. Surficial Geologic Units

Geologic Unit	Unit Symbol	Description
Ground Moraine	G1	Loam till with thin loess (<1 m) cover (Kent, Navarre tills); flat to gently undulating
Ground Moraine	G2	Silty loam till (Darby, Bellfontaine, Centerburg tills); flat to gently undulating
Low-Level Valley-Train Outwash	L4	Clayey Till (Hiram Till); very flat, planed by waves in glacial lakes; small patches of sand, silt, or clay on the surface in many areas
End Moraine	M1	Loam till with thin loess (<1 m) cover (Kent, Navarre tills); End moraine, occurs as hummocky ridges higher than adjacent terrain

3.2.3 Bedrock Geology

Based on the Bedrock Geology map published by the Ohio DNR's Division of Geologic Survey, the Site is underlain by the Maxville Limestone of the Logan and Cuyahoga Formations (Mu) and Sunbury and Bedford Formations (Msbd). According to the US Geological Survey (USGS), the Logan and Cuyahoga Formations consist of interbedded shale, siltstone and sandstone that are various shades of gray, yellow and brown. The Sunbury and Bedford Formations consist of black to brownish-black shale and siltstone. Figure 3 shows the project site overlain on the regional bedrock geology.

3.2.4 Geologic Hazards

Based on our review of geologic literature and our explorations performed on the Site, Table 3-2 summarizes our finding and the relative risk related to geologic hazards in the project site area. The geologic hazards listed below are also summarized on Figure 4.

Table 3-2. Summary of Geologic Hazards

Geologic Hazard	Relative Risk	Comments
Collapsible Soils	Low	Geologic setting and climate do not indicate likely presence of collapsible soils.
Expansive Soils	Medium	Results of Atterberg Limits tests and Grain Size Analysis tests indicate medium shrink/swell potential.
Landslides of Slide-Prone Soils	Low	Based on the *Landslide Overview Map of the Conterminous United States* (1982) by Radbruch-Hall, Dorothy, et al., US Geologic Survey there is a low incidence (less than 1.5% of the area involved) of landslides in the vicinity of the site.
Karst	Low	Based on the *Karst in the United States: A Digital Map Compilation*, by Weary, D.J., US Geological Survey Open-File Report 2014-1156, the project site is not mapped within an area that is known to be comprised of flat-lying beds of carbonate rocks (such as dolomite) beneath an overburden of non-carbonate material. A review of the "Probable Karst areas of Ohio" map published by the OH DNR does not indicate the presence of known karst features in the general vicinity of the site. Kleinfelder did not observe indications of karst features such as depressions, vugs, or voids at the completed exploration or resistivity test locations.
Earthquakes	Low	Based on the USGS 2018 one-year model, the project site has a less than 1 percent chance of potentially minor damage (equivalent to a Modified Mercalli Intensity VI). There are no faults shown in the project area on the USGS Quaternary Faults and Folds Database.
Mining	Low	Based on the "Mines of Ohio" database published by the Ohio Division of Mineral Resources, there are no documented surficial or underground mines directly beneath the project site. There is an inactive surface mine located near the southeast corner of York Road SW and Refugee Rd SW, approximately 1.5 miles southeast of the project site.
Flooding	Medium	Based on our review of the FEMA Flood Insurance Rate Maps, the project site area predominantly lies within Zone X (an area outside the 0.2% annual chance of flooding). A portion of the site is mapped within the 1% Annual Chance Flood Hazard Zone, or Special Flood Hazard Area (SFHA). Special construction or other provisions may apply based on federal, state, and local codes.

3.3 SUBSURFACE CONDITIONS

The following description provides a general summary of the subsurface conditions encountered during the field exploration and further identified by the laboratory testing program. A more detailed description can be found on the Boring and Test Pit Logs presented in Appendix A.

The surface soil conditions encountered at the Site generally consist of Glacial Till. Approximately six inches of topsoil was observed in each test boring. The borings, with the exception of Boring B-3, consist of medium stiff to very stiff lean clay (CL) with various amounts of sand and gravel to a maximum observed depth of 18 feet. Below 18 feet, Boring B-6 encountered loose to dense silty and clayey sand (SM-SC) with varying amounts of gravel to a depth of 48 feet bgs. Boring B-6 encountered stiff lean clay (CL) with sand was encountered at 48 feet bgs. Boring B-3 encountered loose silty and clayey sand (SM-SC) below the topsoil to a depth of 5 feet bgs. Bedrock was not encountered in any of the test borings or test pits.

The subsurface conditions in the two test pits were generally similar to those observed in the borings. Excavation refusal was not encountered in either test pit, which extended to depths of approximately 8 feet bgs.

Engineering properties of the soils were evaluated using field and laboratory testing and are included in Appendix C. Atterberg limits tests performed on selected samples of the soils indicated liquid limit (LL) values ranging from 22 to 35 and plasticity index (PI) values ranging from 5 to 18.

3.3.1 Groundwater

Groundwater was observed in Boring B-6 at a depth of approximately 17 feet bgs during drilling and at a depth of 5 feet bgs prior to backfilling. Some fluctuation in groundwater levels can occur with climatic and seasonal variations. Fluctuation of the groundwater level, localized zones of perched water, and increased soil moisture content should be anticipated during and following rain events. Therefore, subsurface water conditions at other times may be different from those described in this report.

3.4 CORROSIVITY TEST RESULTS

Project X Corrosion Engineering (Project X) completed soil chemistry laboratory testing of two samples to provide data regarding the corrosivity of onsite soils. These analytical laboratory tests were performed on discrete samples and do not provide a complete representation of all soil types at the Site. The soil corrosion laboratory test results are general and should be considered only a random survey. The results of the chemical testing are summarized in Table 3-3 and provided in Appendix D.

Table 3-3. Summary of Laboratory Soil Corrosivity Testing

Boring No.	Depth (ft)	pH	Sulfide (mg/kg)	Chloride (mg/kg)	Sulfate (mg/kg)	Minimum Resistivity (ohm-cm)	Redox Potential Eh (mV)
TP-1	2-4	7.7	<0.01	11.5	56.5	2,680	163
TP-2	2-4	6.4	<0.01	4.9	16.0	4,288	135

These laboratory results were compared to the "Building Code Requirements for Reinforced Concrete", ACI 318, to evaluate the potential of corrosion and attack to concrete. Based upon the tested sulfate concentrations, the soils have a Class S0 exposure rating for sulfate attack. ACI has no special requirements for cement type or concrete formulation for concrete in contact with soil based on the measured sulfate concentrations.

The results of the laboratory resistivity testing, as shown in Appendix D, generally indicate that there is the potential for corrosion to bare steel articles in contact with soils. Galvanization is typically used for protection of PV racking support piles, but additional measures such as coatings or active corrosion protection systems may be necessary depending on the design life of the system. Corrosion design recommendations should be obtained from a corrosion engineer for the project design life.

3.5 THERMAL RESISTIVITY

Two thermal resistivity tests were performed in the laboratory on samples obtained from the test pits. The thermal resistivity tests were performed in general accordance with IEEE Standard 442-2017-Guide for Soil Thermal Resistivity Measurements and ASTM standards. The results of the thermal resistivity testing are presented below in Table 3-4. Graphical results of the individual thermal dry-out curves and more detailed information regarding the sample preparation are presented in Appendix D.

Table 3-4. Thermal Resistivity of Native Soil Samples

Test Location	Tested Initial Moisture Content (% dry weight)	Tested Dry Density (lb/ft^3)	Thermal Resistivity, wet (°C-cm/W)	Thermal Resistivity, dry (°C-cm/W)	Standard Max. Dry Density (lb/ft^3)	Optimum Moisture Content (% dry weight)
TP-1	13.3	114.5	57	218	114.5	13.3
TP-2	15.4	110.7	59	293	110.7	15.4

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 GENERAL CONCLUSIONS

The conclusions and recommendations presented below are based on the subsurface conditions observed in the explorations, laboratory test results, pile load testing, engineering analyses, and our experience with similar utility-scale PV solar projects. Based on the results of our field exploration and laboratory testing, the Site appears to be geotechnically suitable for PV solar development.

4.2 EARTHWORK

4.2.1 Subgrade Preparation

Initial site work should consist of grubbing and stripping of vegetation, demolition, and removal of existing structures and other deleterious materials. Deleterious material should be removed for offsite disposal in accordance with local laws and regulations.

Subgrades below roadways, equipment pads, and areas planned for structural fill placement should be evaluated by an experienced geotechnical engineer or their representative prior to construction. Areas should be proof rolled with a loaded dump truck (minimum 18-kip axle load). Areas that express excessive rutting or pumping should be undercut and backfilled with structural fill per the following paragraphs. The excavations should extend horizontally beyond the construction limits, extending outward one foot for every one foot of excavation.

We recommend native soils below structural fill, equipment pads, spread foundations, and access roadways be scarified, moisture conditioned to zero to three percent above optimum moisture content, and recompacted at least eight inches below the structural fill, access road subgrade, or base of concrete.

In the area where PV array piles will be installed, stripping of the organic materials is not required unless there will be areas of fill in excess of 12 inches in depth. Preparation of the tilled or disturbed soils should be completed as required to facilitate array installation equipment access and will likely include levelling and compaction of the existing soil.

4.2.2 Excavation and Trenching

We anticipate that the site soils can be excavated using conventional heavy-duty construction equipment. Our borings and test pits did not encounter bedrock, boulders, or other layers anticipated to present difficult excavation conditions at typical utility installation depths.

All excavations must comply with applicable local, state, and federal safety regulations including the current OSHA Excavation and Trench Safety Standards. OSHA soil type and allowable sloping must be made in the field by the contractor's OSHA-qualified "competent person" whenever personnel exposure is anticipated. Construction site safety is the responsibility of the contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations.

4.2.3 Structural Fill

Structural fill is defined as any fill that will support structural elements. Structural fill will be required for backfill of utilities and for site-grading fill. All structural fill must be free of sod, rubbish, topsoil, frozen soil, and other deleterious materials. The onsite soils are generally suitable for reuse as structural fill, provided they are properly moisture conditioned to maintain workability. Imported Structural fill materials should consist of a non-expansive, mainly granular material as specified in the table below.

Table 4-1. Structural Fill Criteria

Gradation Requirements	
Standard Sieve Size	Percent Passing
3 inches	100
3/4 inch	80 - 100
No. 200	10 - 35
Plasticity Requirements (Atterberg Limits)	
Liquid Limit	30 or less
Plasticity Index	12 or less

The materials encountered during Kleinfelder's evaluation were generally fine-grained (i.e., greater than 50 percent passing the No. 200 sieve) with higher liquid limits and plasticity indices than listed in

Table 4-1. The in-situ moisture content of tested onsite soils ranged from about 13 to 23 percent, while proctor test results indicate optimum moisture contents ranging from approximately 13 to 16 percent. Fine-grained soils with elevated liquid limits and plastic indices are moisture sensitive and can be difficult to dry out to achieve compaction requirements.

A sample of any imported fill material should be submitted to the geotechnical engineer for approval and testing at least one week prior to stockpiling at the Site. Structural fill should be placed according to the recommendations in Section 4.2.4.

4.2.4 Fill Placement and Compaction

Structural fill should be placed in loose lifts and in thicknesses appropriate for the compaction equipment being used. However, in no case should loose-lift thickness exceed eight inches. Structural fill should be compacted to the specifications presented in Table 4-2.

Table 4-2. Compaction Specifications

Fill Location	Fill Material Type	Minimum Percent Compaction (ASTM D698)	Moisture Content
Foundation and Roadway Subgrade Preparation or Site Grading	Clay Soil	95	0 to +3% of optimum
	Sandy Soil	95	-2 to +2% of optimum

4.2.5 Construction in Wet or Cold Weather

During construction, the Site should be graded such that surface water can drain readily away from excavations. Any water should be promptly pumped out or otherwise removed since water may accumulate in excavations or on subgrade surfaces. These wet areas should be allowed to dry before resuming construction. The use of berms, ditches, and similar means may be used to prevent stormwater from entering the work area and to convey any water off-site efficiently.

If earthwork is performed during the winter months when freezing may occur, no grading fill, structural fill, or other fill should be placed on frosted or frozen ground, nor should frozen material be placed as fill. Frozen ground should be allowed to thaw or be completely removed prior to placement of fill. A good practice is to cover the compacted fill with a “blanket” of loose fill to help prevent the compacted fill from freezing.

4.2.6 Construction Testing and Observation

Field testing and construction observation should take place under the direction of a qualified geotechnical engineer. Furthermore, the opinions and recommendations expressed in a geotechnical report are based on interpretation of limited information obtained from the field exploration. Therefore, it is common to find that actual site conditions differ from those indicated in the report. The geotechnical engineer should remain involved throughout the project to evaluate such differing conditions as they appear, and to modify or add to the geotechnical recommendations, as necessary.

4.2.7 Surface Drainage and Final Site Grading

Positive drainage away from structures is essential to the performance of foundations and roads and should be provided during the life of the facility. Consideration should be given to improving the slope and surface drainage of areas that have ponding of surface water and/or poor surface drainage near slab foundations or roads.

4.3 SEISMIC SITE CLASS

Based on the soil conditions encountered in the borings and our knowledge of geologic conditions in the area of the site, a Site Class of ‘D’ is considered appropriate. From our research, the 2017 Ohio Building Code is currently being utilized, which is based on the 2015 International Building Code and the ASCE 7-10 Minimum Design Loads for Buildings and Other Structures. The seismic design parameters, based on a latitude/longitude of 39.9837°/-82.6401° as determined in ASCE 7-10 from the ATC Hazards by Location website (hazards.atcouncil.org), are summarized below in Table 4-3.

Table 4-3. Seismic Design Parameters

Design Parameter	Recommended Value
Site Class	D
PGA	0.051
PGA_M	0.082
S_s	0.112
S_1	0.096
F_a	1.6
F_v	2.4
S_{MS}	0.179
S_{M1}	0.143
S_{DS}	0.120
S_{D1}	0.096

The typical soil profile encountered in our borings was predominately medium stiff to very stiff lean clay loose to medium dense sand.

It is our opinion that the upper 10- to 15-foot soil profile presents negligible risk of liquefaction due to the presence of stiff clays and low seismicity at the Site. Layers of saturated loose and medium dense sands below the clay profile may be subject to liquefaction if cyclic or vibration loading at the Site were to occur in those layers, but liquefaction due to seismic shaking is unlikely at the Site.

4.4 FROST HEAVE CONSIDERATIONS

The Columbus, Ohio Code of Ordinances, Chapter 2145.03, *Ohio Building Code, Structural – Frost Line*, has indicated that the standard frost depth is thirty-two inches for Columbus, Ohio, located approximately 18 miles west of the project site. Figure 7 from *Soil Mechanics: NAVFAC DM7.01* indicates that the extreme frost depth at the site is between 30 and 40 inches. We estimate the frost depth at the Site is approximately thirty-six inches.

Groundwater was encountered at one boring at the Site at a depth of approximately 17 feet bgs and below the lean clay layer. At the completion of drilling, groundwater was measured at a depth

of approximately 5 feet bgs. Due to the presence, depth and thickness of the lean clay layer encountered in the upper fifteen feet over the majority of the Site, in combination with the depth to groundwater encountered at the Site, we anticipate the risk of frost action to be low to moderate.

4.5 PV ARRAY FOUNDATIONS

Typical foundations used for PV arrays, such as driven steel piles, drilled piers, helical piers, ballasts, or footings will likely be feasible for use for this project. We have assumed driven steel piles are preferred. A summary of the pile axial and lateral pullout load testing is presented in Appendix E. Driving refusal was not encountered in any of the 5 test locations.

The following design values for evaluation of axial and lateral pile capacity are based on the findings of our field investigation, laboratory testing, pile load testing, and our experience in the area. Based on the soils encountered at the Site, results of pile load testing, and potential frost-heave considerations, we recommend all PV support piles have a minimum driven depth of at least 7.5 feet below grade. Greater depths may be required to achieve structural requirements.

4.5.1 Axial Capacity

Axial capacity of driven piles may be estimated based on the perimeter of the pile and embedment depth. The perimeter of a wide-flange beam should be taken as twice the sum of the flange width and web depth. We recommend the upper one foot of soil be neglected from the skin friction component of axial capacity.

Kleinfelder evaluated the skin friction of pile based on the results of the axial pullout testing presented in this report. The ultimate skin friction of driven pile foundations can be taken as 500 psf. Thus, the nominal axial load capacity of the driven piles for PV racking in the upper 15 feet can be calculated using the following formula:

$$Q_{ult} = 500psf * P * (L-1ft)$$

Where: Q_{ult} = ultimate (nominal) axial capacity (pounds)
P = perimeter equal to twice the section depth plus twice the flange width (ft)
L = embedment depth (ft), neglecting the upper 1ft

For design of piles, we recommend a factor of safety of at least 1.5 for evaluation of allowable skin friction, or a resistance factor of 0.7 for design using load and resistance factored design (LRFD).

For piles in compression, end bearing can be considered additive to the skin friction and was based on the exploration and testing results presented in this report. Ultimate end bearing pressure can be taken as 5,000 psf, calculated based on the box end area of the pile. For evaluation of allowable end pressure, we recommend a factor of safety of 2.5. For LRFD, we recommend a maximum a resistance factor of 0.5. The above values can be used to estimate the capacity of piles for both refusal and non-refusal installations.

4.5.2 Lateral Capacity

Lateral load response of pile foundations can be calculated with the computer program LPile, created by Ensoft, Inc. The stiffness of the pile and the stress-strain properties of the surrounding soils determine the lateral resistance of the foundation. Recommended LPile input parameters for the clay soils encountered are included below in Table 4-4. As shown in the table, the upper foot of soil should be neglected for lateral capacity.

Table 4-4: LPile Input Parameters

Depth Below Grade (ft)	Soil Type	Effective Unit Weight (pcf)	Undrained Cohesion (psf)
0 to 1	Neglect		
1 to 15	Stiff Clay w/o Free Water	110	1,600

Kleinfelder developed these parameters from the results of the field and laboratory testing. These parameters can be used for the full depth of pile embedment. If piles will be wider than 7 inches, Kleinfelder should be given the opportunity to reevaluate these parameters.

4.5.3 Refusal Considerations

We recommend all PV support piles have a minimum driven depth of at least 7.5 feet. Greater depths may be required to achieve structural requirements. Refusal is defined as no advancement after driving the piles at full power (i.e., minimum 830 Joules) for at least 30 seconds. Piles that refuse and require additional embedment depth should be withdrawn and the pile location predrilled. Predrilled pile holes should be backfilled with compacted granular material. Compaction should be completed by tamping with a heavy tamping bar with at least three lifts.

4.6 EQUIPMENT FOUNDATIONS

We understand that the proposed substation equipment may be supported on shallow/mat foundations. We evaluated several foundation sizes to provide allowable bearing pressures for various sizes based on the limiting factors of soil bearing capacity and estimates for 1 inch of settlement, whichever is lower. Our recommendations are based on Boring B-6 from within the proposed substation area and are summarized in Table 4-5.

Table 4-5: Summary of Shallow Foundation Bearing Pressures

Width (ft)	Length (ft)	Allowable Bearing Pressure (psf)
2	2	3,000
6	6	2,500
10	10	2,000
20	20	2,000

We recommend mat foundations be designed in accordance with the following criteria:

- The recommended allowable bearing pressures range from 2,000 to 3,000 psf and include a factor of safety of at least 3 with regards to bearing capacity as shown in Table 4-5. Any unsuitable subgrade conditions encountered in the area of mat foundations should be improved as discussed in Section 4.2.1
- An allowable modulus of subgrade reaction, k_{V1}, of 150 pounds per square inch per inch deflection (pci) may be used for design of mat foundations. k_{V1} refers to a 1-foot square plate and should be adjusted for actual foundation dimensions using the following equation (B is the mat width in feet).

$$k_v = \frac{k_{v1}}{B}$$

- To provide frost protection, mat foundations should have a minimum embedment depth of 36 inches based on the frost depth or as required by more stringent codes. Minimum embedment may be achieved by turned down or thickened edges which will also aid in providing mat confinement. Turned down edges for the mat should extend 36 inches below grade and should be a minimum of 12 inches in width at their base. The soils included inside the turned down edges within the entire footprint of the mat should consist of a minimum of

12 inches of gravel (AASHTO No. 57 or equivalent). Drainage provisions should be provided to ensure surface water does not become trapped beneath the mat.

- The mat and foundation should be reinforced per the structural engineer's recommendations.
- Mat foundations should be loaded to distribute loads uniformly over the mat area as much as possible.
- Minimum foundation size should be 2 feet by 2 feet unless otherwise noted.
- Post-construction total settlements of the mat foundations are estimated to be up to about 1 inch (at the sizes and allowable bearing pressures provided in Table 4-5), with post-construction differential settlements of up to about 0.5-inch.
- Underground utilities running parallel to the mat and lying 4 feet or shallower, generally should be located no closer than 2 feet outside of the perimeter edges of the mat slab. Deeper utilities should be located above a 1:1 (horizontal to vertical) slope projected downward from the bottom edges of the mat.
- For resistance to lateral loading, we recommend an ultimate coefficient of friction of 0.30 be utilized for calculation of friction resistance along the bottom of foundations constructed on approved subgrade soils. The vertical dead loads acting on the mat can be utilized to calculate the ultimate friction resistance. We recommend a minimum factor of safety of 1.5 when using sliding friction alone. A passive pressure coefficient of 3.0 may be used to calculate ultimate passive pressure resistance on the side of mats for resistance to sliding in Structural Fill and site soils. A moist unit weight of 110 pcf may be used to calculate passive pressures. The passive pressure can be assumed to act starting at a depth of 1 foot below grade in level unpaved areas. A larger magnitude of movement is required to engage the full passive resistance than sliding friction. Therefore, a minimum factor of safety of 2.0 is recommended on the passive pressure when using passive pressure in conjunction with base friction to resist lateral loads. It should be noted that the lateral load resistance values discussed above are only applicable where the concrete for foundations are either placed directly against undisturbed soils or that the voids created from the use of forming are backfilled with properly compacted soil.

During construction, foundation excavations should be observed by a representative of the Geotechnical Engineer to evaluate the supporting capabilities of the bearing materials. If unsuitable bearing conditions are encountered, the area should be over-excavated and backfilled with compacted Structural Fill at the recommendation of the Geotechnical Engineer of Record.

The Contractor should not allow surface and/or ground water to accumulate in foundation excavations. Foundations should be placed in excavations immediately after foundation

subgrades are approved by the on-site geotechnical representative. Water entering foundation excavations should be removed and the subgrade scarified, moisture conditioned, and re-compacted in accordance with Section 4.2.1 of this report, prior to foundation placement. The use of a “mud mat”, an unreinforced concrete slab (approximately 3 inches thick), may be considered for foundation subgrades to protect the subgrade from damage resulting from precipitation.

4.7 DIRECT EMBEDMENT POLES

Overhead interconnection lines are assumed to be supported on direct embedment poles. Based on the "Design Manual for High Voltage Transmission Lines" RUS Bulletin 1724E-200, the standard for installation of direct embedment poles in “good soil” is "10 percent plus 2 feet". The subsurface conditions encountered in our borings and test pits appear to fall within this category; however, the pole designer should review the logs to determine an appropriate depth for poles.

4.8 ACCESS ROADS

At typical solar sites, access roads are heavily used during construction, but see very low traffic volumes during the life of the installation. Vehicle types are anticipated to vary significantly, from lightly to heavily loaded trucks and construction equipment. Access road sections are typically designed based on post-construction traffic volumes, with the assumption that localized improvements and/or frequent maintenance of the roads will occur during construction. Gravel-surfaced or soil access roads are typical for these facilities.

Near surface soils encountered in the explorations were predominately lean clay with various amounts of sand and gravel with low to medium plasticity. These soils are considered fair to poor subgrade for roads, and the strength of the subgrade will be highly influenced by moisture content. Based on the soil type encountered, we estimate these soils to have a field CBR value of 5 for road section design.

Performance of gravel-surface roads is greatly influenced by moisture in the subgrade soils. High subgrade moisture contents will increase the frequency and depth of rutting and ponding on the wearing surface. The use of subgrade stabilization (e.g., 4 to 6% lime or fly-ash) or a geotextile separation fabric (e.g., Tensar BX1100 geogrid or equivalent) can improve support qualities and may be appropriate for high-traffic areas. A geotextile can also reduce rutting and maintain strength of a gravel surface course.

Based on AASHTO design criteria for low-volume roads, we recommend a minimum wearing surface of ten inches of aggregate for a traffic load of six trucks per weekday for a year during construction. Traffic after construction is anticipated to be very limited, mainly consisting of pick-up trucks and rare heavy trucks for maintenance operations. These traffic volumes are too small for typical road design methods, and the primary concern will be access. Therefore, we recommend a wearing surface of a minimum of six inches of aggregate. This recommendation is not additional to the “during construction” section. The six-inch section can be achieved through grading and spot-filling of ruts and other thin or warn areas in the roads.

Wearing course should consist of imported granular material that meets the requirements of the Ohio Department of Transportation *Construction and Material Specifications* (2019) Section 703.04, Aggregate for Asphalt Concrete Base. An increased thickness of granular material may be required in isolated areas to achieve stability.

We recommend the roads be designed with cross-slope to promote drainage, and, where possible, with ditches to help drain water from road and convey off-site.

Road alignments should be properly prepared by stripping all vegetation, organic soil, and deleterious materials and scarified and recompacted to a depth 12 inches below final subgrade elevation. The road alignment should be proof rolled with a fully loaded dump truck or similar vehicle. Areas that deflect, rut, or pump should be further excavated and recompacted, or stabilized.

Regular maintenance including grading and the addition of gravel should be anticipated during the facility construction because truck and heavy equipment traffic will be frequent. After construction, traffic volumes are anticipated to be very low, and mainly related to facility maintenance operations.

5 LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This report may be used only by Leeward Renewable Energy, LLC and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two (2) years from the date of the report.

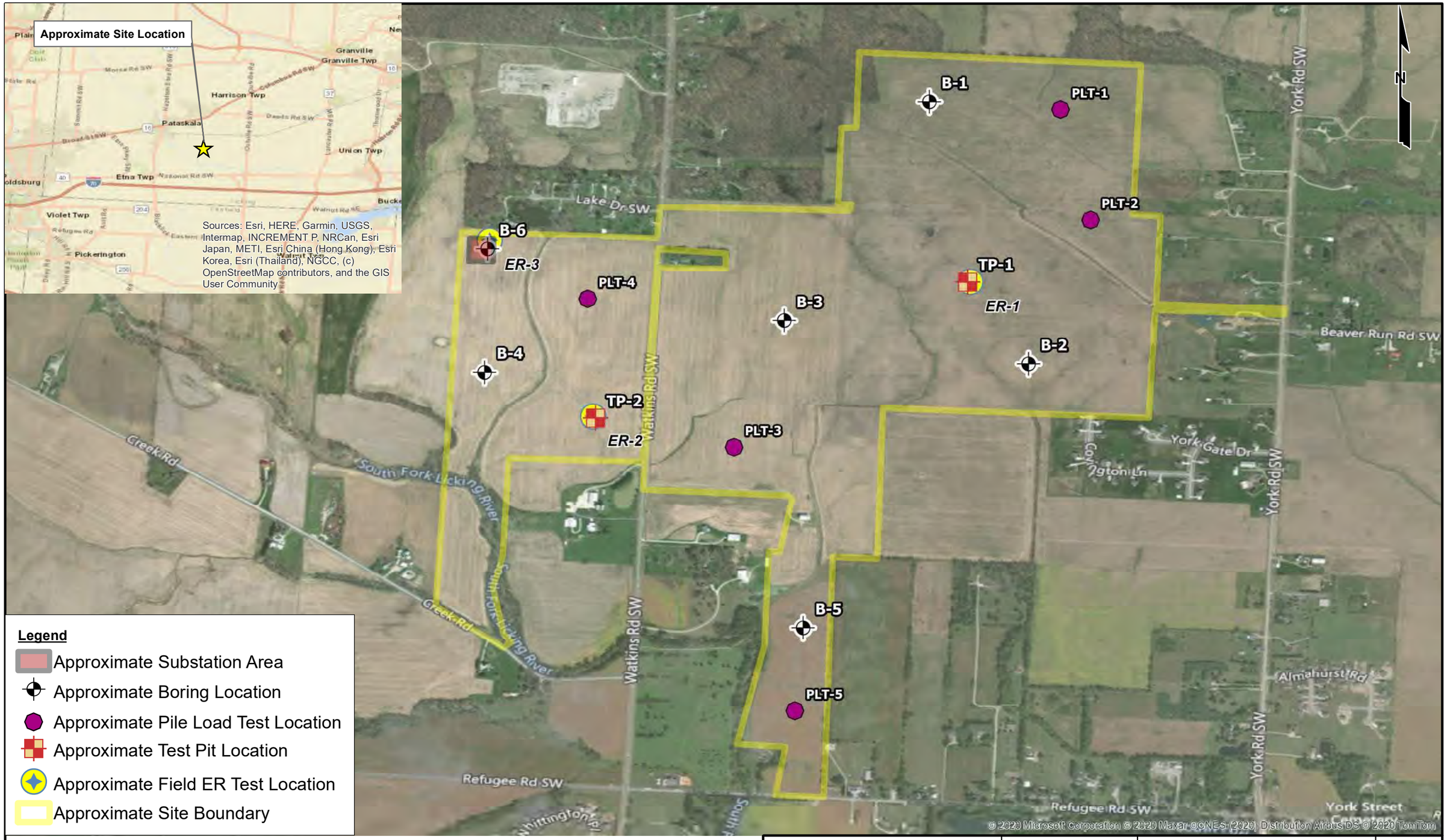
The work performed was based on project information provided by Leeward Renewable Energy, LLC. If Leeward Renewable Energy, LLC does not retain Kleinfelder to review any plans and specifications, including any revisions or modifications to the plans and specifications, Kleinfelder assumes no responsibility for the interpretation or implementation of our recommendations. In addition, if there are any changes in the field to the plans and specifications, Leeward Renewable Energy, LLC must obtain written approval from Kleinfelder's engineer that such changes do not affect our recommendations. Failure to do so will vitiate Kleinfelder's recommendations.

Kleinfelder offers various levels of investigative and engineering services to suit the varying needs of different clients. Although risk can never be eliminated, more detailed and extensive studies yield more information, which may help understand and manage the level of risk. Since detailed study and analysis involves greater expense, our clients participate in determining levels of service, which provide information for their purposes at acceptable levels of risk. Leeward Renewable Energy, LLC and key members of the design team should discuss the issues covered in this report with Kleinfelder, so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk and expectations for future performance and maintenance.

The scope of services for this subsurface exploration and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.

This report, and any future addenda or reports regarding this site, may be made available to bidders to supply them with only the data contained in the report regarding subsurface conditions and laboratory test results at the point and time noted. Bidders may not rely on interpretations, opinions, recommendations, or conclusions contained in the report. Because of the limited nature of any subsurface study, the contractor may encounter conditions during construction which differ from those presented in this report. In such event, the contractor should promptly notify the owner so that Kleinfelder's Geotechnical Engineer can be contacted to confirm those conditions. We recommend the contractor describe the nature and extent of the differing conditions in writing and that the construction contract include provisions for dealing with differing conditions. Contingency funds should be reserved for potential problems during foundation construction.

FIGURES



Legend

- Approximate Substation Area
- Approximate Boring Location
- Approximate Pile Load Test Location
- Approximate Test Pit Location
- Approximate Field ER Test Location
- Approximate Site Boundary

0 750 1,500 3,000 Feet

KLEINFELDER
Bright People. Right Solutions.

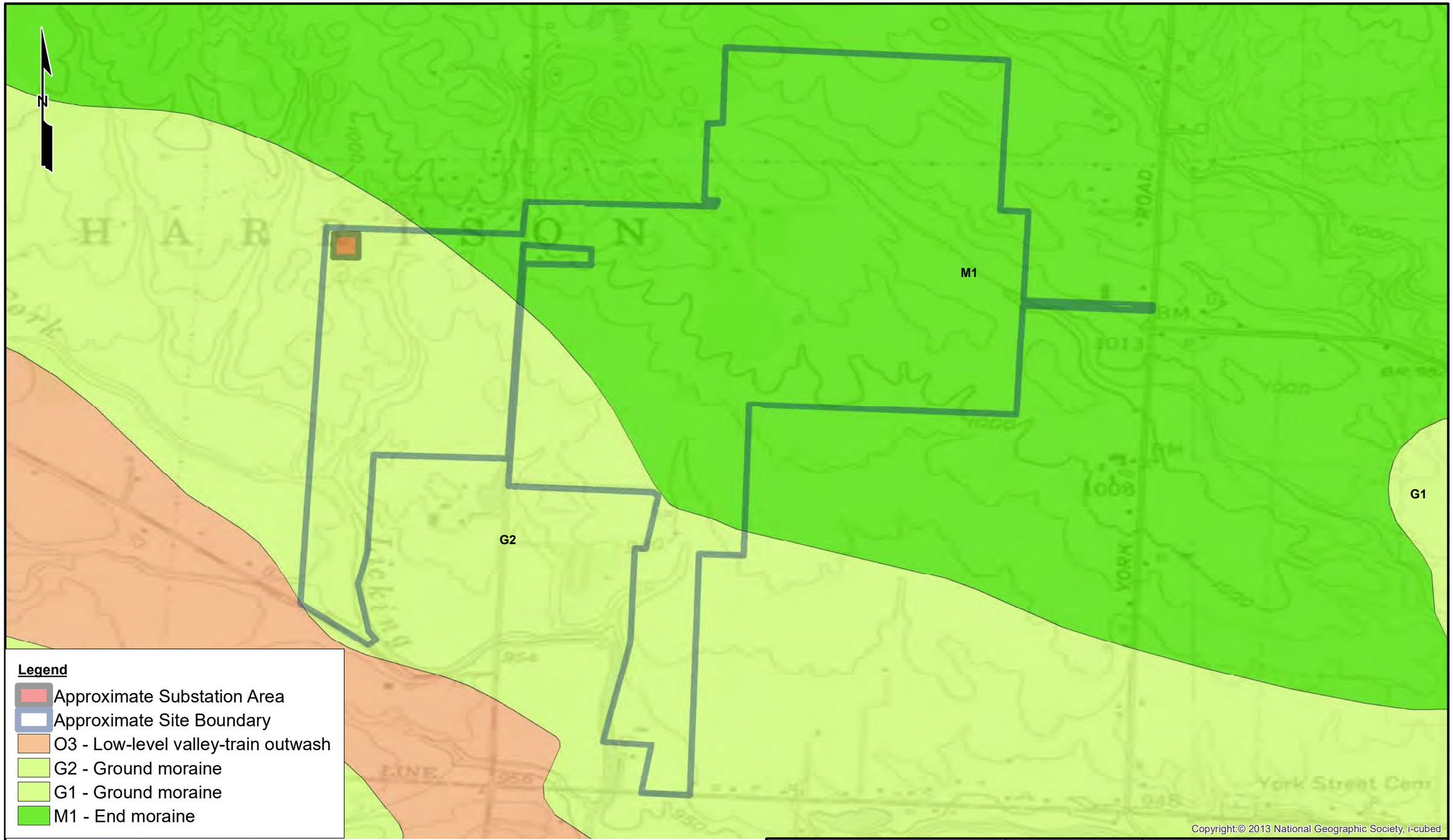
PROJECT NO.	20212714.001A
DRAWN:	01/21/2021
DRAWN BY:	ASK
CHECKED BY:	JC
FILE NAME:	Figure 1 - Exploration Location Plan

EXPLORATION LOCATION PLAN & VICINITY MAP

Union Ridge Solar Project
Licking County, Ohio

FIGURE
1

Document Path: K:_clients\Leeward Renewable Energy LLC\20212714.001A - Union Ridge Solar\Union Ridge\Figure 1 – Exploration Location Plan and Vicinity Map.mxd



REFERENCE
"Quaternary Geology 500K - Geologic Units"
Published by : Ohio Department of Natural Resources - Division of Geological Survey

KLEINFELDER
Bright People. Right Solutions.

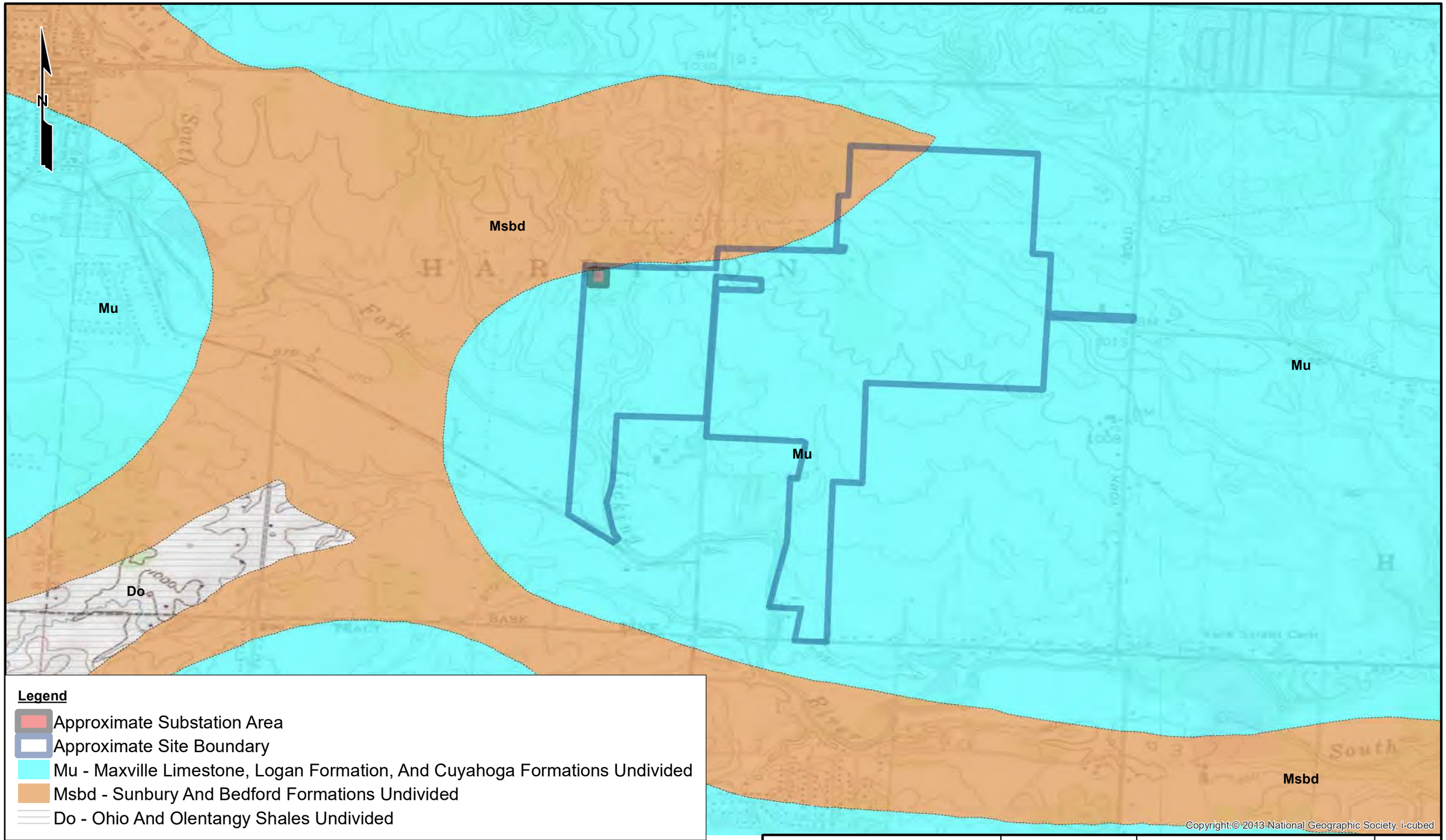
PROJECT NO.	20212714.001A
DRAWN:	01/06/2021
DRAWN BY:	ASK
CHECKED BY:	JC
FILE NAME:	Figure 2 - Surficial Geology

SURFICIAL GEOLOGY MAP

Union Ridge Solar Project
Licking County, Ohio

FIGURE
2

Document Path: K:_clients\Leeward Renewable Energy LLC\20212714.001A - Union Ridge Solar\Union Ridge\Figure 2 - Surficial Geology.mxd



REFERENCE
"Bedrock Geology 24K - Geologic Units"
Published by : Ohio Department of Natural Resources - Division of Geological Survey

KLEINFELDER
Bright People. Right Solutions.

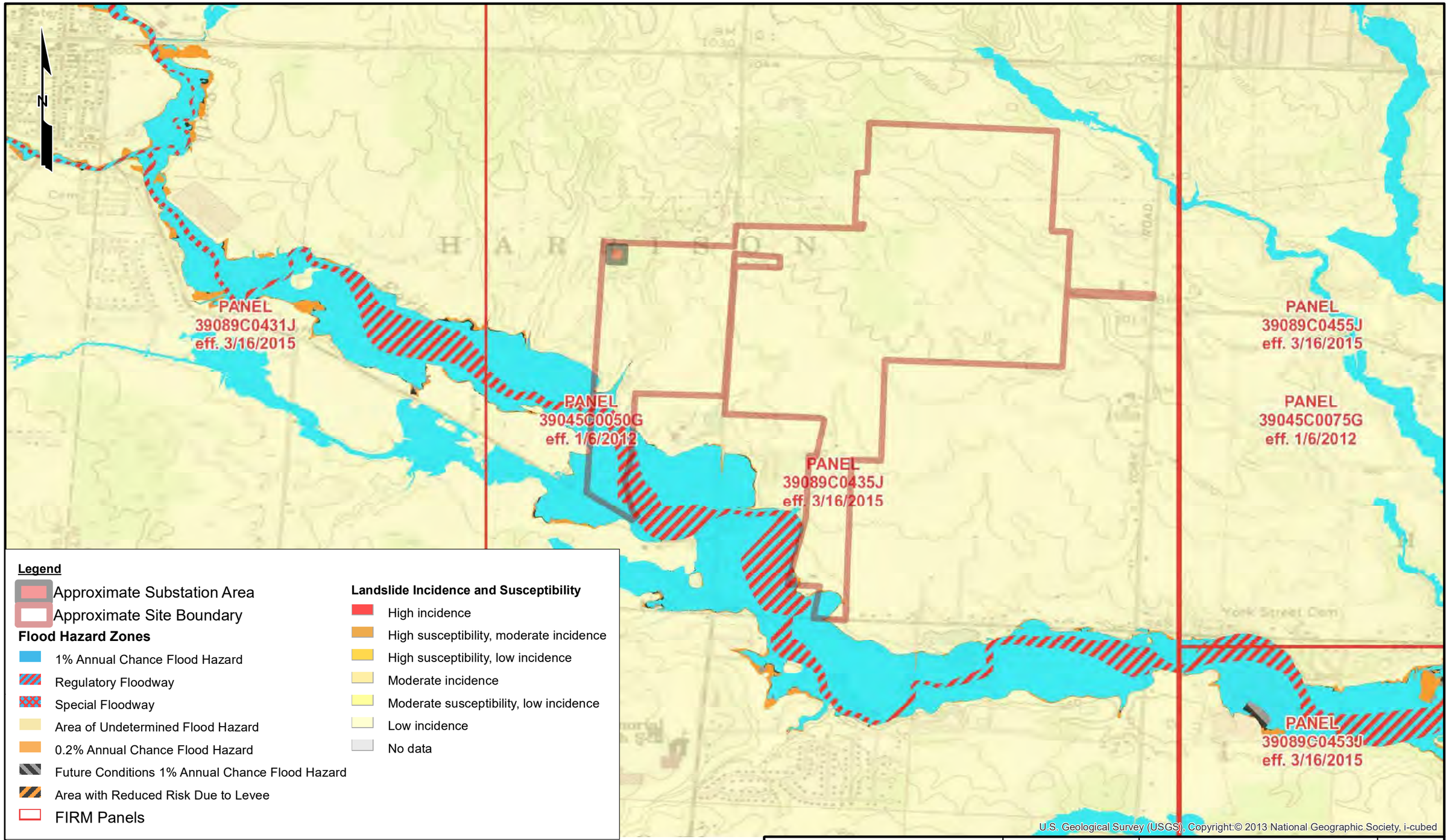
PROJECT NO.	20212714.001A
DRAWN:	01/06/2021
DRAWN BY:	ASK
CHECKED BY:	JC
FILE NAME:	Figure 3 - Bedrock Geology

BEDROCK GEOLOGY MAP

Union Ridge Solar Project
Licking County, Ohio

FIGURE
3

Document Path: K:_clients\Leeward Renewable Energy LLC\20212714.001A - Union Ridge Solar\Union Ridge\Figure 3 - Bedrock Geology.mxd



Legend

- Approximate Substation Area
- Approximate Site Boundary

Flood Hazard Zones

- 1% Annual Chance Flood Hazard
- Regulatory Floodway
- Special Floodway
- Area of Undetermined Flood Hazard
- 0.2% Annual Chance Flood Hazard
- Future Conditions 1% Annual Chance Flood Hazard
- Area with Reduced Risk Due to Levee
- FIRM Panels

Landslide Incidence and Susceptibility

- High incidence
- High susceptibility, moderate incidence
- High susceptibility, low incidence
- Moderate incidence
- Moderate susceptibility, low incidence
- Low incidence
- No data

0 1,250 2,500 5,000 Feet

REFERENCE

Radbruch-Hall, Dorothy, et al., "Landslide Overview Map of the Conterminous United States (1982)", published by : US Geologucal Survey
National Flood Hazard Layer (NFHL) obtained from Federal Emergency Management Agency (FEMA)

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.	20212714.001A
DRAWN:	01/06/2021
DRAWN BY:	ASK
CHECKED BY:	JC
FILE NAME:	Figure 4 - Geohazard Map

GEOHAZARD MAP

Union Ridge Solar Project
Licking County, Ohio

FIGURE 4

Document Path: K:_clients\Leeward Renewable Energy LLC\20212714.001A - Union Ridge Solar\Union Ridge\Figure 4 - Geohazard Map.mxd

APPENDIX A.
SOIL BORING AND TEST PIT LOGS

SAMPLE/SAMPLER TYPE GRAPHICS

BULK SAMPLE

STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after exploration completion)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS

PID - Photoionization Detector

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	**GRAVELS** (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu≥4 and 1≤Cc≤3		**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			Cu<4 and/ or 1>Cc>3		**GP**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5% TO 12% FINES	Cu≥4 and 1≤Cc≤3		**GW-GM**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			Cu<4 and/ or 1>Cc>3		**GP-GM**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH > 12% FINES			**GM**	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
					GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
					GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (Half or more of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu≥6 and 1≤Cc≤3		**SW**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu<6 and/ or 1>Cc>3		**SP**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu≥6 and 1≤Cc≤3		**SW-SM**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			Cu<6 and/ or 1>Cc>3		**SP-SM**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH > 12% FINES			**SM**	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
					SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
					SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES

FINE GRAINED SOILS (Half or more of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	**ML**	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid Limit 50 or greater)	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

NOTE: USE MATERIAL DESCRIPTION ON THE LOG TO DEFINE A GRAPHIC THAT MAY NOT BE PROVIDED ON THIS LEGEND.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20212714.001A
DRAWN BY:	MG
CHECKED BY:	BB
DATE:	12/30/2020

GRAPHICS KEY

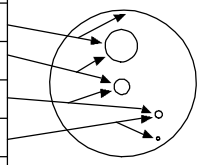
Union Ridge Solar Project
Licking County, OH

FIGURE

A-1

GRAIN SIZE

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 -3 in. (19 - 76.2 mm.)	3/4 -3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



SECONDARY CONSTITUENT

	AMOUNT	
Term of Use	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	≥5 to <15%	≥15 to <30%
Modifier	≥15%	≥30%

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT - N_{60} (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q_u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 - 4	0.25 ≤ PP <0.5	500 - 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 - 8	0.5 ≤ PP <1	1000 - 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 - 15	1 ≤ PP <2	2000 - 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 - 30	2 ≤ PP <4	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4 ≤ PP	>8000	Thumbnail will not indent soil.

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N_{60} (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

FROM TERZAGHI AND PECK, 1948

PLASTICITY

DESCRIPTION	LL	Either the LL or the PI (or both) may be used to describe the soil plasticity. The ranges of numbers shown here do not imply that the LL ranges correlate with the PI ranges for all soils.	PI
Non-Plastic	NP		NP
Low	< 30		< 15
Medium	30 - 50		15 - 25
High	> 50		> 25

LL is from Casagrande, 1948. PI is from Holtz , 1959.

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness.
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20212714.001A

DRAWN BY: MG

CHECKED BY: BB

DATE: 12/30/2020

SOIL DESCRIPTION KEY

Union Ridge Solar Project
Licking County, OH

FIGURE

A-2

Date Begin - End:	12/07/2020	**Drilling Company:**	Terra Testing	**BORING LOG B-1**	
Logged By:	M. Glassmeyer	**Drill Crew:**	J. Winters		
Hor.-Vert. Datum:	WGS 1984 - Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Automatic - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	30°F Snow	**Exploration Diameter:**	3.25 in. I.D.		

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Latitude: 39.99093° Longitude: -82.63680° Surface Condition: Bare Earth											
		TOPSOIL		BC=1 2 3 3	24"								
		Sandy Lean CLAY (CL): low plasticity, olive yellow, moist, medium stiff to stiff, trace gravel		BC=4 7 8 12	18"	CL	17.8		92	65	31	13	
5		**Gravelly Lean CLAY (CL)**: low plasticity, gray, moist, stiff		BC=10 9 13 11	16"								
				BC=4 7 6 6	12"								
10													
				BC=5 8 8 8	24"								
15													
20													
25													
30													

The boring was terminated at approximately 15 ft. below ground surface. The boring was backfilled with auger cuttings on December 07, 2020.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
A iPad integrated GPS unit was used to locate the exploration with an accuracy of 5 meters.
Caving was observed at a depth of 11 ft. below ground surface.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20212714.001A	BORING LOG B-1		BORING
DRAWN BY: MG	Union Ridge Solar Project Licking County, OH		B-1
CHECKED BY: BB			
DATE: 12/30/2020			PAGE: 1 of 1

Date Begin - End:	12/07/2020	**Drilling Company:**	Terra Testing	**BORING LOG B-2**	
Logged By:	M. Glassmeyer	**Drill Crew:**	J. Winters		
Hor.-Vert. Datum:	WGS 1984 - Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Automatic - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	30°F Snow	**Exploration Diameter:**	3.25 in. I.D.		

Latitude: 39.98305°
Longitude: -82.63382°
Surface Condition: Bare Earth

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		TOPSOIL											
		Sandy Lean CLAY (CL): low plasticity, olive yellow, moist, stiff		BC=1 2 3 5	12"								
				BC=2 5 4 5	24"								
5				BC=7 7 8 8	14"	CL	13.1		85	65	27	10	
		Lean CLAY (CL): low plasticity, light brownish gray, moist, very stiff, trace sand		BC=7 10 12 11	24"								
10													
		Gravelly Lean CLAY (CL): low plasticity, gray, moist, stiff, trace sand		BC=3 4 7 8	24"								
15													
20													
25													
30													

The boring was terminated at approximately 15 ft. below ground surface. The boring was backfilled with auger cuttings on December 07, 2020.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
A iPad integrated GPS unit was used to locate the exploration with an accuracy of 5 meters.
Caving was observed at a depth of 9.5 ft. below ground surface.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20212714.001A
DRAWN BY:	MG
CHECKED BY:	BB
DATE:	12/30/2020

BORING LOG B-2

Union Ridge Solar Project
Licking County, OH

BORING
B-2
PAGE: 1 of 1

Date Begin - End:	12/08/2020	**Drilling Company:**	Terra Testing	**BORING LOG B-3**	
Logged By:	M. Glassmeyer	**Drill Crew:**	J. Winters		
Hor.-Vert. Datum:	WGS 1984 - Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Automatic - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	30°F Snow	**Exploration Diameter:**	3.25 in. I.D.		

Latitude: 39.98436°
Longitude: -82.64116°
Surface Condition: Bare Earth

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		TOPSOIL											
		Silty, Clayey SAND with Gravel (SC-SM): low plasticity, yellow, moist to wet, loose		BC=1 2 2 4	8"								
				BC=4 2 3 4	14"	SC-SM	19.9		68	31	23	5	
5		**Lean CLAY (CL)**: low plasticity, olive yellow, moist, stiff, trace sand and gravel		BC=4 4 6 7	12"								
				BC=5 6 7 8	24"								
10													
		Lean CLAY with Gravel (CL): low plasticity, gray, moist, stiff, trace sand		BC=6 7 7 7	13"								
15													
20													
25													
30													

The boring was terminated at approximately 15 ft. below ground surface. The boring was backfilled with auger cuttings on December 08, 2020.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
A iPad integrated GPS unit was used to locate the exploration with an accuracy of 5 meters.
Caving was observed at a depth of 9.5 ft. below ground surface.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20212714.001A	BORING LOG B-3		BORING
DRAWN BY: MG	Union Ridge Solar Project Licking County, OH		B-3
CHECKED BY: BB			
DATE: 12/30/2020			PAGE: 1 of 1

BORING LOG B-4

Date Begin - End:	12/08/2020	**Drilling Company:**	Terra Testing		
Logged By:	M. Glassmeyer	**Drill Crew:**	J. Winters		
Hor.-Vert. Datum:	WGS 1984 - Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Automatic - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	30°F Snow	**Exploration Diameter:**	3.25 in. I.D.		

Latitude: 39.98280°
Longitude: -82.65016°
Surface Condition: Bare Earth

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		TOPSOIL											
		Lean CLAY with Sand (CL): low plasticity, olive yellow, moist, soft to stiff, trace gravel		BC=WOH 1 2 3	24"								
				BC=2 5 4 5	24"								
5				BC=3 4 5 5	24"	CL	17.5		98	75	29	12	
				BC=7 10 10 10	9"								
10													
		SAND (SW): fine to medium-grained, subangular, gray, moist, loose, trace gravel		BC=2 5 4 5	4"								
15													
20													
25													
30													

The boring was terminated at approximately 15 ft. below ground surface. The boring was backfilled with auger cuttings on December 08, 2020.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
A iPad integrated GPS unit was used to locate the exploration with an accuracy of 5 meters.
Caving was observed at a depth of 11.5 ft. below ground surface.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20212714.001A
DRAWN BY:	MG
CHECKED BY:	BB
DATE:	12/30/2020

BORING LOG B-4

Union Ridge Solar Project
Licking County, OH

BORING
B-4
PAGE: 1 of 1

Date Begin - End:	12/07/2020	**Drilling Company:**	Terra Testing	**BORING LOG B-5**	
Logged By:	M. Glassmeyer	**Drill Crew:**	J. Winters		
Hor.-Vert. Datum:	WGS 1984 - Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Automatic - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	30°F Snow	**Exploration Diameter:**	3.25 in. I.D.		

Latitude: 39.97513°
Longitude: -82.64059°
Surface Condition: Bare Earth

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		TOPSOIL											
		Sandy Lean CLAY (CL): low plasticity, reddish yellow, moist, soft to stiff, trace gravel		BC=1 2 3 3	16"								
				BC=2 6 7 7	18"	CL	19.7		97	60	35	18	
5				BC=3 5 5 7	24"								
				BC=7 7 7 9	16"								
10													
				BC=4 8 7 6	24"								
15													
20													
25													
30													

The boring was terminated at approximately 15 ft. below ground surface. The boring was backfilled with auger cuttings on December 07, 2020.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
A iPad integrated GPS unit was used to locate the exploration with an accuracy of 5 meters.
Caving was observed at a depth of 11 ft. below ground surface.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20212714.001A
DRAWN BY:	MG
CHECKED BY:	BB
DATE:	12/30/2020

BORING LOG B-5

Union Ridge Solar Project
Licking County, OH

BORING

B-5

BORING LOG B-6

Date Begin - End:	12/08/2020	**Drilling Company:**	Terra Testing		
Logged By:	M. Glassmeyer	**Drill Crew:**	J. Winters		
Hor.-Vert. Datum:	WGS 1984 - Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Automatic - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	30°F Snow	**Exploration Diameter:**	3.25 in. I.D.		

Latitude: 39.98651°
Longitude: -82.65007°
Surface Condition: Bare Earth

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		TOPSOIL											
		Sandy Lean CLAY (CL): low plasticity, olive yellow, moist, soft to stiff, trace gravel		BC=1 1 3 3	24"								
				BC=3 4 5 5	24"								
5				BC=2 4 6 5	24"	CL	15.1		88	53	25	9	
				BC=3 5 5 6	24"								
10													
				BC=3 7 9 8	24"								
15													
		Silty, Clayey SAND with Gravel (SC-SM): low plasticity, gray, moist, loose		BC=2 4 3 4	18"	SC-SM	13.3		79	48	22	6	
20													
		- medium dense below 22.5 feet		BC=9 10 11 11	18"								
25													
				BC=3 6 8 9	24"								
30													Rig chattering at 30.5 to 31.5 feet
				BC=3 5 5 6	16"								

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20212714.001A
DRAWN BY:	MG
CHECKED BY:	BB
DATE:	12/30/2020

BORING LOG B-6

Union Ridge Solar Project
Licking County, OH

BORING

B-6

Date Begin - End: 12/08/2020 **Drilling Company:** Terra Testing

BORING LOG B-6

Logged By: M. Glassmeyer **Drill Crew:** J. Winters

Hor.-Vert. Datum: WGS 1984 - Not Available **Drilling Equipment:** Geoprobe 7822DT **Hammer Type - Drop:** 140 lb. Automatic - 30 in.

Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger

Weather: 30°F Snow **Exploration Diameter:** 3.25 in. I.D.

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Latitude: 39.98651° Longitude: -82.65007° Surface Condition: Bare Earth											
		Silty, Clayey SAND with Gravel (SC-SM): low plasticity, gray, moist, medium dense											
				BC=5 7 10 11	18"	SC-SM	11.9		82	48	22	7	
40		- dense below 42.5 feet											
				BC=8 10 25 30	24"								
45													
		Sandy Lean CLAY (CL): low plasticity, gray, moist, stiff		BC=4 6 8 11	24"								
50													

The boring was terminated at approximately 50 ft. below ground surface. The boring was backfilled with auger cuttings on December 08, 2020.

GROUNDWATER LEVEL INFORMATION:

- Groundwater was observed at approximately 17 ft. below ground surface during drilling.
- Groundwater was observed at approximately 5 ft. below ground surface at the end of drilling.

GENERAL NOTES:

A iPad integrated GPS unit was used to locate the exploration with an accuracy of 5 meters.
Caving was observed at a depth of 35 ft. below ground surface.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20212714.001A

DRAWN BY: MG

CHECKED BY: BB

DATE: 12/30/2020

BORING LOG B-6

Union Ridge Solar Project
Licking County, OH

BORING

B-6

TEST PIT LOG TP-1

Date Begin - End:	12/09/2020	**Excavation Company:**	Terra Testing
Logged By:	M. Glassmeyer	**Excavation Crew:**	J. Winters
Hor.-Vert. Datum:	WGS 1984 - Not Available	**Excavation Equip.:**	John Deere 35G Excavator
Plunge:	-90 degrees	**Excav. Dimensions:**	3x12 ft
Weather:	45°F Clear		

FIELD EXPLORATION

Latitude: 39.98551°
Longitude: -82.63565°
Surface Condition: Bare Earth

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		TOPSOIL									
		Lean CLAY with Sand (CL): olive yellow, moist									
				CL	19.2		93	70	32	14	**ASTM D698 Method B=** Max. Dry Unit Wt.: 114.5 pcf Opt. Water Content: 12.9%
5											
10											
15											

The test pit was terminated at approximately 8 ft. below ground surface. The test pit was backfilled with excavated material on December 09, 2020.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.

GENERAL NOTES:
A iPad integrated GPS unit was used to locate the exploration with an accuracy of 5 meters.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20212714.001A
DRAWN BY:	MG
CHECKED BY:	BB
DATE:	12/30/2020

TEST PIT LOG TP-1

Union Ridge Solar Project
Licking County, OH

TEST PIT

TP-1

PAGE: 1 of 1

TEST PIT LOG TP-2

Date Begin - End:	12/09/2020	**Excavation Company:**	Terra Testing
Logged By:	M. Glassmeyer	**Excavation Crew:**	J. Winters
Hor.-Vert. Datum:	WGS 1984 - Not Available	**Excavation Equip.:**	John Deere 35G Excavator
Plunge:	-90 degrees	**Excav. Dimensions:**	3x12 ft
Weather:	45°F Clear		

FIELD EXPLORATION

Latitude: 39.98142°
Longitude: -82.64682°
Surface Condition: Bare Earth

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		TOPSOIL									
		Sandy Lean CLAY (CL): yellowish brown, moist, trace gravel									
				CL	22.9		89	51	31	13	**ASTM D698 Method B=** Max. Dry Unit Wt.: 111.4 pcf Opt. Water Content: 13.3%
5											
		Lean CLAY with Sand (CL): light brownish gray, moist, trace gravel									
10											
15											

The test pit was terminated at approximately 8 ft. below ground surface. The test pit was backfilled with excavated material on December 09, 2020.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.

GENERAL NOTES:
A iPad integrated GPS unit was used to locate the exploration with an accuracy of 5 meters.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.:	20212714.001A
DRAWN BY:	MG
CHECKED BY:	BB
DATE:	12/30/2020

TEST PIT LOG TP-2

Union Ridge Solar Project
Licking County, OH

TEST PIT

TP-2

PAGE: 1 of 1

APPENDIX B.
FIELD TESTING: RESISTIVITY TESTING RESULTS

707 17th Street; Suite 3000
Denver, CO 80202
Tel: (303) 237-6601
Fax: (303) 237-6602

FIELD ELECTRICAL RESISTIVITY TESTING

Project Number	Project Name	Client
20212714.001A	Union Ridge Solar Project	Leeward Energy
Date and Time	**Location**	**Coordinates**
1/13/2021	Licking County, OH	ER-1
Type of Test	**Weather**	**Surface Conditions**
4-Point Test (Wenner)	Sunny, 40°F	Moist Soil

Equipment Make	Model	Test Engineer(s)	Checked by
L&R Ultra MiniRes	Ultra MiniRes - SN-302	Akhil Katari	JAC/ADT/JB

Probe Spacing "A" (feet)	**Probe depth "B"** (inches)	**Reading R** (Ω)	**Resistivity ρ (calc.)** (Ω-m)	**Notes:**
North - South				
2	**6**	17.90	**75**	
5	**6**	6.08	**59**	
10	**6**	2.83	**54**	
20	**6**	1.33	**51**	
30	**6**	0.89	**51**	
50	**6**	0.55	**53**	
East-West				
2	**6**	16.90	**71**	
5	**6**	6.17	**60**	
10	**6**	2.75	**53**	
20	**6**	1.28	**49**	
30	**6**	0.84	**48**	
50	**6**	0.52	**50**	

707 17th Street; Suite 3000
Denver, CO 80202
Tel: (303) 237-6601
Fax: (303) 237-6602

FIELD ELECTRICAL RESISTIVITY TESTING

Project Number	Project Name	Client
20212714.001A	Union Ridge Solar Project	Leeward Energy
Date and Time	**Location**	**Coordinates**
1/13/2021	Licking County, OH	ER-2
Type of Test	**Weather**	**Surface Conditions**
4-Point Test (Wenner)	Sunny, 43°F	Moist Soil

Equipment Make	Model	Test Engineer(s)	Checked by
L&R Ultra MiniRes	Ultra MiniRes - SN-302	Akhil Katari	JAC/ADT/JB

Probe Spacing "A" (feet)	**Probe depth "B"** (inches)	**Reading R** (Ω)	**Resistivity ρ (calc.)** (Ω-m)	**Notes:**
North - South				
2	**6**	14.50	**61**	
5	**6**	6.61	**64**	
10	**6**	2.88	**55**	
20	**6**	1.57	**60**	
30	**6**	0.99	**57**	
50	**6**	0.71	**68**	
East-West				
2	**6**	15.60	**66**	
5	**6**	5.83	**57**	
10	**6**	2.73	**53**	
20	**6**	1.68	**64**	
30	**6**	1.06	**61**	
50	**6**	0.75	**72**	

707 17th Street; Suite 3000
Denver, CO 80202
Tel: (303) 237-6601
Fax: (303) 237-6602

FIELD ELECTRICAL RESISTIVITY TESTING

Project Number	Project Name	Client
20212714.001A	Union Ridge Solar Project	Leeward Energy
Date and Time	**Location**	**Coordinates**
1/13/2021	Licking County, OH	ER-3
Type of Test	**Weather**	**Surface Conditions**
4-Point Test (Wenner)	Sunny, 45°F	Moist Soil

Equipment Make	Model	Test Engineer(s)	Checked by
L&R Ultra MiniRes	Ultra MiniRes - SN-302	Akhil Katari	JAC/ADT/JB

Probe Spacing "A" (feet)	**Probe depth "B"** (inches)	**Reading R** (Ω)	**Resistivity ρ (calc.)** (Ω-m)	**Notes:**
North - South				
2	**6**	25.80	**109**	
5	**6**	6.75	**66**	
10	**6**	3.04	**59**	
20	**6**	1.30	**50**	
30	**6**	0.94	**54**	
50	**6**	0.69	**66**	
East-West				
2	**6**	28.90	**122**	
5	**6**	7.06	**69**	
10	**6**	3.11	**60**	
20	**6**	1.43	**55**	
30	**6**	1.02	**58**	
50	**6**	0.68	**65**	

APPENDIX C.
LABORATORY TEST RESULTS: INDEX TESTING

Exploration ID	Depth (ft.)	Sample Description	Water Content (%)	Dry Unit Wt. (pcf)	Sieve Analysis (%)			Atterberg Limits			Additional Tests
					Passing 3/4"	Passing #4	Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	
B-1	2.5	SANDY LEAN CLAY (CL)	17.8		100	92	65	31	18	13	
B-2	5.0	SANDY LEAN CLAY (CL)	13.1		100	85	65	27	17	10	
B-3	2.5	SILTY, CLAYEY SAND WITH GRAVEL (SC-SM)	19.9		69	68	31	23	18	5	
B-4	5.0	LEAN CLAY WITH SAND (CL)	17.5		100	98	75	29	17	12	
B-5	2.5	SANDY LEAN CLAY (CL)	19.7		100	97	60	35	17	18	
B-6	5.0	SANDY LEAN CLAY (CL)	15.1		100	88	53	25	16	9	
B-6	18.0	SILTY, CLAYEY SAND WITH GRAVEL (SC-SM)	13.3		91	79	48	22	16	6	
B-6	38.0	SILTY, CLAYEY SAND WITH GRAVEL (SC-SM)	11.9		100	82	48	22	15	7	
TP-1	2.0	LEAN CLAY WITH SAND (CL)	19.2		96	93	70	32	18	14	**ASTM D698 Method B=**
											Maximum Dry Unit Weight: 114.5 pcf
											Optimum Water Content: 12.9%
TP-2	2.0	SANDY LEAN CLAY (CL)	22.9		100	89	51	31	18	13	**ASTM D698 Method B=**
											Maximum Dry Unit Weight: 111.4 pcf
											Optimum Water Content: 13.3%

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = NonPlastic

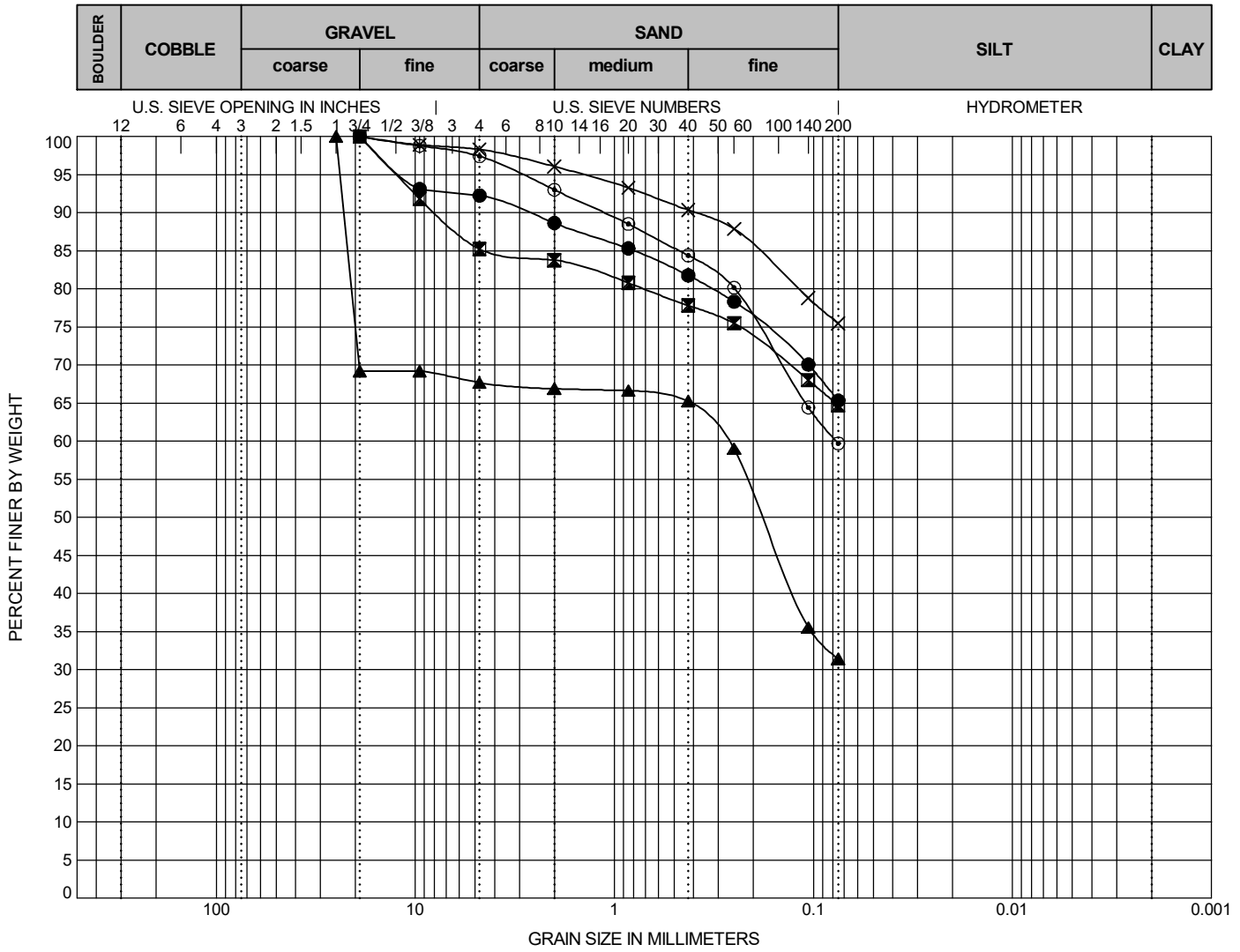
KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20212714.001A
DRAWN BY: MG
CHECKED BY: BB
DATE: 12/30/2020

LABORATORY TEST RESULT SUMMARY

Union Ridge Solar Project
Licking County, OH

TABLE
C-1



Exploration ID		Depth (ft.)	Sample Description	LL	PL	PI
●	B-1	2.5 - 4.5	SANDY LEAN CLAY (CL)	31	18	13
⊠	B-2	5 - 7	SANDY LEAN CLAY (CL)	27	17	10
▲	B-3	2.5 - 4.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	23	18	5
×	B-4	5 - 7	LEAN CLAY with SAND (CL)	29	17	12
⊙	B-5	2.5 - 4.5	SANDY LEAN CLAY (CL)	35	17	18

Exploration ID		Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt*	%Clay*
●	B-1	2.5 - 4.5	19	NM	NM	NM	NM	NM	100	92	65	NM	NM
⊠	B-2	5 - 7	19	NM	NM	NM	NM	NM	100	85	65	NM	NM
▲	B-3	2.5 - 4.5	25	0.272	NM	NM	NM	NM	69	68	31	NM	NM
×	B-4	5 - 7	19	NM	NM	NM	NM	NM	100	98	75	NM	NM
⊙	B-5	2.5 - 4.5	19	0.077	NM	NM	NM	NM	100	97	60	NM	NM

*These numbers represent silt-sized and clay-sized content but may not indicate the percentage of the material with the engineering properties of silt or clay. Sieve Analysis and Hydrometer Analysis testing performed in general accordance with ASTM D6913(Sieve Analysis) and ASTM D7928 (Hydrometer Analysis).
NP = Nonplastic
NM = Not Measured

Coefficients of Uniformity - $C_u = D_{60} / D_{10}$
Coefficients of Curvature - $C_C = (D_{30})^2 / D_{60} D_{10}$
D_{60} = Grain diameter at 60% passing
D_{30} = Grain diameter at 30% passing
D_{10} = Grain diameter at 10% passing

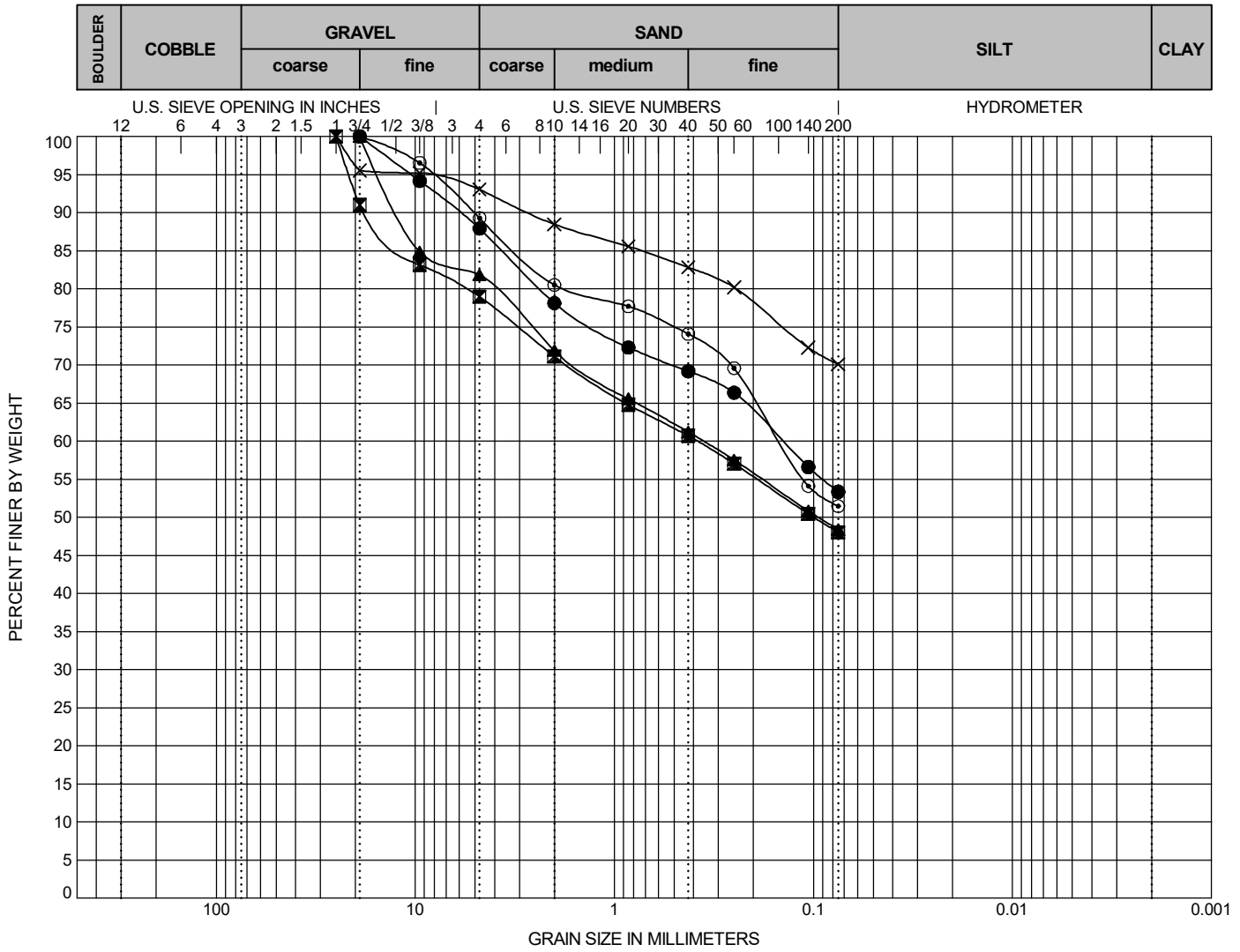
KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20212714.001A
DRAWN BY: MG
CHECKED BY: BB
DATE: 12/30/2020

SIEVE ANALYSIS

Union Ridge Solar Project
Licking County, OH

FIGURE
C-2



Exploration ID		Depth (ft.)	Sample Description	LL	PL	PI
●	B-6	5 - 7	SANDY LEAN CLAY (CL)	25	16	9
⊠	B-6	18 - 20	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	22	16	6
▲	B-6	38 - 40	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	22	15	7
×	TP-1	2 - 4	LEAN CLAY with SAND (CL)	32	18	14
⊙	TP-2	2 - 4	SANDY LEAN CLAY (CL)	31	18	13

Exploration ID		Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt*	%Clay*
●	B-6	5 - 7	19	0.143	NM	NM	NM	NM	100	88	53	NM	NM
⊠	B-6	18 - 20	25	0.384	NM	NM	NM	NM	91	79	48	NM	NM
▲	B-6	38 - 40	19	0.358	NM	NM	NM	NM	100	82	48	NM	NM
×	TP-1	2 - 4	25	NM	NM	NM	NM	NM	96	93	70	NM	NM
⊙	TP-2	2 - 4	19	0.147	NM	NM	NM	NM	100	89	51	NM	NM

*These numbers represent silt-sized and clay-sized content but may not indicate the percentage of the material with the engineering properties of silt or clay. Sieve Analysis and Hydrometer Analysis testing performed in general accordance with ASTM D6913(Sieve Analysis) and ASTM D7928 (Hydrometer Analysis).
NP = Nonplastic
NM = Not Measured

Coefficients of Uniformity - $C_u = D_{60} / D_{10}$
Coefficients of Curvature - $C_C = (D_{30})^2 / D_{60} D_{10}$
D_{60} = Grain diameter at 60% passing
D_{30} = Grain diameter at 30% passing
D_{10} = Grain diameter at 10% passing

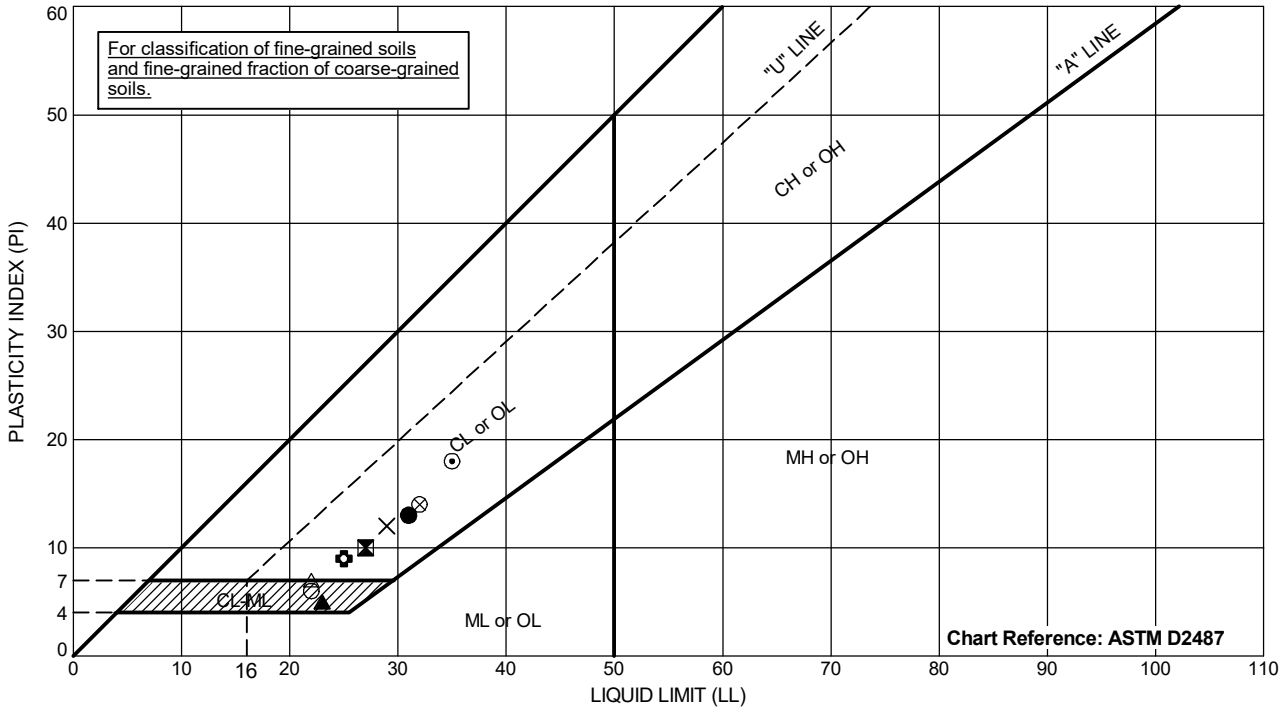
KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20212714.001A
DRAWN BY: MG
CHECKED BY: BB
DATE: 12/30/2020

SIEVE ANALYSIS

Union Ridge Solar Project
Licking County, OH

FIGURE
C-3



Exploration ID		Depth (ft.)	Sample Description	Passing #200	LL	PL	PI
●	B-1	2.5 - 4.5	SANDY LEAN CLAY (CL)	65	31	18	13
⊠	B-2	5 - 7	SANDY LEAN CLAY (CL)	65	27	17	10
▲	B-3	2.5 - 4.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	31	23	18	5
×	B-4	5 - 7	LEAN CLAY with SAND (CL)	75	29	17	12
⊙	B-5	2.5 - 4.5	SANDY LEAN CLAY (CL)	60	35	17	18
✿	B-6	5 - 7	SANDY LEAN CLAY (CL)	53	25	16	9
○	B-6	18 - 20	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	48	22	16	6
△	B-6	38 - 40	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	48	22	15	7
⊗	TP-1	2 - 4	LEAN CLAY with SAND (CL)	70	32	18	14
⊕	TP-2	2 - 4	SANDY LEAN CLAY (CL)	51	31	18	13

Testing performed in general accordance with ASTM D4318.
NP = Nonplastic
NM = Not Measured

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20212714.001A
DRAWN BY: MG
CHECKED BY: BB
DATE: 12/30/2020

ATTERBERG LIMITS

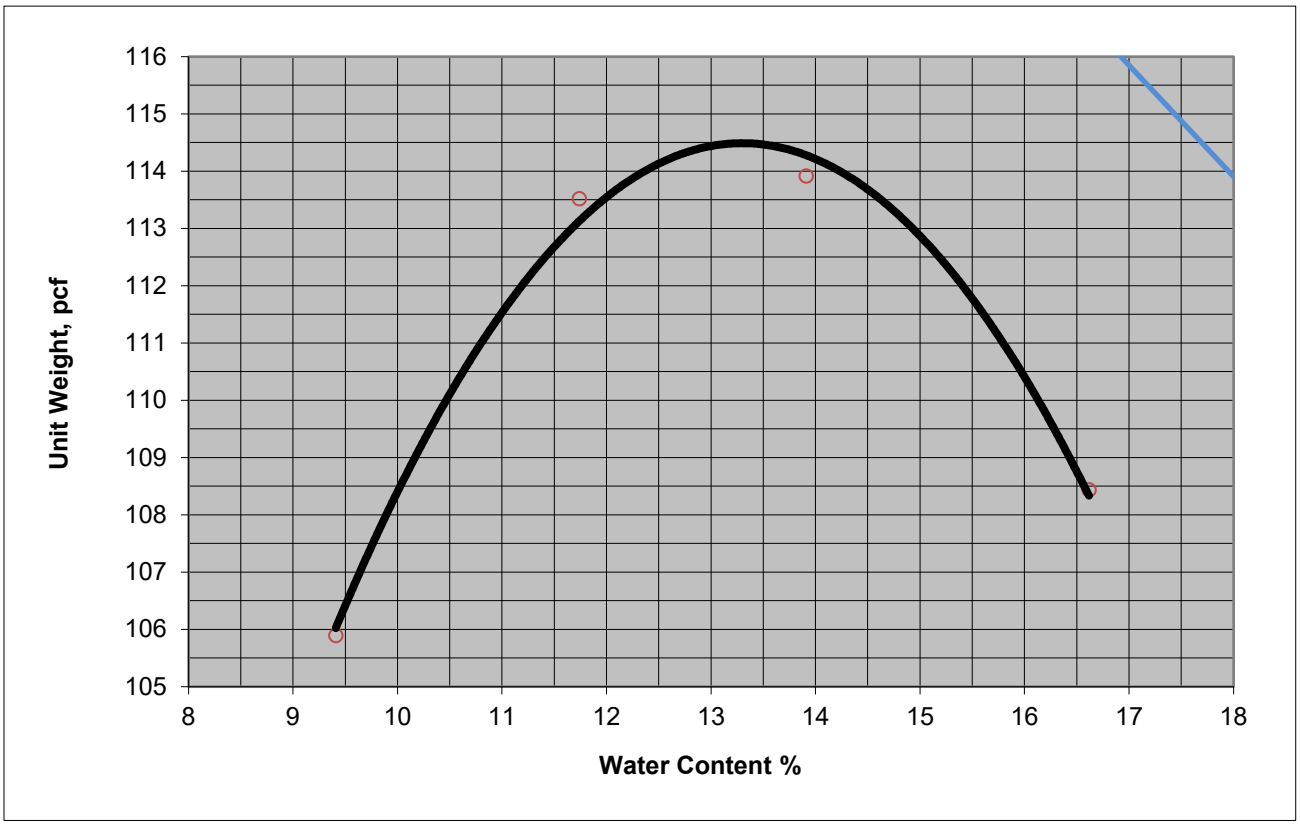
Union Ridge Solar Project
Licking County, OH

FIGURE
C-4

Laboratory Compaction Characteristics of Soil

Project Number: *20212714.001A*
Project Name: *Union Ridge Solar Project*
Client *Leeward Renewable Energy, LLC* *Lick Co., OH*
Report Date: *December 28, 2020*
Sample: *TP-1 / 2-4 ft.*
Soil Description: *Olive yellow sandy clay*

Maximum Dry Density, pcf @ Optimum Water Content, % ***114.5*** **@** ***13.3***



ASTM Method	*D 698: B*
Preparation Method	*Dry*
As-received Water Content %	*19*
% Retained on Controlling Sieve	*4.8*
Oversize Correction BSG	*N/A*

Type of Rammer *manual*

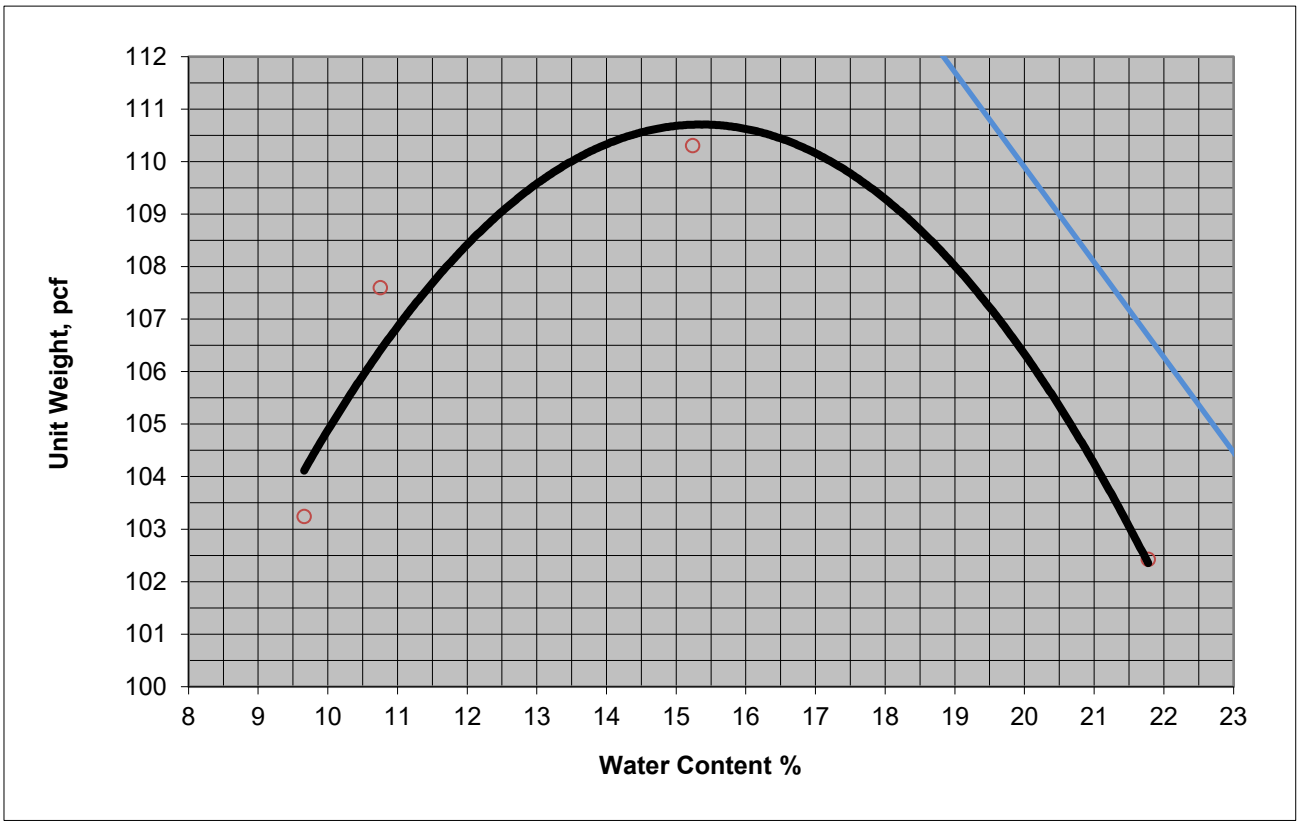
Remarks:

ASTM Test Method: ASTM D 698-12e

Laboratory Compaction Characteristics of Soil

Project Number: *20212714.001A*
Project Name: *Union Ridge Solar Project*
Client *Leeward Renewable Energy, LLC* *Lick Co., OH*
Report Date: *December 28, 2020*
Sample: *TP-2 / 2-4 ft.*
Soil Description: *Brown sandy clay*

Maximum Dry Density, pcf @ Optimum Water Content, % ***110.7*** **@** ***15.4***



ASTM Method	*D 698: B*
Preparation Method	*Dry*
As-received Water Content %	*23*
% Retained on Controlling Sieve	*2*
Oversize Correction BSG	*N/A*

Type of Rammer *manual*

Remarks:

ASTM Test Method: ASTM D 698-12e

APPENDIX D.
LABORATORY TEST RESULTS: CORROSION AND THERMAL RESISTIVITY TESTING

Thermal Dry Out Curve & Results Only Soil Testing for Union Ridge Solar

January 4, 2021

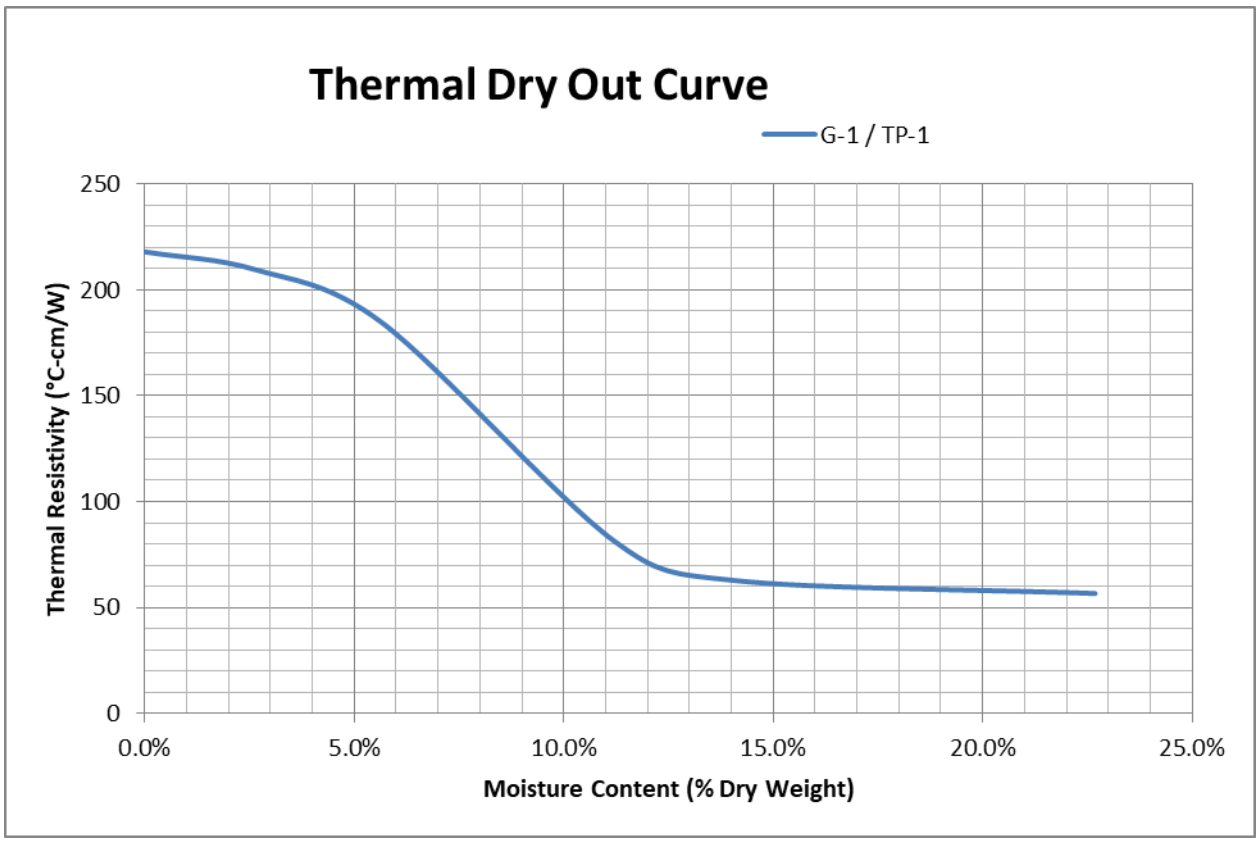
Prepared for:
David Acampora
Kleinfelder, Inc
180 Sheree Blvd, Suite #3800
Exton, PA 19341
dacampora@kleinfelder.com

Project X Job#: S201223D
Client Job or PO#: 20212714.001A

Respectfully Submitted,

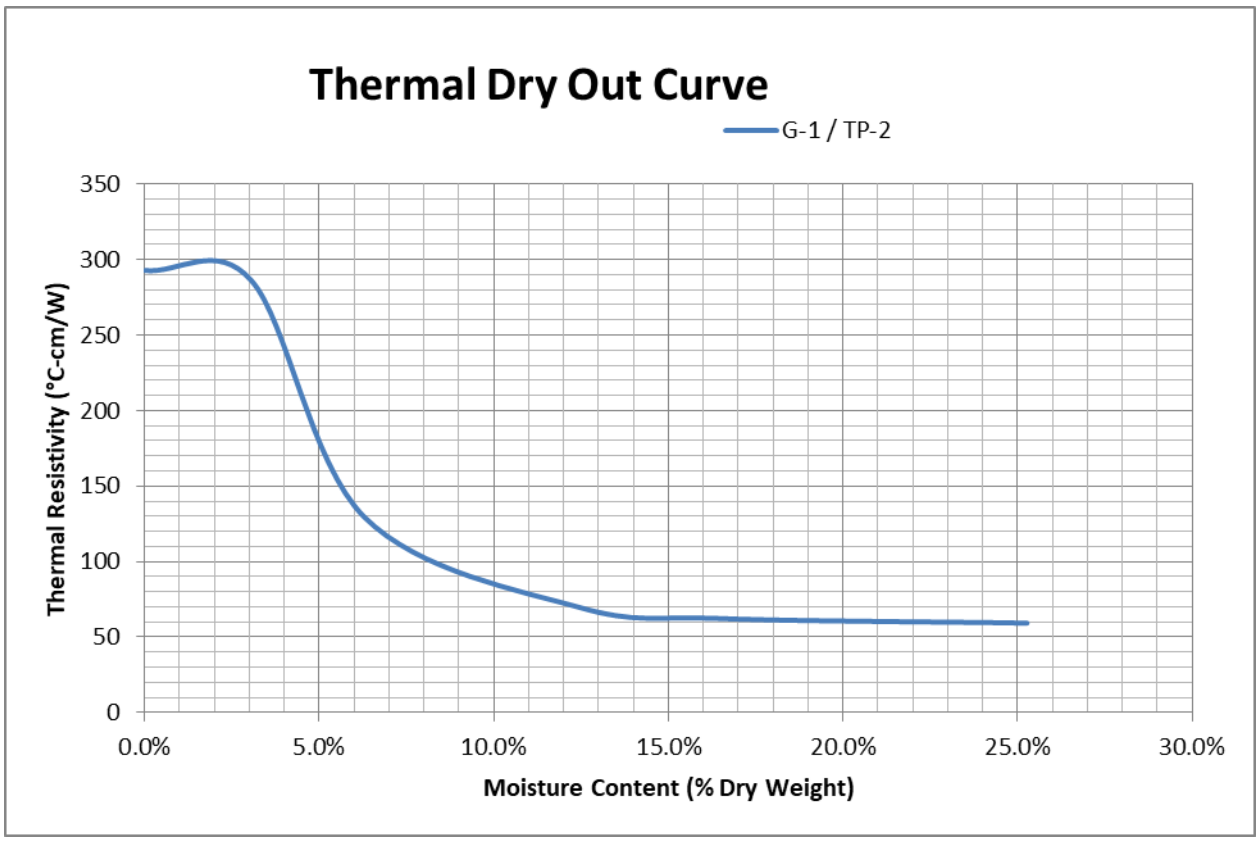
Eduardo Hernandez, M.Sc., P.E.
Sr. Corrosion Consultant
NACE Corrosion Technologist #16592
Professional Engineer
California No. M37102
ehernandez@projectxcorrosion.com

Client: Kleinfelder, Inc
Job Name: Union Ridge Solar
Client Job Number: 20212714.001A
Project X Job Number: S201223D
Method: IEEE Std 442-81
Report Date: January 4, 2021



(S201223D) Sample Location	Sample Depth (ft)	Thermal Resistivity (°C-cm/W)		Remolded Tube Sample		
				Optimal Moisture Content	Proctor Dry Density	Requested Compaction
		Wet	Dry	(%)	(PCF)	(%)
G-1 / TP-1	2-4	57	218	13.3%	114.50	90%

Client: Kleinfelder, Inc
Job Name: Union Ridge Solar
Client Job Number: 20212714.001A
Project X Job Number: S201223D
Method: IEEE Std 442-81
Report Date: January 4, 2021



				Remolded Tube Sample		
(S201223D) Sample Location	Sample Depth (ft)	Thermal Resistivity (°C-cm/W)		Optimal Moisture Content	Proctor Dry Density	Requested Compaction
		Wet	Dry	(%)	(PCF)	(%)
G-1 / TP-2	2-4	59	293	15.4%	110.70	90%

Soil Analysis Lab Results

Client: Kleinfelder, Inc
Job Name: Union Ridge Solar
Client Job Number: 20212714.001A
Project X Job Number: S201223D
January 4, 2021

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM D4972	ASTM G200	SM 4500-S2-D	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd | Minimum		**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^-	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
G-1 / TP-1	2-4	56.5	0.0057	11.5	0.0011	2,814	2,680	7.7	163	<0.01	6.0	12.2	0.0	14.4	1.0	37.2	177.0	3.4	0.9
G-1 / TP-2	2-4	16.0	0.0016	4.9	0.0005	4,422	4,288	6.4	135	<0.01	3.2	6.3	0.0	8.7	1.6	43.5	123.3	4.5	6.6

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract

Project X Corrosion Engineering

Lab Request Sheet Chain of Custody

Phone: (213) 928-7213 · Fax (951) 226-1720 · www.projectxcorrosion.com

Ship Samples To: 29990 Technology Dr, Suite 13, Murrieta, CA 92563

Project X Job Number: S201223D Kleinfelder Inc. 20212714.001A Union Ridge

IMPORTANT: Please complete Project and Sample Identification Data as you would like it to appear in report & include this form with samples.

Company Name:	Kleinfelder Inc.	**Contact Name:**	David Acampora
Mailing Address:	180 Sheree Blvd. Suite #3800	**Phone No:**	551-579-1555
Accounting Contact:	Accounts Payable	**Contact Email:**	dacampora@kleinfelder.com
Client Project No:	20212714.001A	**Invoice Email:**	AccountsPayableUS@kleinfelder.com
P.O. #:		**Project Name:**	Union Ridge Solar Project

	3-5 Day Standard	3 Day Guarantee (50% mark-up)	24 Hr RUSH (100% mark-up)
(Business Days) Turn Around Time:	✓		

Results By: ☐ Phone ☐ Fax ☐ Email

Date & Received by: 12-23-2020

Default Method

Special Instructions:

The samples will be re-compacted to 90 percent Proctor compaction at natural moisture content, and thermal resistivity measurements taken at zero percent moisture, natural moisture, and at least two intermediate moisture contents Email ble@kleinfelder.com & dacampora@kleinfelder.com for proctor and moisture data

ANALYSIS REQUESTED (Please circle)

	SAMPLE ID - BORE #	DESCRIPTION	DEPTH (ft)	DATE COLLECTED
1	G-1 / TP-1		2'-4'	
2				
3	G-1 / TP-2		2'-4'	
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

	Geo Quad																	Full Corrosion Series	Reports									
	Soil Resistivity	pH	Sulfate	Chloride	Redox Potential	Sulfide	Ammonia	Nitrate	Fluoride	Phosphate	Lithium	Sodium	Potassium	Magnesium	Calcium	BiCarbonate	Full Corrosion Series	Soil Corrosivity Evaluation Report	Water Corrosivity Mini Report	Moisture Content	Total Alkalinity	Thermal Resistivity	Metallurgical Analysis	Langelier Index	Puckorius Index	XRF Elemental Analysis	Water Hardness
1	X	X	X	X	X							X										X					
2																											
3	X	X	X	X	X							X										X					
4																											
5																											
6																											
7																											
8																											
9																											
10																											
11																											
12																											
13																											
14																											
15																											

*Req; Min. 3 Samples, site map, and groundwater info

APPENDIX E.
PILE LOAD TEST RESULTS

AXIAL PILE TEST SUMMARY				
Pile ID	Pile Section	Approximate Embedment Depth (ft)	Approximate Pullout Load (lb)	Pile Drive Time (sec)
PLT-1A	W6x9	5	7,590	36
PLT-1B	W6x9	7	12,980	77
PLT-1C	W6x15	6	10,270	68
PLT-2A	W6x9	5	6,350	36
PLT-2B	W6x9	7	13,790	71
PLT-2C	W6x15	6	10,200	85
PLT-3A	W6x9	5	6,260	35
PLT-3B	W6x9	7	6,240	58
PLT-3C	W6x15	6	10,280	59
PLT-4A	W6x9	5	4,900	24
PLT-4B	W6x9	7	7,800	54
PLT-4C	W6x15	6	10,040	85
PLT-5A	W6x9	5	3,390	22
PLT-5B	W6x9	7	6,150	35
PLT-5C	W6x15	6	7,950	43

*Note: Pullout load defined as load to achieve 1 inch of movement.

Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

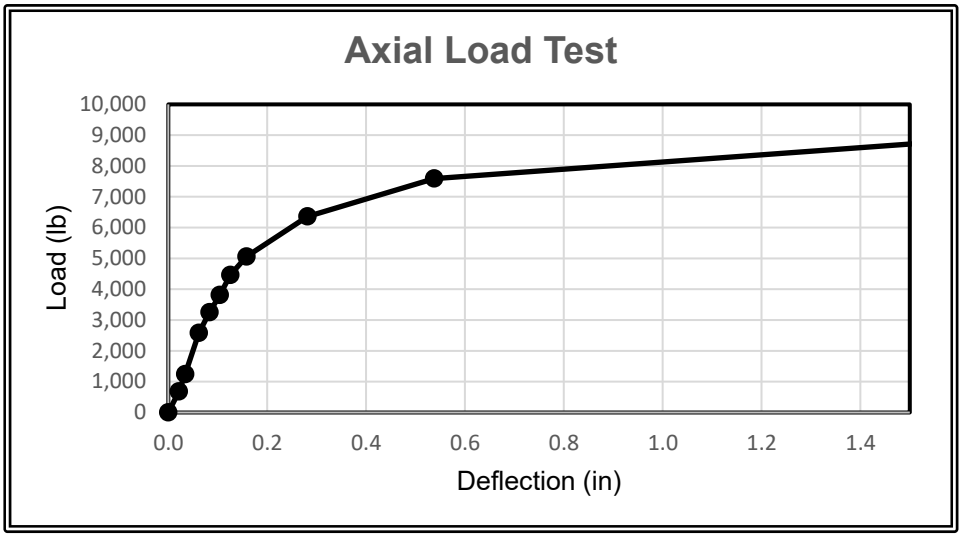
Technician: MG
Test Date: 1/13/2021

Test Location: **PLT-1A**

Notes:
Drive Time: 36 sec

Pile Indentifier: 1A
Pile Type: W6x9
Embedment Depth: 5.17 ft
Pile Reveal: 58 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	5,060	0.158
680	0.021	6,360	0.282
1,240	0.034	7,590	0.538
2,580	0.062	8,910	1.669
3,250	0.083		
3,810	0.104		
4,460	0.125		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

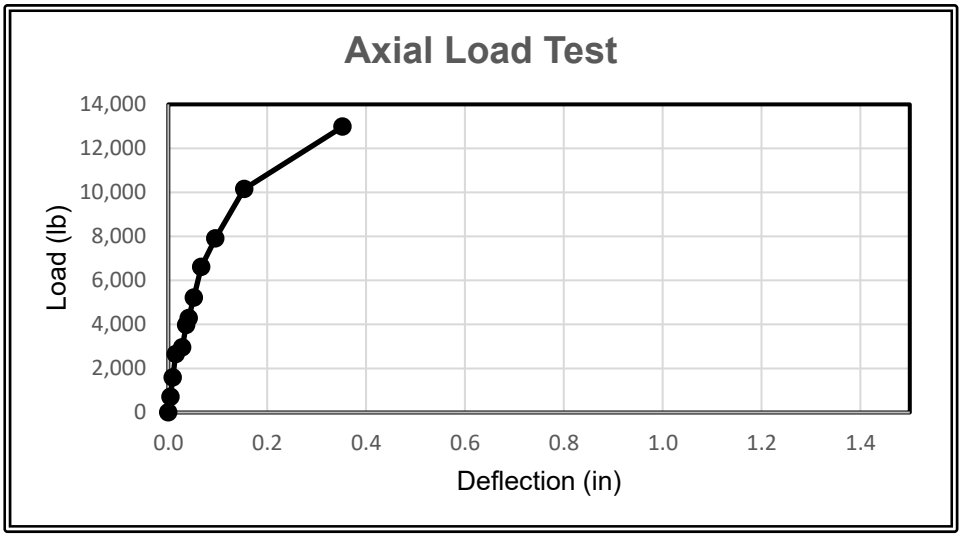
Technician: MG
Test Date: 1/13/2021

Test Location: **PLT-1B**

Notes:
Drive Time: 77 sec

Pile Indentifier: 1B
Pile Type: W6x9
Embedment Depth: 7.10 ft
Pile Reveal: 59 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	5,210	0.052
710	0.004	6,610	0.067
1,590	0.009	7,900	0.095
2,650	0.015	10,150	0.154
2,950	0.028	12,980	0.352
3,970	0.036		
4,280	0.041		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

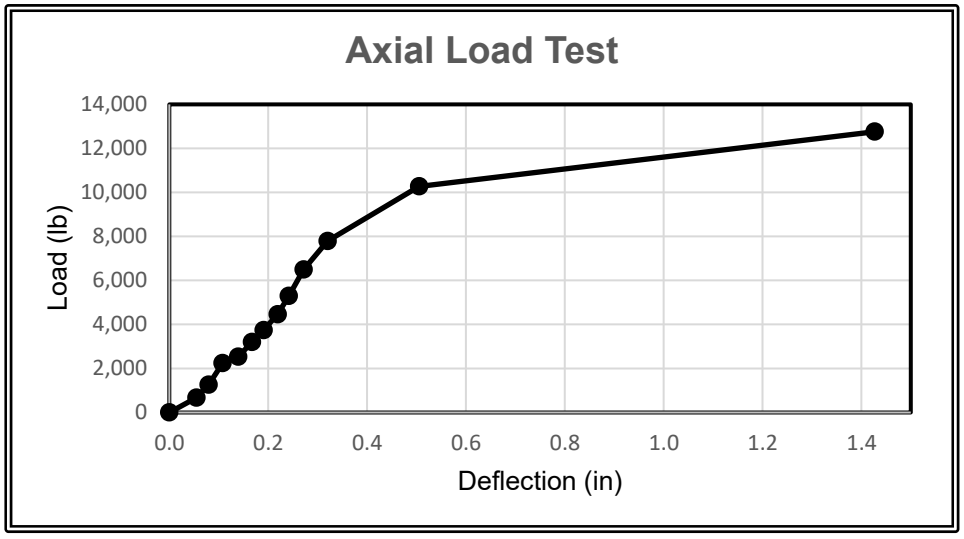
Technician: MG
Test Date: 1/13/2021

Test Location: **PLT-1C**

Notes:
Drive Time: 68 sec

Pile Indentifier: 1C
Pile Type: W6x15
Embedment Depth: 6.06 ft
Pile Reveal: 59 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	4,460	0.219
670	0.055	5,290	0.242
1,260	0.080	6,490	0.272
2,240	0.108	7,790	0.320
2,530	0.139	10,270	0.505
3,200	0.167	12,760	1.427
3,740	0.191		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

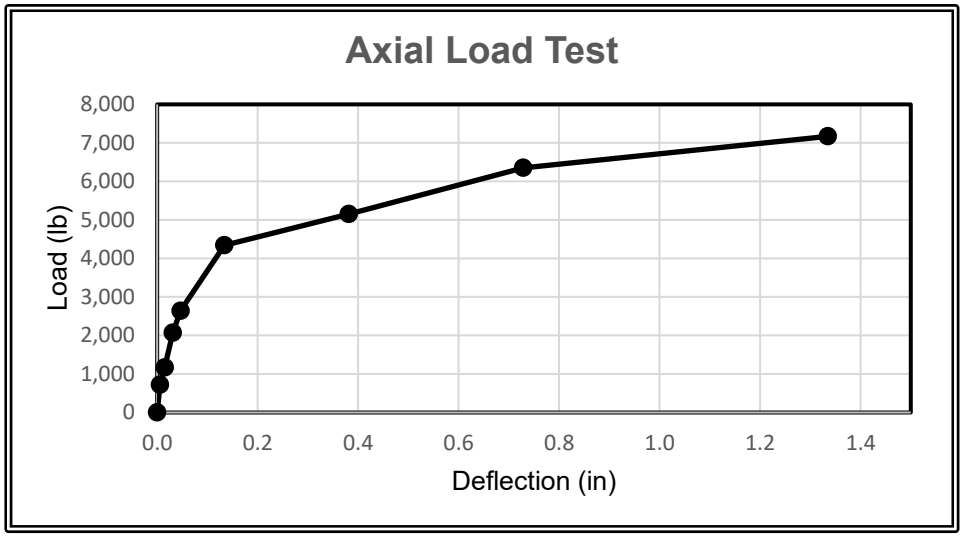
Technician: MG
Test Date: 1/13/2021

Test Location: **PLT-2A**

Notes:
Drive Time: 36 sec

Pile Indentifier: 2A
Pile Type: W6x9
Embedment Depth: 5.04 ft
Pile Reveal: 60 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	6,350	0.729
720	0.006	7,170	1.335
1,170	0.015		
2,070	0.031		
2,640	0.047		
4,340	0.134		
5,150	0.381		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

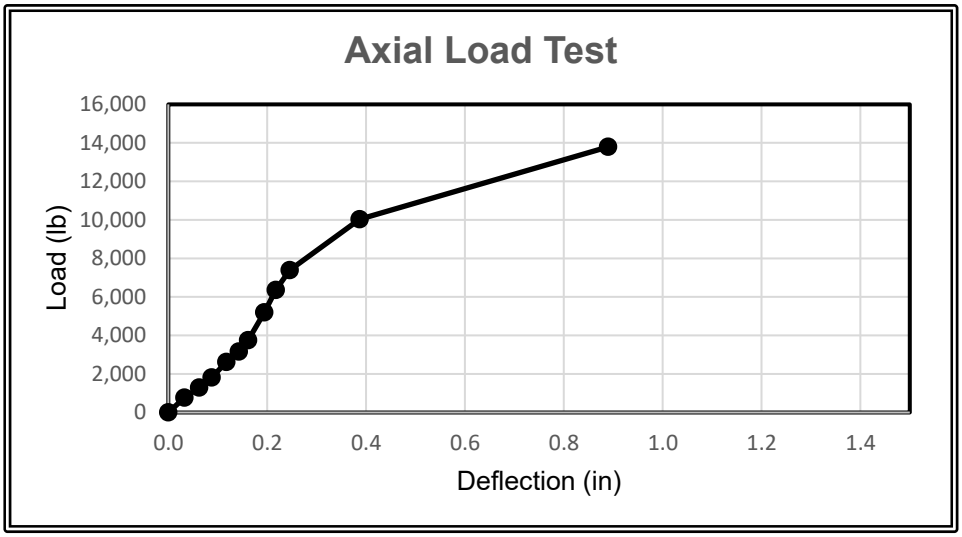
Technician: MG
Test Date: 1/13/2021

Test Location: **PLT-2B**

Notes:
Drive Time: 71 sec

Pile Indentifier: 2B
Pile Type: W6x9
Embedment Depth: 6.98 ft
Pile Reveal: 60 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	5,190	0.194
770	0.033	6,360	0.218
1,290	0.062	7,390	0.246
1,810	0.088	10,030	0.387
2,620	0.118	13,790	0.889
3,160	0.143		
3,750	0.162		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

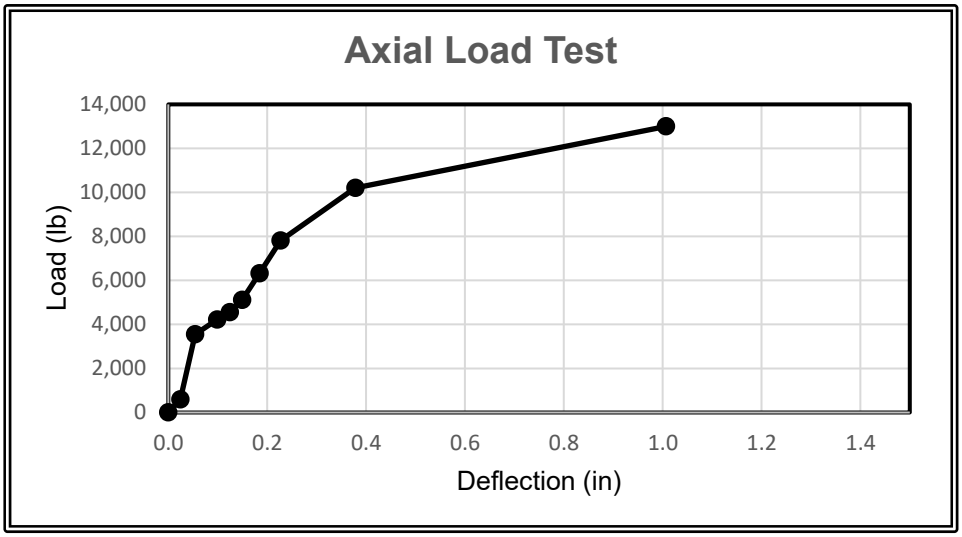
Technician: MG
Test Date: 1/13/2021

Test Location: **PLT-2C**

Notes:
Drive Time: 85 sec

Pile Indentifier: 2C
Pile Type: W6x15
Embedment Depth: 6.15 ft
Pile Reveal: 58 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	7,810	0.227
590	0.025	10,200	0.379
3,550	0.054	13,000	1.007
4,220	0.099		
4,550	0.125		
5,110	0.149		
6,320	0.185		



Axial Pile Test Results

Project Name: Union Ridge Solar Project
Project Number: 20212714.001A
Client Name: Leeward Renewable Energy, LLC

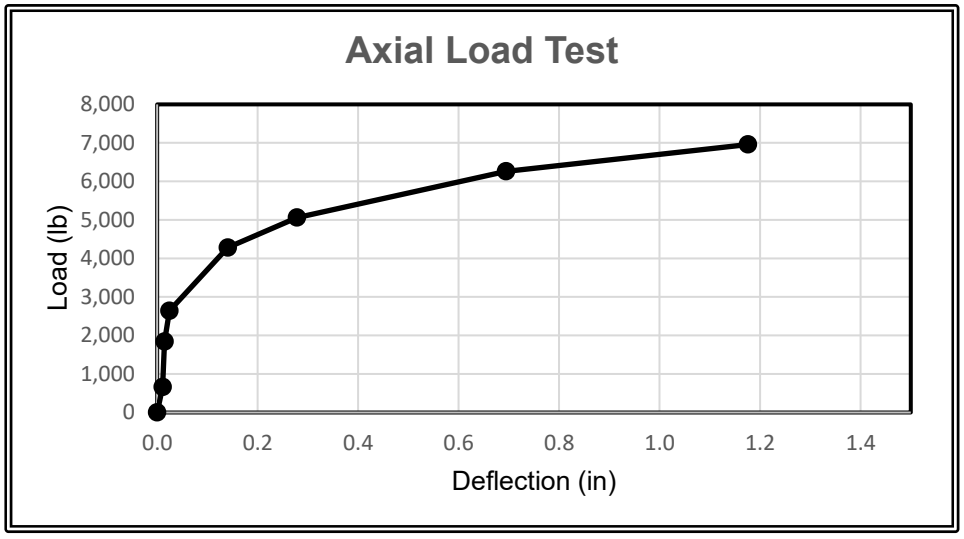
Technician: MG
Test Date: 1/5/2021

Test Location: PLT-3A

Notes:
Drive Time: 35 sec

Pile Indentifier: 3A
Pile Type: W6x9
Embedment Depth: 5.06 ft
Pile Reveal: 59 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	6,960	1.176
660	0.011		
1,840	0.015		
2,640	0.025		
4,280	0.141		
5,060	0.278		
6,260	0.694		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

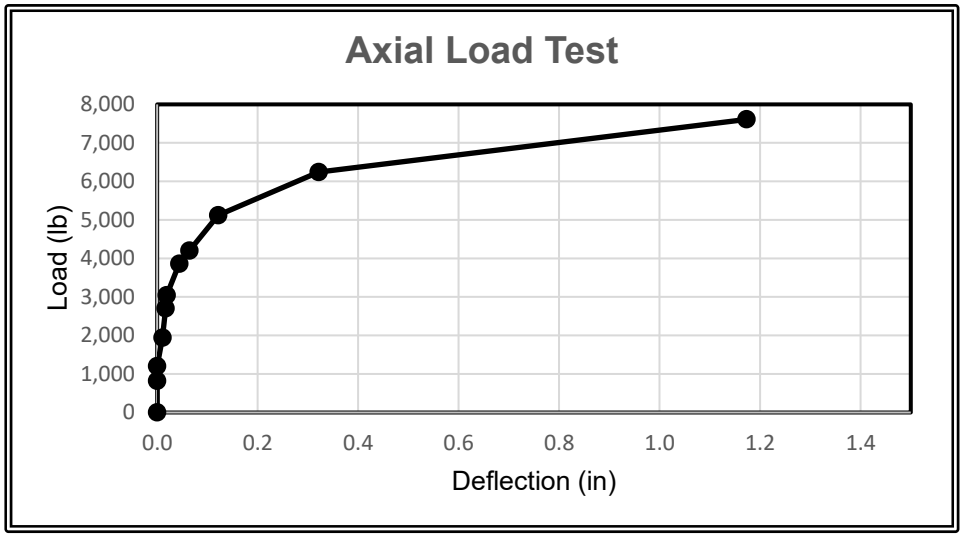
Technician: MG
Test Date: 1/5/2021

Test Location: **PLT-3B**

Notes:
Drive Time: 58 sec

Pile Indentifier: 3B
Pile Type: W6x9
Embedment Depth: 6.98 ft
Pile Reveal: 60 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	4,200	0.064
820	0.000	5,120	0.121
1,200	0.000	6,240	0.322
1,940	0.011	7,610	1.173
2,700	0.017		
3,040	0.019		
3,860	0.044		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

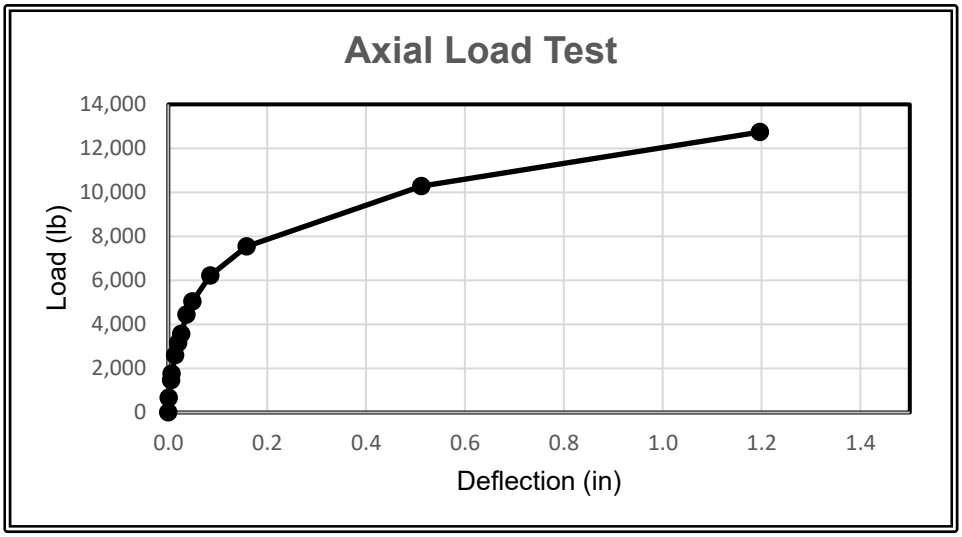
Technician: MG
Test Date: 1/5/2021

Test Location: **PLT-3C**

Notes:
Drive Time: 59 sec

Pile Indentifier: 3C
Pile Type: W6x15
Embedment Depth: 6.00 ft
Pile Reveal: 60 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	4,440	0.037
660	0.001	5,040	0.049
1,460	0.006	6,220	0.085
1,760	0.007	7,540	0.159
2,600	0.014	10,280	0.512
3,160	0.020	12,740	1.197
3,560	0.026		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

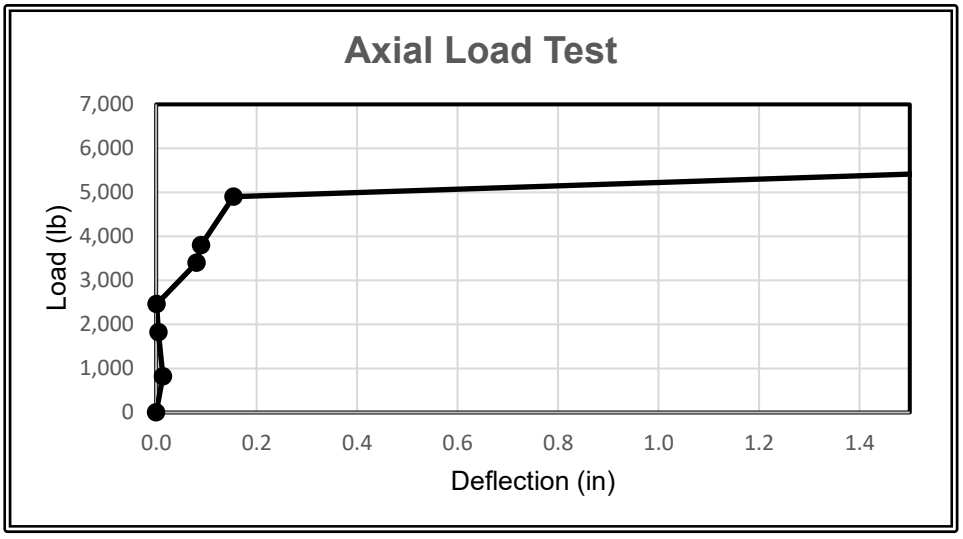
Technician: MG
Test Date: 1/5/2021

Test Location: **PLT-4A**

Notes:
Drive Time: 24 sec

Pile Indentifier: 4A
Pile Type: W6x9
Embedment Depth: 5.04 ft
Pile Reveal: 60 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	6,180	3.500
820	0.014		
1,820	0.005		
2,460	0.001		
3,400	0.081		
3,800	0.090		
4,900	0.154		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

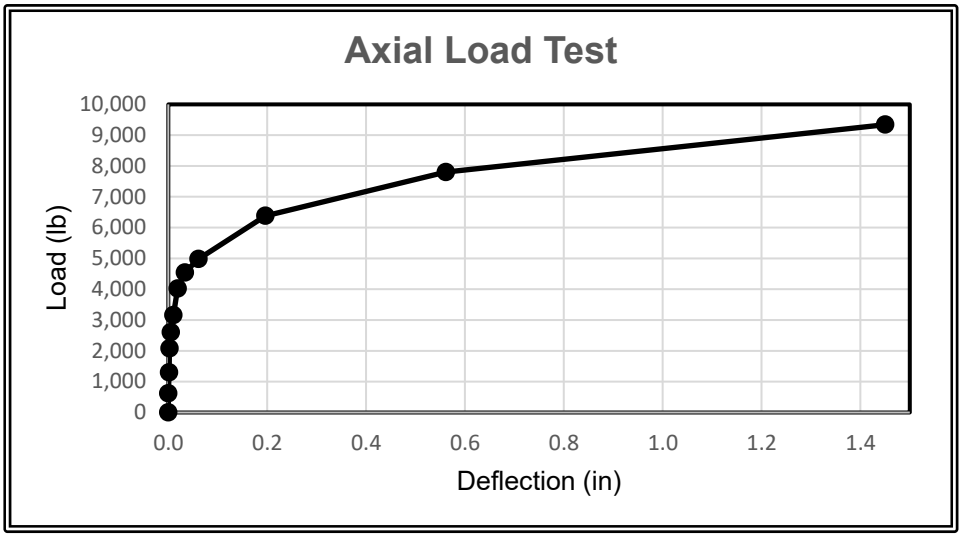
Technician: MG
Test Date: 1/5/2021

Test Location: **PLT-4B**

Notes:
Drive Time: 54 sec

Pile Indentifier: 4B
Pile Type: W6x9
Embedment Depth: 7.04 ft
Pile Reveal: 60 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	4,540	0.034
620	0.000	4,980	0.061
1,300	0.002	6,380	0.197
2,080	0.002	7,800	0.562
2,600	0.005	9,340	1.450
3,160	0.010		
4,020	0.019		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

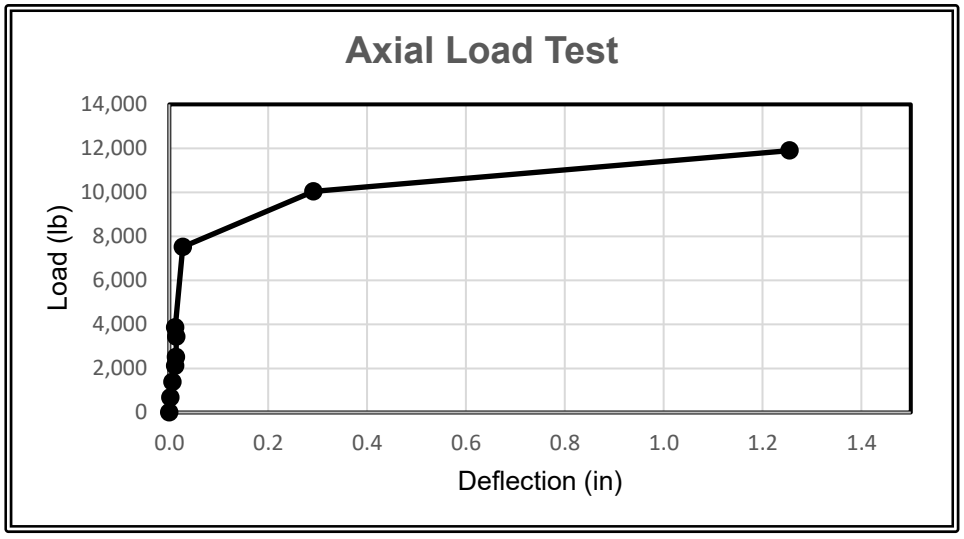
Technician: MG
Test Date: 1/5/2021

Test Location: **PLT-4C**

Notes:
Drive Time: 85 sec

Pile Indentifier: 4C
Pile Type: W6x15
Embedment Depth: 5.96 ft
Pile Reveal: 61 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	7,520	0.027
680	0.002	10,040	0.292
1,380	0.006	11,900	1.255
2,120	0.012		
2,520	0.014		
3,440	0.014		
3,860	0.012		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

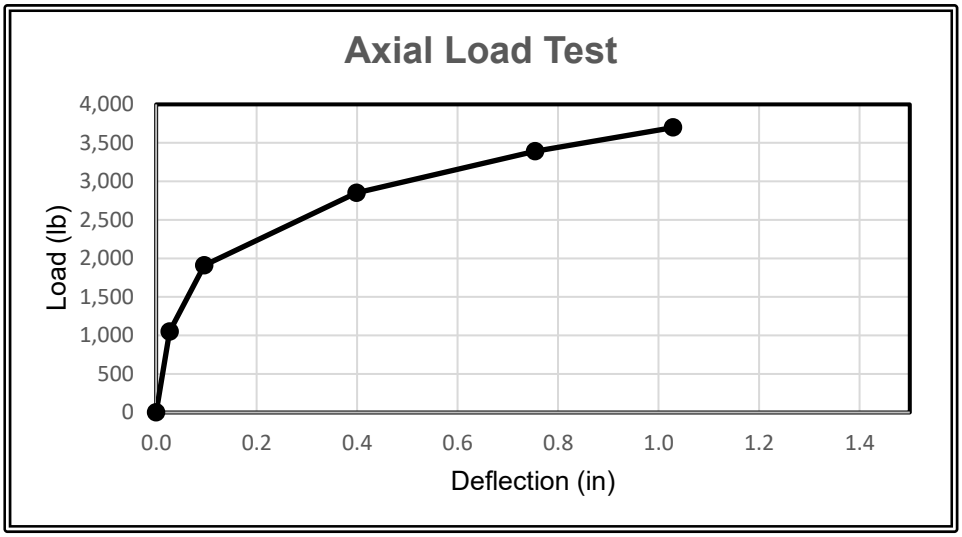
Technician: MG
Test Date: 1/13/2021

Test Location: **PLT-5A**

Notes:
Drive Time: 22 sec

Pile Indentifier: 5A
Pile Type: W6x9
Embedment Depth: 5.15 ft
Pile Reveal: 58 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000		
1,050	0.027		
1,910	0.096		
2,850	0.399		
3,390	0.754		
3,700	1.029		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

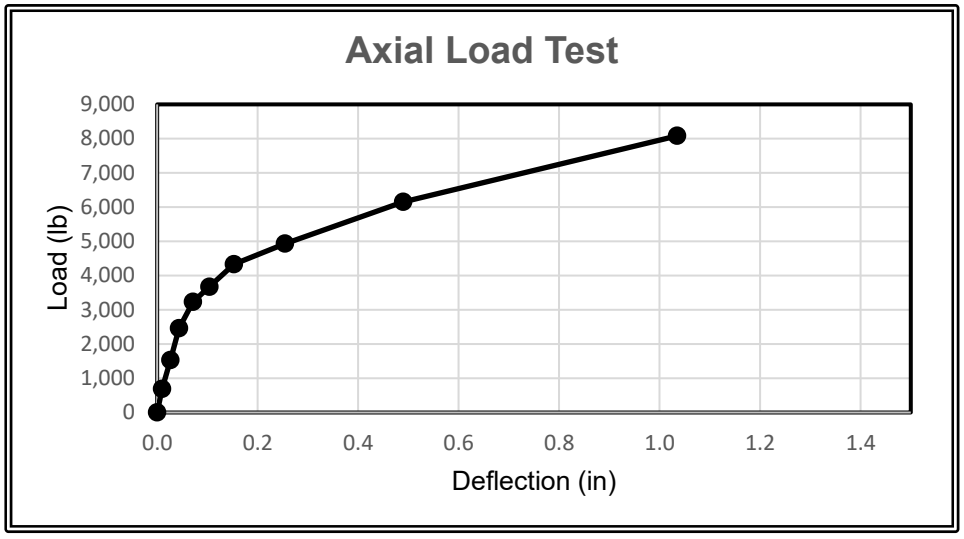
Technician: MG
Test Date: 1/13/2021

Test Location: **PLT-5B**

Notes:
Drive Time: 35 sec

Pile Indentifier: 5B
Pile Type: W6x9
Embedment Depth: 7.00 ft
Pile Reveal: 60 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	4,930	0.254
690	0.010	6,150	0.490
1,530	0.026	8,080	1.035
2,460	0.044		
3,230	0.071		
3,670	0.104		
4,330	0.153		



Axial Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

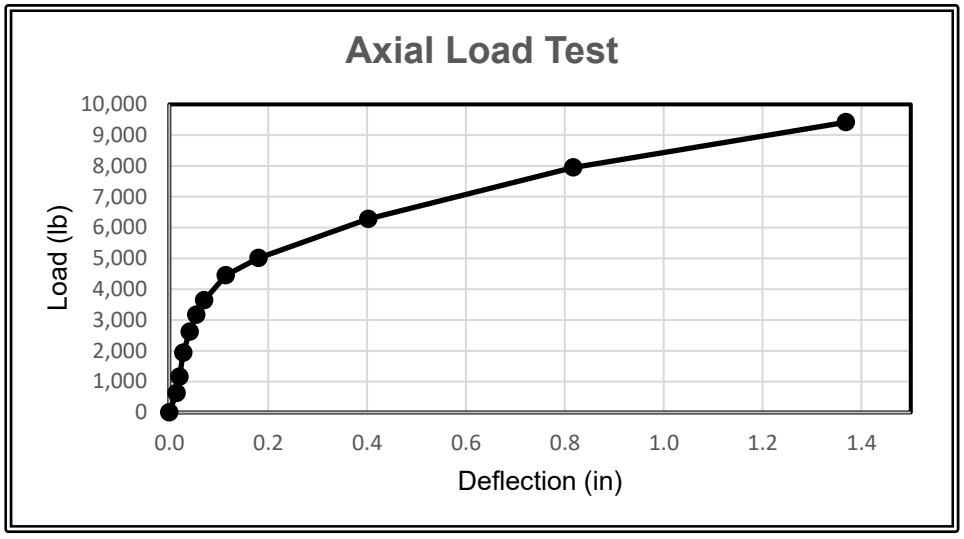
Technician: MG
Test Date: 1/13/2021

Test Location: **PLT-5C**

Notes:
Drive Time: 43 sec

Pile Indentifier: 5C
Pile Type: W6x15
Embedment Depth: 6.08 ft
Pile Reveal: 59 in

Load (lb)	Deflection (in)	Load (lb)	Deflection (in)
0	0.000	4,450	0.114
630	0.015	5,010	0.180
1,160	0.021	6,280	0.403
1,940	0.028	7,950	0.817
2,620	0.041	9,420	1.368
3,170	0.055		
3,640	0.071		



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/13/2021

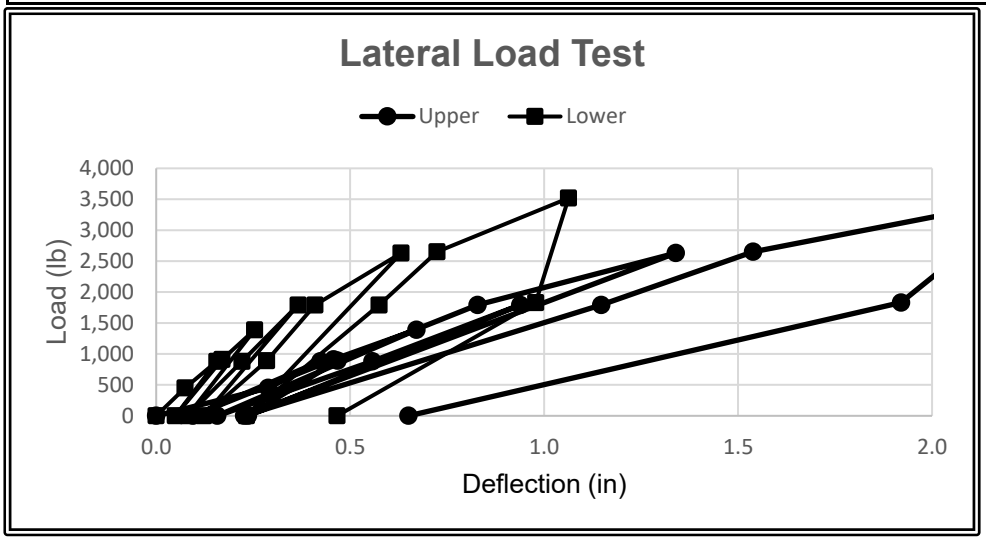
Test Location: **PLT-1A**

Notes:
Drive Time: 36 sec

Pile Indentifier: 1A
Pile Type: W6x9
Embedment Depth: 5.17 ft
Pile Reveal: 58 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.237	0.123
450	0.289	0.075	890	0.468	0.285
880	0.424	0.157	1790	0.828	0.410
0	0.095	0.050	2630	1.339	0.632
910	0.457	0.170	0	0.227	0.233
1390	0.671	0.254	1790	1.147	0.575
0	0.158	0.081	2650	1.539	0.724
880	0.558	0.222	3520	2.254	1.063
1790	0.939	0.366	1830	1.920	0.979
0	0.237	0.123	0	0.650	0.467



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/13/2021

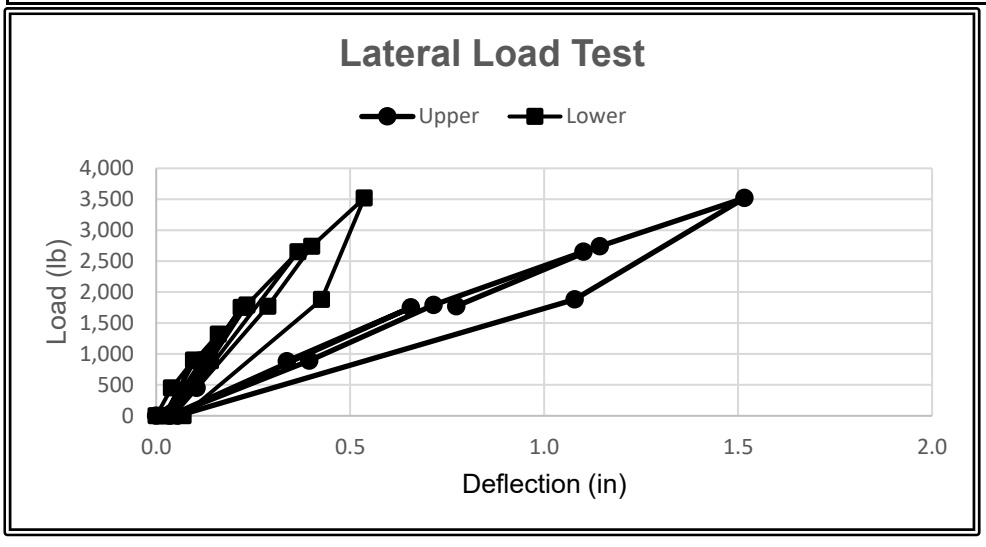
Test Location: **PLT-1B**

Notes:
Drive Time: 77 sec

Pile Indentifier: 1B
Pile Type: W6x9
Embedment Depth: 7.10 ft
Pile Reveal: 59 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.035	0.032
450	0.104	0.040	890	0.394	0.140
900	-	0.097	1790	0.715	0.234
0	-	0.021	2650	1.101	0.366
890	0.112	0.100	0	-	0.044
1320	-	0.161	1770	0.773	0.288
0	-	0.025	2740	1.144	0.401
880	0.337	0.122	3520	1.516	0.537
1750	0.657	0.220	1880	1.079	0.427
0	0.035	0.032	0	0.055	0.070



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/13/2021

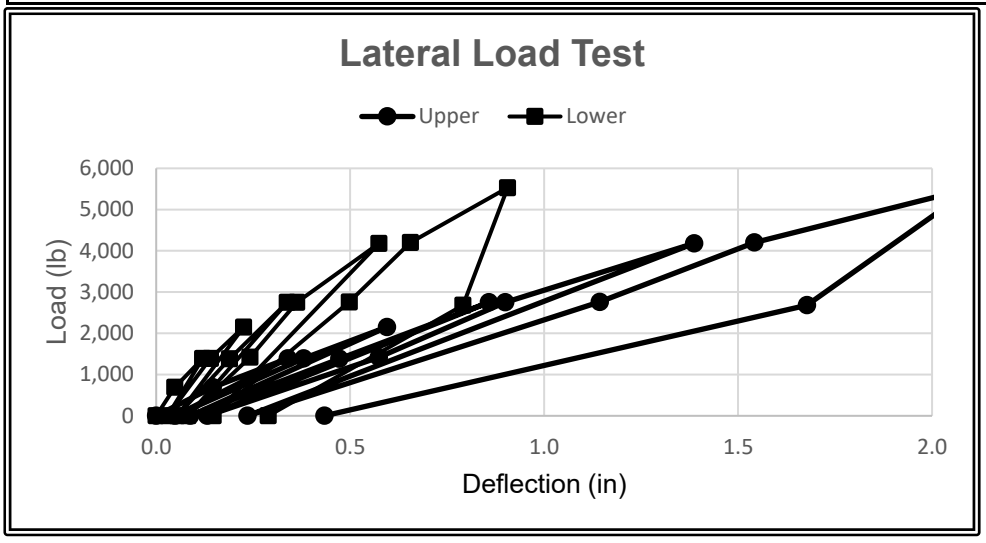
Test Location: **PLT-1C**

Notes:
Drive Time: 68 sec

Pile Indentifier: 1C
Pile Type: W6x15
Embedment Depth: 6.06 ft
Pile Reveal: 59 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.131	0.082
690	0.146	0.048	1420	0.574	0.242
1390	0.339	0.120	2750	0.900	0.363
0	0.049	0.030	4180	1.387	0.575
1390	0.380	0.140	0	0.236	0.147
2150	0.595	0.226	2760	1.143	0.498
0	0.088	0.054	4200	1.542	0.656
1380	0.472	0.189	5530	2.104	0.906
2750	0.858	0.338	2680	1.678	0.791
0	0.131	0.082	0	0.434	0.289



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/13/2021

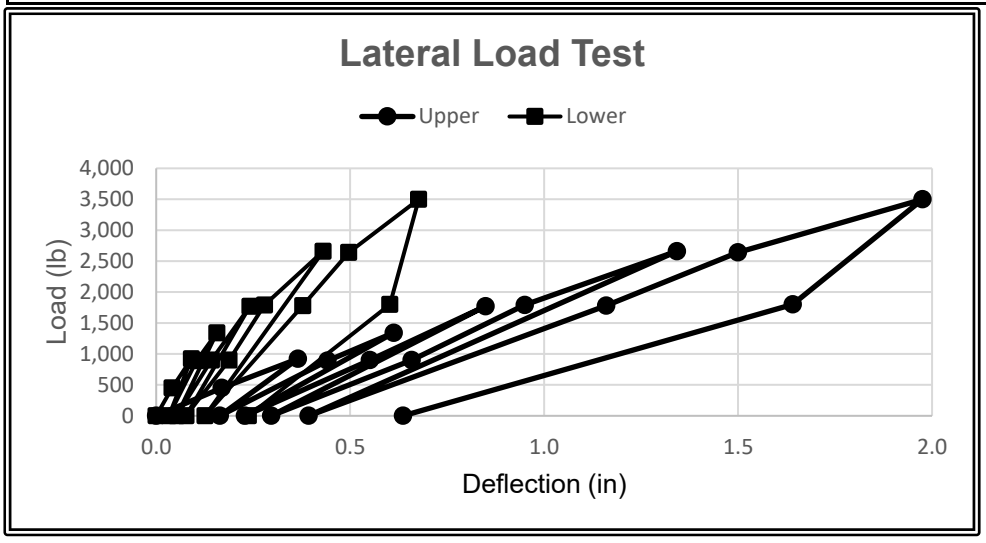
Test Location: **PLT-2A**

Notes:
Drive Time: 36 sec

Pile Indentifier: 2A
Pile Type: W6x9
Embedment Depth: 5.04 ft
Pile Reveal: 60 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.296	0.077
450	0.169	0.041	900	0.659	0.188
920	0.365	0.091	1790	0.950	0.280
0	0.164	0.033	2660	1.342	0.431
890	0.442	0.104	0	0.393	0.126
1340	0.612	0.157	1780	1.160	0.378
0	0.229	0.053	2640	1.499	0.497
900	0.551	0.143	3500	1.975	0.677
1770	0.849	0.242	1800	1.641	0.603
0	0.296	0.077	0	0.636	0.238



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/13/2021

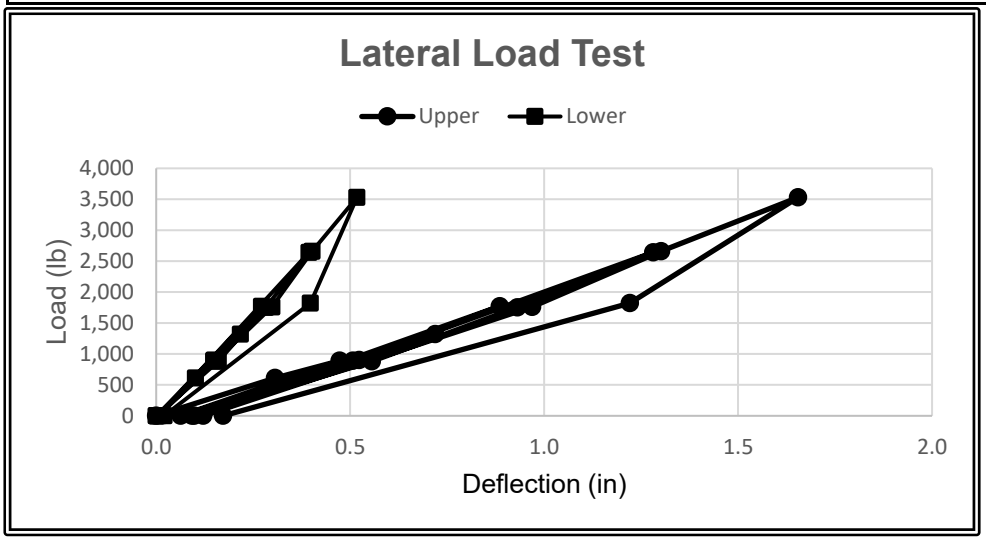
Test Location: **PLT-2B**

Notes:
Drive Time: 71 sec

Pile Indentifier: 2B
Pile Type: W6x9
Embedment Depth: 6.98 ft
Pile Reveal: 60 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.092	0.002
610	0.307	0.102	880	0.556	0.161
890	0.473	0.151	1750	0.931	0.282
0	0.063	0.002	2640	1.281	0.394
890	0.507	0.149	0	0.121	0.007
1320	0.719	0.217	1760	0.969	0.299
0	0.098	0.002	2660	1.302	0.402
900	0.523	0.150	3530	1.654	0.518
1770	0.886	0.272	1820	1.221	0.398
0	0.092	0.002	0	0.172	0.021



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/13/2021

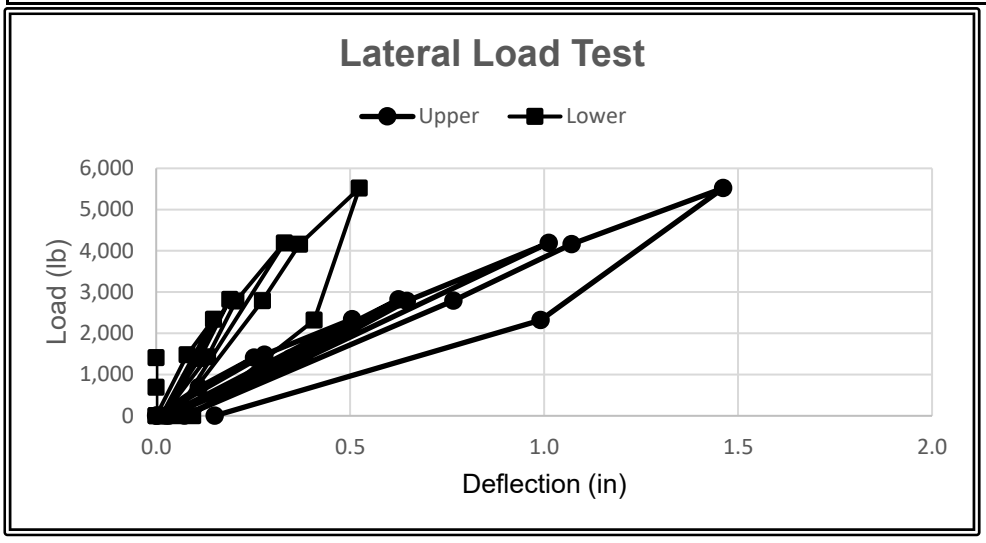
Test Location: **PLT-2C**

Notes:
Drive Time: 85 sec

Pile Indentifier: 2C
Pile Type: W6x15
Embedment Depth: 6.15 ft
Pile Reveal: 58 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.033	0.018
690	0.110	0.000	1430	0.381	0.133
1410	0.252	0.000	2780	0.646	0.206
0	0.002	0.000	4190	1.012	0.331
1480	0.279	0.080	0	0.073	0.048
2340	0.505	0.148	2790	0.766	0.274
0	0.025	0.013	4160	1.071	0.370
1390	0.347	0.113	5520	1.462	0.524
2820	0.625	0.190	2320	0.991	0.408
0	0.033	0.018	0	0.151	0.095



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/5/2021

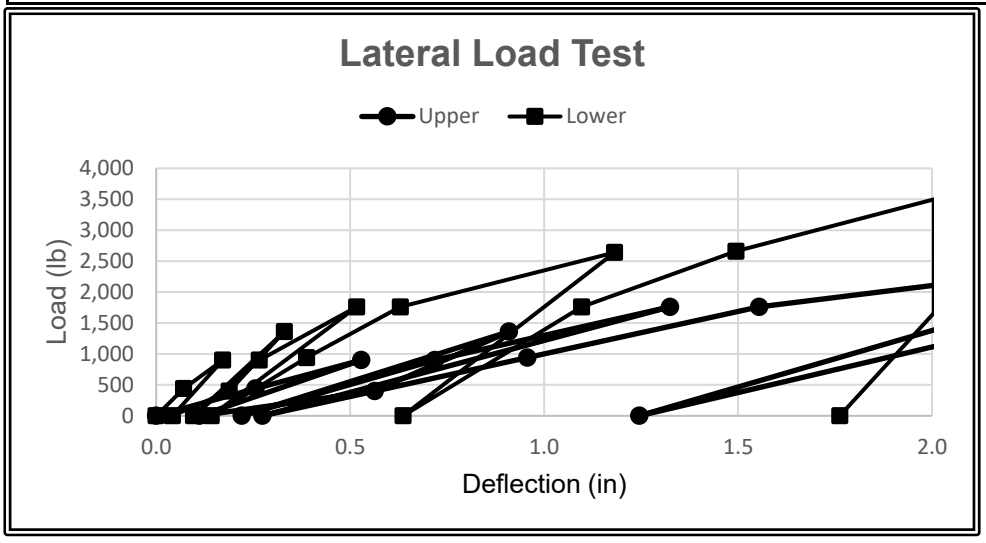
Test Location: **PLT-3A**

Notes:
Drive Time: 35 sec

Pile Indentifier: 3A
Pile Type: W6x9
Embedment Depth: 5.06 ft
Pile Reveal: 59 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.274	0.142
440	0.256	0.071	940	0.957	0.388
900	0.529	0.172	1760	1.554	0.630
0	0.112	0.042	2640	2.691	1.182
400	0.563	0.189	0	1.245	0.637
1360	0.909	0.331	1760	2.440	1.097
0	0.221	0.097	2660	3.2898+	1.495
900	0.718	0.266	3500	3.2898+	2.0045+
1760	1.325	0.517	1660	3.2898+	2.0045+
0	0.274	0.142	0	3.2898+	1.763



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/5/2021

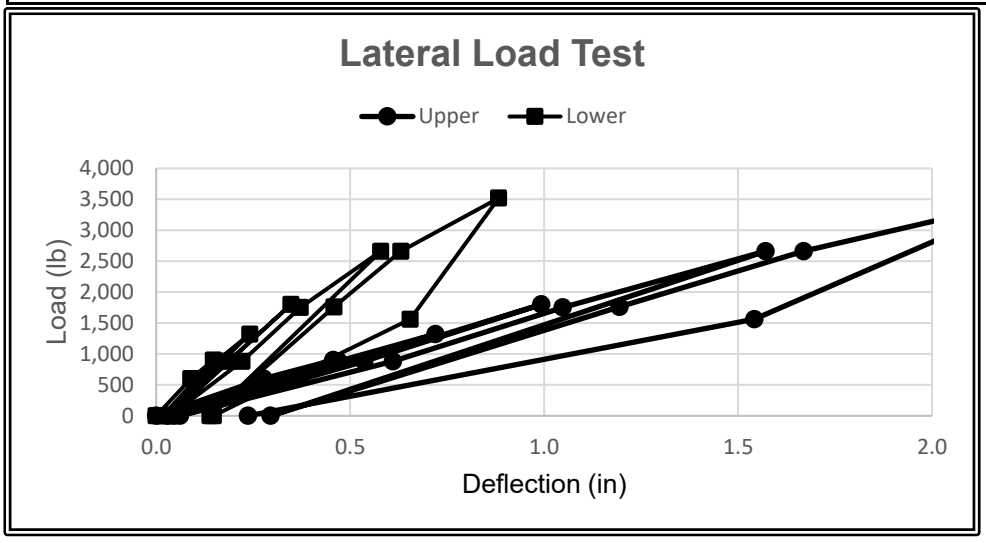
Test Location: **PLT-3B**

Notes:
Drive Time: 58 sec

Pile Indentifier: 3B
Pile Type: W6x9
Embedment Depth: 6.98 ft
Pile Reveal: 60 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.061	0.036
600	0.277	0.090	880	0.610	0.222
900	0.457	0.148	1750	1.048	0.372
0	0.030	0.018	2660	1.571	0.579
880	0.470	0.155	0	0.295	0.139
1320	0.720	0.242	1760	1.194	0.459
0	0.046	0.025	2660	1.669	0.631
880	0.537	0.186	3520	2.261	0.883
1800	0.993	0.348	1560	1.542	0.655
0	0.061	0.036	0	0.237	0.148



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/5/2021

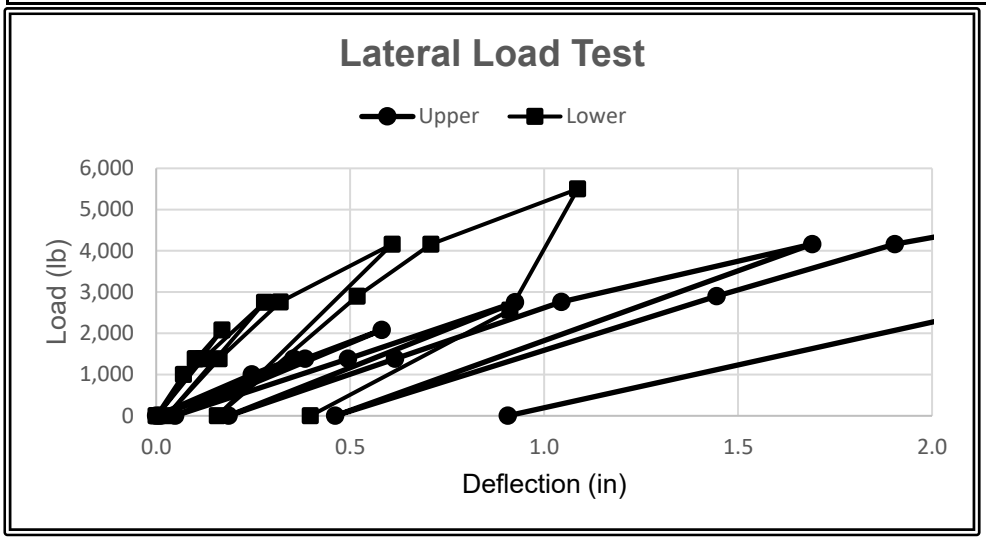
Test Location: **PLT-3C**

Notes:
Drive Time: 59 sec

Pile Indentifier: 3C
Pile Type: W6x15
Embedment Depth: 6.00 ft
Pile Reveal: 60 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.187	0.028
1000	0.246	0.071	1380	0.616	0.163
1380	0.354	0.101	2760	1.045	0.320
0	0.009	0.005	4160	1.691	0.609
1380	0.384	0.104	0	0.462	0.158
2080	0.582	0.170	2900	1.445	0.519
0	0.049	0.003	4160	1.904	0.709
1380	0.494	0.122	5500	2.696	1.087
2750	0.925	0.280	2560	2.139	0.912
0	0.187	0.028	0	0.906	0.398



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/5/2021

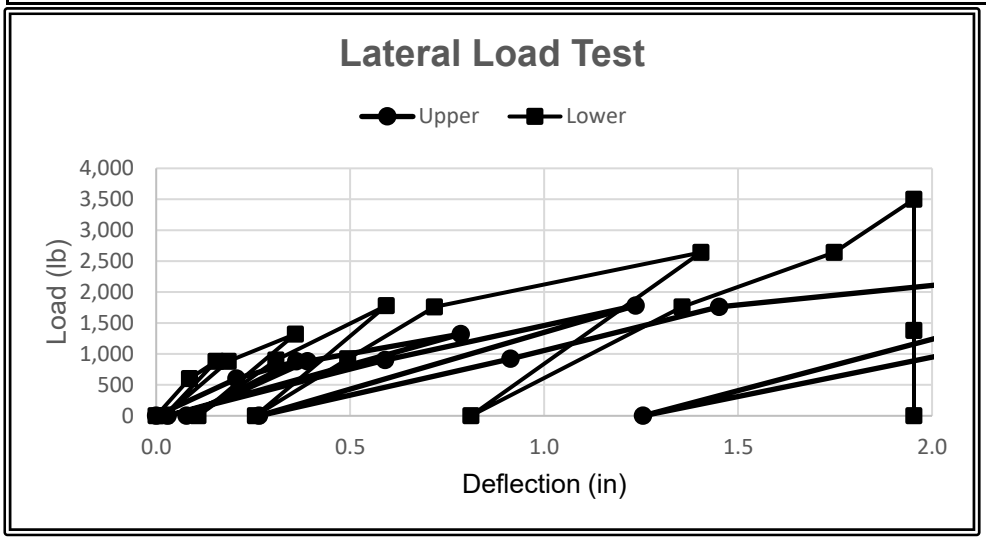
Test Location: **PLT-4A**

Notes:
Drive Time: 24 sec

Pile Indentifier: 4A
Pile Type: W6x9
Embedment Depth: 5.04 ft
Pile Reveal: 60 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.265	0.256
600	0.207	0.086	920	0.914	0.494
880	0.361	0.155	1760	1.451	0.718
0	0.078	0.022	2640	2.844	1.405
880	0.390	0.186	0	1.255	0.812
1320	0.785	0.359	1760	2.638	1.356
0	0.030	0.108	2640	3.485	1.748
900	0.590	0.309	3500	3.7477+	1.9535+
1780	1.236	0.594	1380	3.7477+	1.9535+
0	0.265	0.256	0	3.7477+	1.9535+



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/5/2021

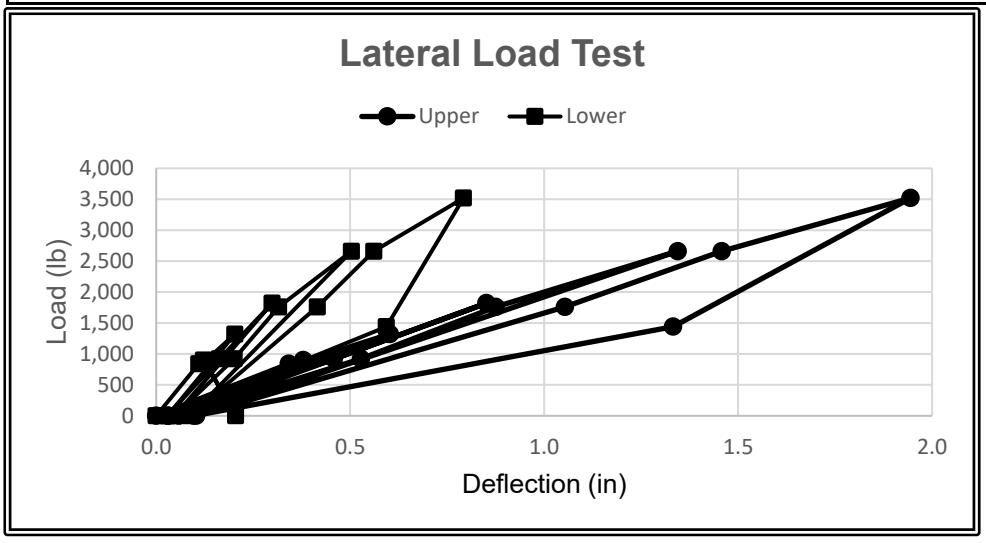
Test Location: **PLT-4B**

Notes:
Drive Time: 54 sec

Pile Indentifier: 4B
Pile Type: W6x9
Embedment Depth: 7.04 ft
Pile Reveal: 60 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.058	0.048
840	0.342	0.110	920	0.528	0.201
900	0.379	0.122	1760	0.875	0.316
0	0.030	0.205	2660	1.344	0.504
880	0.382	0.126	0	0.103	0.087
1320	0.603	0.203	1760	1.054	0.416
0	0.030	0.029	2660	1.458	0.561
920	0.458	0.163	3520	1.945	0.792
1820	0.851	0.299	1440	1.332	0.594
0	0.058	0.048	0	0.097	0.031



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/5/2021

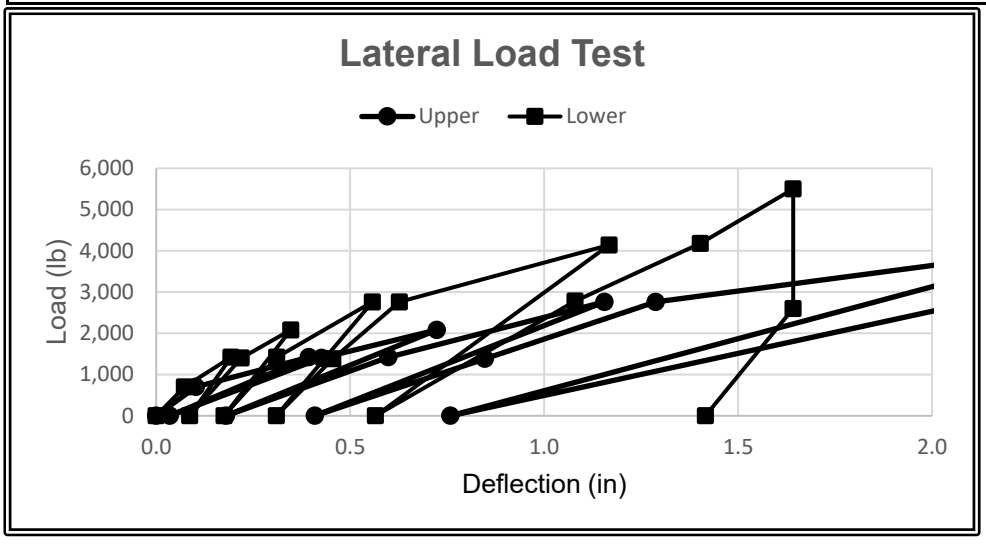
Test Location: **PLT-4C**

Notes:
Drive Time: 85 sec

Pile Indentifier: 4C
Pile Type: W6x15
Embedment Depth: 5.96 ft
Pile Reveal: 61 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.409	0.310
700	0.102	0.073	1380	0.847	0.456
1420	0.394	0.193	2760	1.288	0.627
0	0.035	0.087	4140	2.402	1.168
1400	0.426	0.220	0	0.758	0.566
2080	0.723	0.347	2780	2.121	1.080
0	0.180	0.175	4180	2.838	1.403
1420	0.598	0.311	5500	3.6303+	1.6420+
2760	1.155	0.558	2600	3.6303+	1.6420+
0	0.409	0.310	0	2.306	1.416



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/13/2021

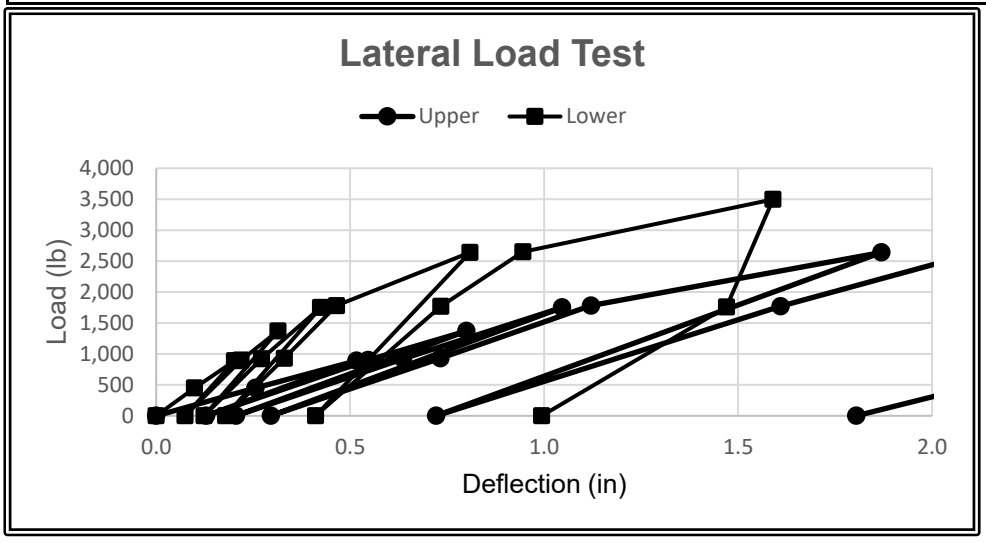
Test Location: **PLT-5A**

Notes:
Drive Time: 22 sec

Pile Indentifier: 5A
Pile Type: W6x9
Embedment Depth: 5.15 ft
Pile Reveal: 58 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.296	0.180
450	0.256	0.099	930	0.733	0.331
890	0.516	0.202	1780	1.121	0.465
0	0.129	0.075	2640	1.869	0.809
900	0.546	0.219	0	0.722	0.411
1370	0.800	0.314	1770	1.610	0.734
0	0.206	0.124	2650	2.123	0.946
920	0.636	0.272	3500	2.9280+	1.590
1750	1.046	0.424	1760	2.9280+	1.471
0	0.296	0.180	0	1.805	0.994



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/13/2021

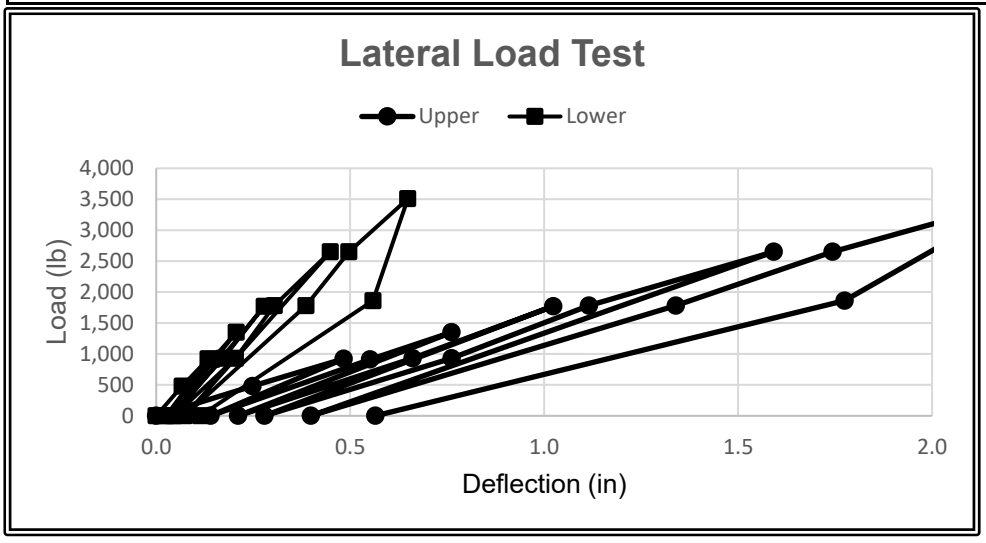
Test Location: **PLT-5B**

Notes:
Drive Time: 35 sec

Pile Indentifier: 5B
Pile Type: W6x9
Embedment Depth: 7.00 ft
Pile Reveal: 60 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.279	0.047
480	0.248	0.067	930	0.762	0.205
920	0.483	0.134	1780	1.116	0.305
0	0.140	0.026	2650	1.592	0.449
910	0.551	0.144	0	0.399	0.073
1350	0.761	0.207	1780	1.340	0.387
0	0.211	0.037	2650	1.743	0.497
930	0.661	0.174	3510	2.235	0.649
1770	1.023	0.279	1860	1.775	0.559
0	0.279	0.047	0	0.565	0.114



Lateral Pile Test Results

Project Name: **Union Ridge Solar Project**
Project Number: **20212714.001A**
Client Name: **Leeward Renewable Energy, LLC**

Technician: MG
Test Date: 1/13/2021

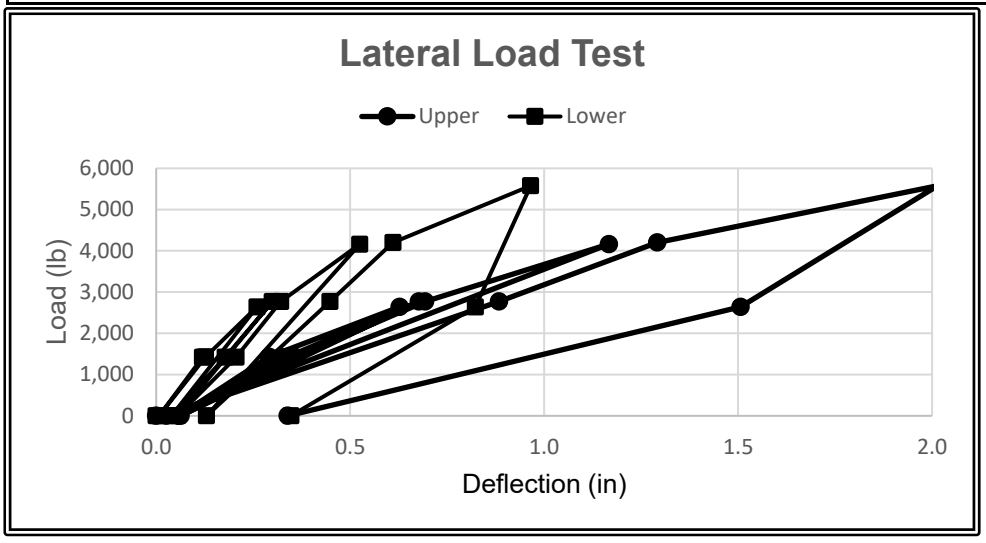
Test Location: **PLT-5C**

Notes:
Drive Time: 43 sec

Pile Indentifier: 5C
Pile Type: W6x15
Embedment Depth: 6.08 ft
Pile Reveal: 59 in

Load Application Height: 48 in
Upper Measurement Height: 48 in
Lower Measurement Height: 4 in

Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)	Load (lb)	Top Gauge Deflection (in)	Lower Gauge Deflection (in)
0	0.000	0.000	0	0.063	0.055
-	-	-	1420	0.359	0.206
1420	0.321	0.120	2770	0.693	0.321
0	0.058	0.008	4160	1.167	0.525
1430	0.291	0.128	0	0.026	0.130
2640	0.628	0.260	2770	0.884	0.448
0	0.058	0.040	4200	1.292	0.611
1420	0.336	0.178	5580	2.014	0.966
2770	0.677	0.300	2640	1.507	0.823
0	0.063	0.055	0	0.339	0.348



APPENDIX F.
GBA DOCUMENT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Appendix D

OHIO HISTORY CONNECTION

In reply, please refer to:
2020-LIC-49808

March 26, 2021

Ryan Weller
Weller & Associates
1345 W 5th Avenue
Columbus, OH 43212

RE: Union Ridge Solar Project – Revised History/Architecture Survey Report
Harrison Township, Licking County, Ohio

Dear Ms. Weller:

This letter is in response to correspondence received February 19, 2021. The comments of Ohio's State Historic Preservation Office (SHPO) are submitted in accordance with provisions of Ohio Revised Code 149.55 requesting cooperation among state agencies in the preservation of historic properties, Ohio Administrative Code Chapters 4906-1 to 4906-17, and with provisions of the National Historic Preservation Act of 1966, as amended and the associated regulations at 36 CFR Part 800.

The correspondence included the revised *History/Architecture Investigations for the 214.6 to 532.9 acre Union Ridge Solar Project in Harrison Township, Licking County, Ohio*. The Project includes the construction and operation of a commercial-scale solar energy facility. The report states that there are multiple previously surveyed history/architecture resources within the 2-mile intensive study area, and many of these resources are listed in the National Register of Historic Places (NRHP). However, these resources were not resurveyed or evaluated for this project. Although resurveying of previously surveyed properties should be done to evaluate the effect a project has on them, these resources appear to be closer to the outer edge of the 2-mile area for this project. Therefore, we are accepting the report as is.

There were twenty-three (23) newly identified properties 50 years of age or older. The report recommends that one (1) of these properties is eligible for listing in the NRHP. This property is the Goldstein Farmstead (OHI #LIC0155120) located at 8331 Creek Road Southwest, and is recommended under Criterion C as an excellent example of Greek Revival Architecture. The other twenty-two (22) properties were recommended as not eligible. The SHPO agrees with these recommendations.

The report also states that the proposed solar facility will not adversely affect the Goldstein Farmstead. The basis for the recommendation is that the western portion of the project area will not have any above ground elements, such as the photovoltaic panels, the substation, etc. The report states that the closest these elements will be from the NRHP eligible resource is over 1/2-mile and will be buffered by vegetation. The SHPO agrees with this recommendation.

Please note that this letter is only for history/architecture resources. Archaeological resources are being reviewed under a separate letter. No further coordination on history/architecture resources is necessary unless there is a change in the project, such as panels being moved further to the west.

If you have any questions, please contact me at kkoehlinger@ohiohistory.org or (614) 298-2000. Thank you for your cooperation.

Sincerely,

Kristen Koehlinger

Kristen Koehlinger, Project Reviews Manager
Resource Protection and Review

RPR Serial No: 1087454

Appendix E

1395 West Fifth Avenue
Columbus, Ohio 43212
Ph: 614-485-9435
Fx: 614-485-9439
www.wellercrm.com

May 3, 2021

Ohio History Connection
Attn: K. Koehlinger
800 E 17th Ave
Columbus, OH 43211

Re: No Adverse Effect per Project Layout Evolution on the Goldstein Farmstead for the Union Ridge Solar Project in Harrison Township, Licking County, Ohio.

We appreciate your review of the potential for impact to historic architectural resources relating to the proposed Union Ridge Solar project, and your finding that no adverse effect will occur and that no further coordination is required (McIntosh and White 2020). The Goldstein Farmstead is specifically noted, and the basis for the conclusion in your letter is that the closest above-ground project element is over ½ mile from this structure and potential views will be buffered by vegetation.

While no panels were originally contemplated within the western leg of the project area (closest to the Goldstein Farmstead), as project layout has evolved, panels may now be located in the northern portion of this area (see Figure 1). This would result in a distance between above-ground project elements and the Goldstein Farmstead of 0.4 miles. However, all project-related elements are located north of the vegetated stream that traverses that portion of the solar facility property. The vegetation along that stream consists of shrubs and deciduous trees up to approximately 30 feet tall. The project team has conducted a viewshed analysis to evaluate the visibility of the project from the Goldstein Farmstead (Figure 2). As you can see, existing vegetative screening (both along the riparian edge and along Route 151) and distance result in no change in the potential to view project elements.

We believe that, with this layout adjustment, the Goldstein Farmstead remains well-buffered from the project and will not be adversely affected. We would appreciate your review of this change to document the Ohio State Historic Preservation Office's position in this regard.

Thank you

Ryan J. Weller, MA, Principal Investigator

Austin White, MS, Principal Investigator

Weller & Associates, Inc.
1395 West Fifth Avenue
Columbus, OH 43212

References

McIntosh, S. and A. White
2020 *History/Architecture Investigations for the 201.5 ha (497.8 ac) Union Ridge Solar Proejct in Harrison Township, Licking County, Ohio*. Weller & Associates, Inc. Copy available for review from Ohio History Connection.

Figure 1. Facility Layout Update

Union Ridge Solar

Harrison Township,
Licking County, Ohio

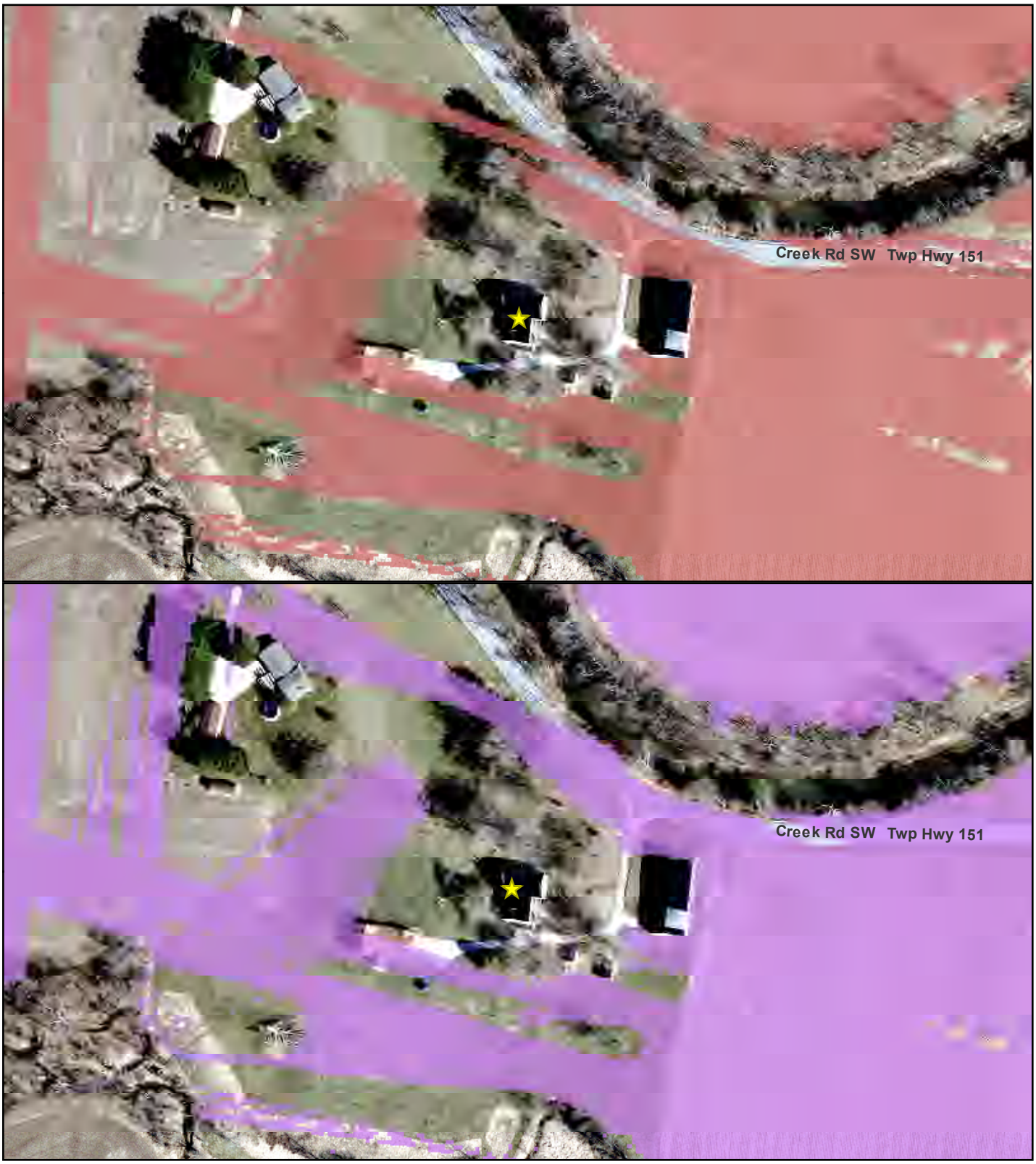
- Goldstein Farmstead
- Underground Collection Lines
- Access Roads
- Fenceline
- Previous PV Panel Area
- Updated PV Panel Area
- Project Area

0 100 200 400
Feet

Prepared April 30, 2021
Basemap: OSIP Licking County 2019 orthoimagery map service

EDR

Figure 2. Viewshed Comparison



Union Ridge Solar

Harrison Township, Licking County, Ohio

Goldstein Farmstead

OHPO Layout Viewshed

OPSB Layout Viewshed

0 50 100 200

Feet

Prepared April 30, 2021

Basemap: OSIP Licking County 2019 orthoimagery map service

Summary: Response of Union Ridge Solar, LLC to OPSB Staff First Data Request electronically filed by Teresa Orahood on behalf of Dylan F. Borchers